Microbiology: The Effect of Environmental Mechanical Forces on the Growth of Walled Cells

Research question: To what extent does the environmental mechanical force (EMF) affect the growth of *Saccharomyces cerevisiae* (measured by yeast colony size) on stiffness conditioned potato dextrose agar (PDA) media plates containing different agar over a 3-day-period?

Biology Extended Essay

Word count: 3897

Table of Contents

Chapter I: Introduction 1

1.2 Background 2

1.3 Hypothesis 4

1. Independent variable (IV) 5

2. Dependent variable (DV) 5

3. Controlled variable (CV) 5

Chapter II: Investigation 7

2.1 Material and Apparatus 7

2.2 Methodology 7

Chapter III: Discussion 19

4.1 Conclusion 19

4.2 Evaluation of Procedure 21

Works Cited 24

Appendices 26

Chapter I: Introduction

It is well known that life activities are a complex network system of chemical reactions and physical variables, which are modulated by the interaction of the organism with its environments, such as temperature, moisture, mechanical forces and so on. It has been written in the IB Biology textbook that the responses of organisms to external temporary stimuli is one of the characteristics of life and that, generally, organisms exhibit transient stress behaviors in response to the stimuli. All multicellular organisms, such as human beings, animals or plants can sense and respond to the heat, cold, touch or pressure. In 2021, the Nobel Prize in Physiology and Medicine was awarded jointly to Drs. David Julius and Ardem Patapoutian, whose finding filled the gap in our understanding of the complex interaction between organism and their environment, for their groundbreaking discoveries about temperature and touch receptors (The Nobel Prize). In their investigation, unsurprisingly, temperature plays a crucial role in life activity by influencing the activation of enzymes (protein) that promote metabolism of organisms at the desired optimum temperature, but the mechanical forces and touch mentioned that affect the cells or organisms piqued my interest to explore more. It has also been shown from the literature that external forces on human bodies arise from mechanical actions such as blood flow, trauma, or the loading of bones, while abnormal mechanical forces also come from inflammation or the growth of solid tumors or cancers. During body's metabolism, variable external mechanical forces that cells constantly perceive are critical for sculpting cells or tissues into their functional structure (G. Paci and Y. Mao, Seminars in Cell and developmental Biology 120 (2021) 160-170).

However, there are few studies related to the effect of environmental mechanical forces (EMF) on unicellular organisms or walled cells (e. g. yeast) that were able to grow under natural conditions on surfaces with different hardness (rocks or biotic surface) while interacting with different mechanical forces. As common matrix used for grow yeast in the laboratory, potato dextrose agar (PDA) media allows creamy or white yeast colonies to be easily observed. Through speculation, different EMF might affect the growth activity of yeast. In order to test this hypothesis, yeasts (*Saccharomyces cerevisiae*) are cultivated on PDA plates made of different concentrations of agar which helps adjust the hardness and elasticity of the culture matrix, and the growth capacity of yeasts are measured by their colonies size using ImageJ Software. This investigation will help us better understand the effects of surrounding environmental mechanical forces (EMF) on the growth of walled cells.

1.1 Research Question

To what extent does the environmental mechanical force (EMF) affect the growth of Saccharomyces cerevisiae (measured by yeast colony size) on stiffness conditioned potato dextrose agar (PDA) media plates containing different agar over a 3-day-period?

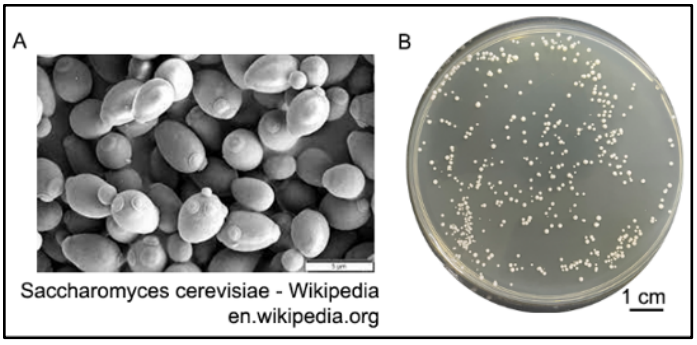
In order to answer this question, the effect of mechanical forces on *S. cerevisiae* will be determined through changing the culture matrix stiffness with different agar concentration and measuring the growth rate of yeast by its colony size on the conditioned matrix.

1.2 Background

Beside chemical signals, cell behavior is also guided by the mechanical properties of the cells and their surrounding environments (Bayir, et al. 2019). It is evident that environmental

mechanical forces (EMF) can profoundly affect cell growth and also its physiological behaviors, as body cells can sense and transduce external mechanical inputs into biochemical and electrical signals, which influence processes such as cell proliferation, adhesion and migration (Bayir, et al. 2019). Unicellular fungi grow as clusters adhering to biotic surfaces (e. g. plant or animal hosts) or abiotic surfaces (rocks, medical devices, etc.), thus forming a functional community (Mishra. et al. 2022). A stiffness change in the natural habitat can pose various mechanical forces to these organisms, so some fungus have developed to adapt to the surrounding environment (Mishra. et al. 2022). For instance, studies have suggested that organisms as simple as *S. cerevisiae* (Fig. 1) have also evolved complex signaling networks to sense and respond to intrinsic and extrinsic mechanical forces even though they can oppose mechanical force by their rigid cell walls (Mishra. et al. 2022). Different matrix stiffness might also stimulate *S. cerevisiae* in a way that affects their function, proliferation as well as migration through altering mechanical forces.

Fig 1. *Saccharomyces cerevisiae.* ***A.*** *Electron micrograph of S. cerevisiae, extracted from en.wikipedia.org* ***B.*** *The image of S. cerevisiae on the PDA plate.*



Agar is commonly used for solidifying the microbiological culture media, as it can be easily melted at higher temperature and has no nutritive value for many kinds of microorganisms. One

of the interesting nonlinear mechanical behaviors when shear is applied is strain stiffening, observed only in a few polysaccharide gels such as in agar gels, and if the individual fibrils are stretched beyond the Hookean limit, they start to stiffen. (Macromolecules). Thus, agar concentrations are correlated with different hardness or mechanical forces of the agar matrix. Notably, the concentration of glucose in the agar has a negligible effect on radial growth rate (Kamath & Bungay, 1988). Hence, agar concentration is manipulated to alter mechanical forces (IV) of the agar matrix.

Similar to multicellular organisms, unicellular eukaryotes such as *S. cerevisiae* are also exposed to a myriad of physical forces, including compressive, tensile, and shear forces in their natural habitat (Mishra et al. 2022). *S. cerevisiae* is a small single cell with a doubling time at 27-30°C of 1.25–2 h and importantly can be cultured easily, which permits their rapid production and maintenance of multiple strains at low cost (Stewart, n. d). Colonies on nutrient agar show linear increases in diameter and height with time throughout most of the growth cycle (Kamath & Bungay, 1988). Additionally, Jones & Gray (19781, b,1979) has observed that mature colonies show an exponential increase in the diameter with time in a constant nutrient concentration at the colony-gel interface. Thus, yeasts' growth can be quantified by measuring the size of yeast colonies (area of rounded shape) and *S. cerevisiae* can be used as a good model organism to study the effects of EMF on walled cells' growth by measuring the size of yeast colonies (area of rounded shape).

1.3 Hypothesis

As yeast cells come across higher external forces from the harder PDA plate resulting from higher concentration of agar, the yeast might destabilize and reorganize away from the obstacle

(Mishra et al. 2022), and a hypoosmotic shock promoted by stronger mechanical forces is likely to result in a transient inhibition of cell-wall growth (Rojas & Huang, 2018). The hypothesis is that the yeast growth will be inhibited, shown as smaller size of colonies, when they are cultivated on harder PDA media made with higher concentration of agar.

1.4 Variables

1. **Independent variable (IV)**

- Mechanical forces (stiffness) of PDA plates changed by agar concentrations (1.5 %, 2 %, 2.5%, 3%, 3.5%)

2. **Dependent variable (DV)**

- Growth size (area) of colonies (Measured by ImageJ Software, NIH)
- Growth rate of colonies (%)

3. **Controlled variable (CV)**

Controlled variables	How to control	Effect on the result
Condition of incubation (Temperature & Time)	All the yeast grown on PDA media are set in the same incubator at 27℃ for 3 days. Referred to International Baccalaureate guidelines, the incubation temperature of the Petri dishes was kept at 27℃.	*S. cerevisiae* is a small single cell with a doubling time of 27-30°C of 1.25–2 h (Stewart). Optimal temperature and growing time ensure yeast colonies survive so the data can be collected.
PDA media (Before adding agar)	It can be controlled through following the same recipe to make the potato dextrose agar media for each trial, under the same	Same PDA media without adding agar will guarantee yeast colonies not affected by different nutrient levels provided. Colonies

	conditions. In each trial, 50g diced potatoes are measured by the same weight scale and 500 cm^3 H_2O measured by a glass measuring cylinder.	on nutrient agar show linear increases in diameter and height with time throughout most of the growth cycle (Kamath & Bungay, 1988).
Sterilization techniques	The PDA media and the apparatus (spreader, beaker and plate) are autoclaved with a pressure cooker. The operating branch and some apparatuses are sterilized regularly by hypochlorite or ethanol. Once the contamination occurs, all contaminants need to be destroyed at high temperatures.	Bacterial contamination occurring will jeopardize the experiments as other contaminated bacteria or fungus in the PAD plates will affect the yeast growth or kill the yeast.
Quantity of yeast (*S. cerevisiae; brand name: RedMan*)	0.5 g *S. cerevisiae* are activated with 100 cm^3 hot water (80℃), and wait 45 mins. Then the solution is diluted in a ratio of 1:1000 by first adding 1 cm^3 solution to 99 cm^3 water, and then adding extra 99 cm^3 water. Finally, 100 μmol yeast was applied to the PDA plate by a micropipette.	The same amount of *S. cerevisiae* applied to the plate can guarantee that the change in yeast colony area or size is due to the changing agar concentration instead of yeast quantity difference.

Chapter II: Investigation

2.1 Material and Apparatus

Measurement equipment	General apparatus	Materials
1 × Texture profile analysis 1 × Micropipette ± 0.1 μmol 1 × Weight scale ± 0.1g 5 × Beaker (500 cm^3) 2 × Glass measuring cylinder (250 cm^3) ± 2cm^3	1 × Spreader 50 × Pipette tip 1 × Pressure cooker 50 × Plate dish (15 × 100 mm) 1 × Masking tape 1 × Paraffin 1 × Knife 1 × Marker pen 1 × hard plastic board 1 × Phone with camera 1 × Alcohol lamp	200 g Agar 1000 g Saccharomyces cerevisiae 5000 cm^3 Water 100 g Dextrose 250 g Potato

2.2 Methodology

1. Make solid Potato Dextrose Agar (PDA) media for growing *S. cerevisiae*.

a. Prepare 50g potatoes measured by a weight scale, and cut them into dices. (Fig.2-A)

b. Add the diced potato to a beaker (250 cm^3).

c. Add 500 cm^3 water measured by a glass measuring cylinder (250 cm^3) into the beaker.

d. Boil the diced potatoes on a heater for 30 mins until softened. (Stirring it during the process)

e. Filter to obtain its extract to a beaker (250 cm^3).

f. Add water to the total volume of 500 cm^3 and mix well.

g. Sterilization.

1. Take some tin foil and wrap your plates
2. Place them into a pressure cooker and set the maximum temperature. (Fig.2-B)
3. Add 7.5 g agars (for 1.5% concentration) and 5g dextrose while shaking the beaker.
4. Repeat step (g-2) for 15 mins.
5. Remove the beaker at the temperature of 60°C, and leave it for 5mins.
6. Frame the lips for final sterilization.
7. Dispense 20 - 25 cm^3 portions into sterile 15 × 100 mm per dishes (25-30 µl) and hit the plate with a frame to remove bubbles. (Avoid melting the media).
8. Leave the plate for 20 mins till it cools.
9. Flipped the plates.

i. Cover the plate and label it as a form of "concentration of agar + trial". (Fig.2-C)

2. Repeat step 1-2 for 8 trials

3. Repeat step 1-2 for 8 trials but change agar concentration in h(3) to 2.0%, 2.5%, 3.0%, 3.5% by changing agar mass to 10g, 12.5g, 15g, 17.5g respectively.

Table 1. *Potato dextrose agar (PDA) media recipe*

Agar concentration (%)	**Agar mass (g) +/- 0.1g**	**Total volume (cm^3) +/- 2cm^3**	**Dextrose mass (g) +/- 0.1g**
1.5	7.5	500	5
2	10	500	5
2.5	12.5	500	5
3	15	500	5
3.5	17.5	500	5

Fig. 2 A-D. *The process of making potato dextrose agar(PDA) media for yeast cultivation.* ***E-F.*** *Using Texture Analysis Profile to collect data of mechanical forces, hardness and resilience.*

4. Put these plates in the refrigerator for 3 hours to cool them down.

5. Measure the atomic forces in PDA plates by Texture profile analysis. (Fig. 2-F)

6. Sketch the graph of agar concentration (X-axis) and culture stiffness measured by Texture Analysis Profile (Y-axis). (They were measured in University Laboratory)

a. Draw a circle briefly on the bottom of the plate. (Fig. 3-A)

b. The Texture Analysis Profile is conducted using a TA-XT2i Texture Analysis Profile (stable Micro System, Surrey, UK) according to the AIB Standard Procedure (2011) with modification.

c. The agar plate sample is subjected to a double compression by an SP20 probe (20mm diameter cylindrical probe) at a speed of 2 mm/s to a distance of 2mm.

d. Conduct 3 replicates for each concentration of agar in the plate.

e. Collect the data. (Fig. 2-E)

6. Plating the *S. cerevisiae* on conditioned PDA media for another 5 trials. (Fig. 3-B)

a. Activate 0.5g yeast with 100 cm^3 hot water (80°C) for 45 mins.

b. Dilute the yeast solution in a ratio of 1:100 by adding 1 cm^3 solution to 99 cm^3 water.

c. Repeat step(6-b).

d. Use a micropipette to apply 100 µmL *S. cerevisiae* (1:1000) to the plate.

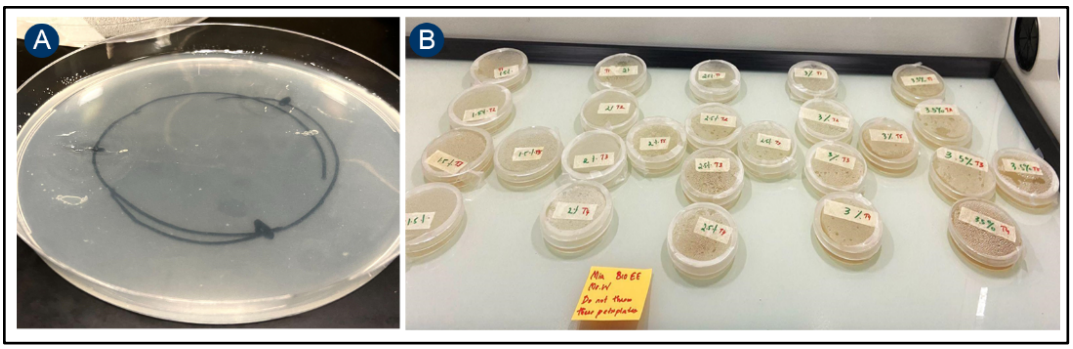
e. Eject the pipette tips.

f. Sterile the spreader with an alcohol lamp.

g. Gently spread the yeast culture around the plate with the spreader.

- Tilt the plate and take your spreader at 90° to the plate.
- Start at the bottom and very gently swipe it back and forth from the top to the bottom of the plate.

Fig.3 A. *Draw a circle on the bottom of the plates and select three random spots on it for data collection in PDA media with different agar concentrations.* ***B.*** *Culturing yeast colonies on PDA media.*



7. After 3 days, take photos and measure yeast colony size by imageJ Software and get the result data.

a. Open the ImageJ Software and open a file of the image.

a. Make a copy of the image using Image > Duplicate.

b. Leave one copy as-is for now, and use your other copy to create a binary image.

c. Use Process > Binary > Make Binary to create a binary image

d. When particles are merged together, the Process > Binary > Watershed accurately cuts them apart by adding a 1 Pixel thick line where it feels the division should be.

e. Click on the Binary image to select it, then go to Analyze > Analyze Particles. (Data are in Appendix B, C, D, E, F, G）

Risk assessment:

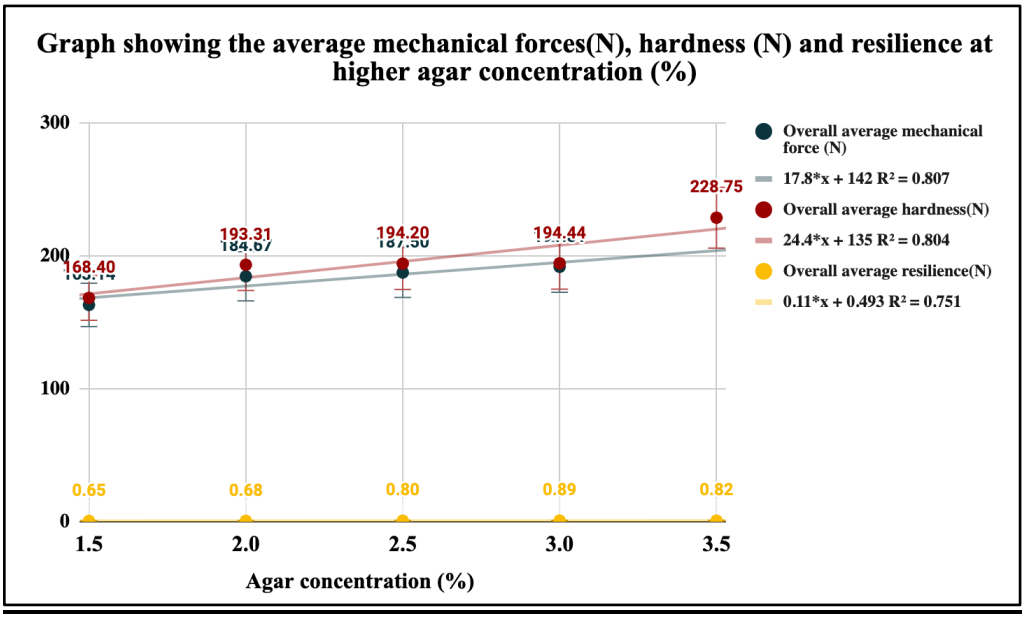
1. Prevent cutting fingers when using a knife.
2. When working in such close proximity to a burner to maintain a zone of sterility there is a risk of burns. Allow the heated apparatus (heater, pressure cooker, alcohol lamp. etc) to cool before handing it, and keep a safe distance between the heated apparatus before it cools.
3. Cleaning up the table after the experiment prevents others ingesting yeasts accidently, which might hurt digestion.
4. Once bacterial contamination occurs during yeast cultivation, contaminants have to be destroyed to prevent cutaneous mycoses if contacting it . When destroying the contaminated objects, remember to wash hands carefully and wipe the apparatus with hypochlorite and ethanol.

2.3 Result Data (IV):

Processed Table. 1. *Showing average mechanical forces(N), hardness(N), resilience(N) in PDA media with agar concentration of 1.5 % 2.0%, 2.5%, 3.0%, 3.5% (N : Newton).*

Agar concentration(%)	Overall average mechanical force (N)	Overall average hardness(N)	Overall average resilience(N)
1.5	163.14	168.40	0.65
2	184.67	193.31	0.68
2.5	187.50	194.20	0.8
3	191.81	194.44	0.89
3.5	193.73	228.75	0.82

Graph 1.



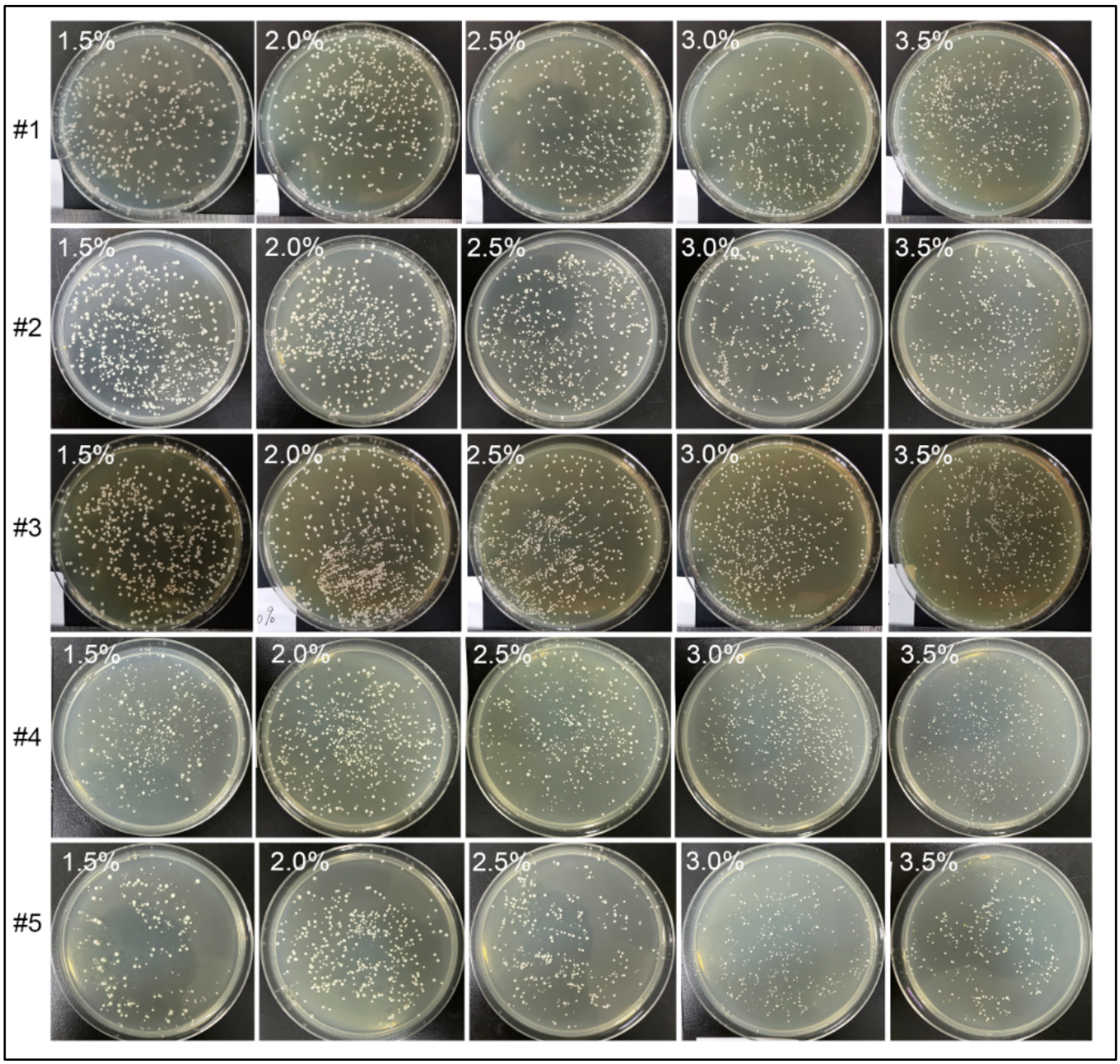
The hardness of PDA media positively correlates with the concentration of agar

Conditioned PDA media plates were prepared with potato infusion, dextrose and 1.5%, 2.0%, 2.5%, 3.0% or 3.5% agar, named 1.5%, 2.0%, 2.5%, 3.0% or 3.0% PDA media respectively. After cooling and solidification, the hardness of conditioned PDA media plates were measured using Texture analyzers (Ta.XT2i, Stable Micro Systems) by collecting three different spots on the PDA media and calculating the average.

2.4 Result Data(DV):

Qualitative

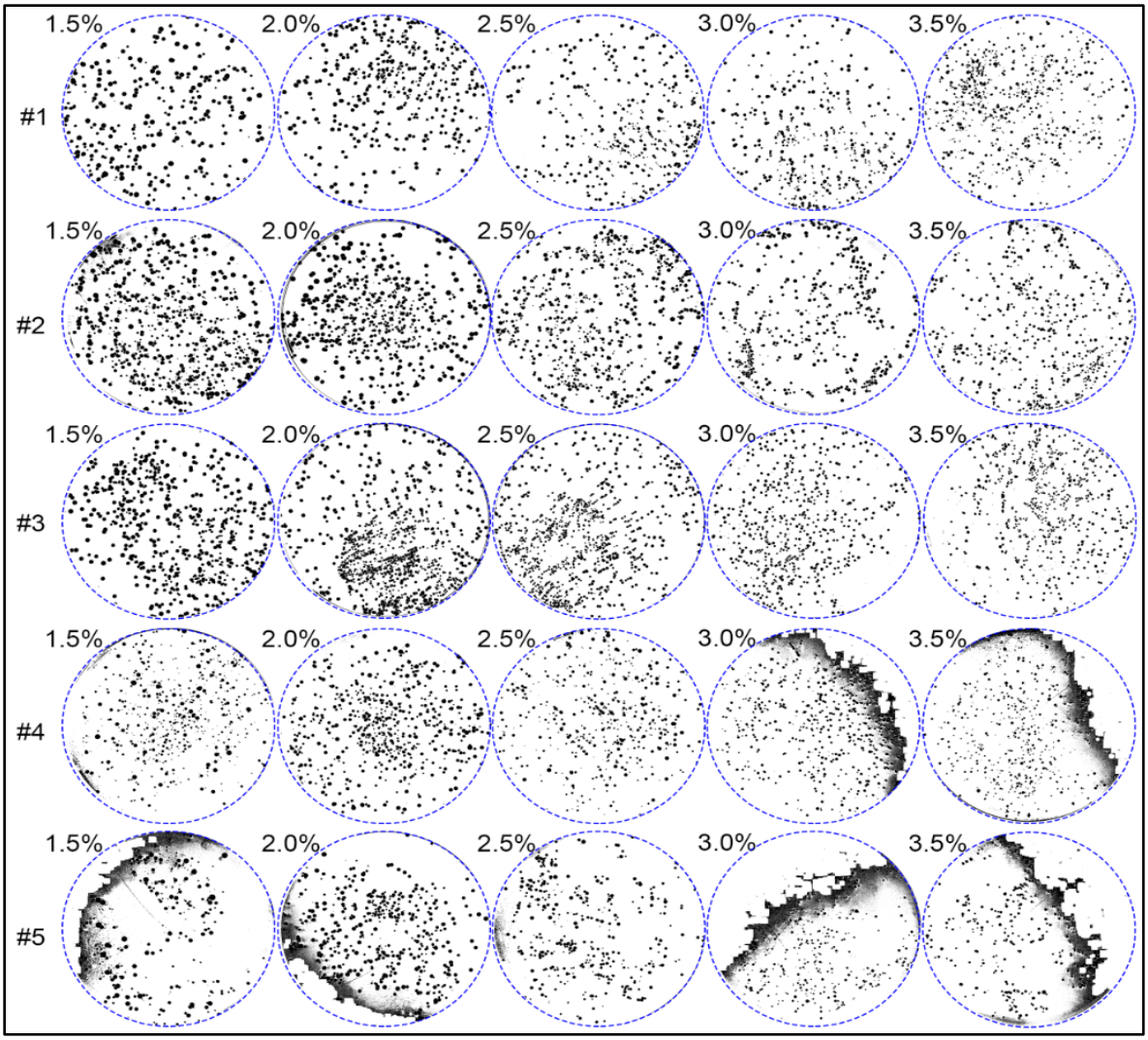
Fig 4. *The represent image of S. cerevisiae colonies cultured on PDA media with agar concentrations of 1.5%, 2.0%, 2.5%, 3.0% and 3.5%.*



The growth rate of *S. cerevisiae* decreased in harder PDA media (e. g. Trial 1)

To determine the effect of environmental mechanical forces changed by surface stiffness on the growth of *S. cerevisiae*, the yeasts were cultured in solid 1.5%, 2.0%, 2.5% or 3.0% PDA media for another three days at the temperature of 27 °C to form colonies and then each colony size was measured. To better elaborate, Figure 4 depicts that the *S. cerevisiae* colonies exhibit a **larger round** pattern distribution on 1.5 % and 2.0% PDA media, **smaller round** pattern distribution on 2.5%, 3.0% and 3.5% PDA media, and **irregular shape** pattern distribution in harder 3.0% and 3.5% PDA media.

Fig. 5*. Binary versions of the scanned images of S. cerevisiae colonies on PDA media with agar concentrations of 1.5%, 2.0%, 2.5%, 3.0% and 3.5% for 5 replicated trials.*



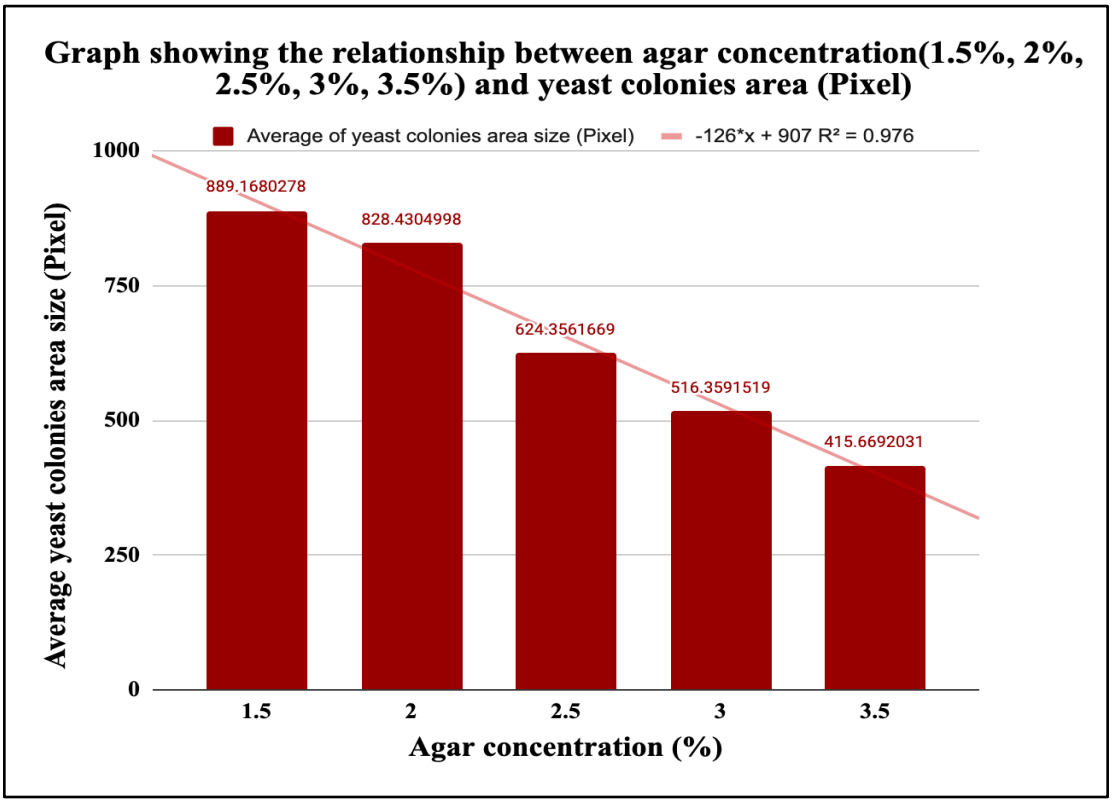
In Figure 5, Processed Table 2 and Graph 2, after processing with ImageJ Software, the average areas of yeasts' colonies grown on stiffer plates (with higher agar concentrations) was significantly smaller than those grown on softer plates (with lower agar concentrations).

Quantitative

Processed Table 2 *showing the relationship between agar concentration (1.5%, 2%, 2.5%, 3%, 3.5%) and yeast colonies area (Pixel).*

Agar concentration (%)	Average of total area of yeast colonies (Pixel)						Standard Deviation (SD)
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Average	
1.5	889.26	1,253.42	1,331.68	549.63	421.85	889.17	406.87
2	672.28	1,151.39	790.06	965.50	562.92	828.43	234.22
2.5	438.51	1,063.12	565.13	674.51	380.51	624.36	270.43
3	365.09	803.80	667.80	374.27	370.85	516.36	206.03
3.5	239.63	734.03	420.23	295.94	388.52	415.67	191.99

Graph 2.



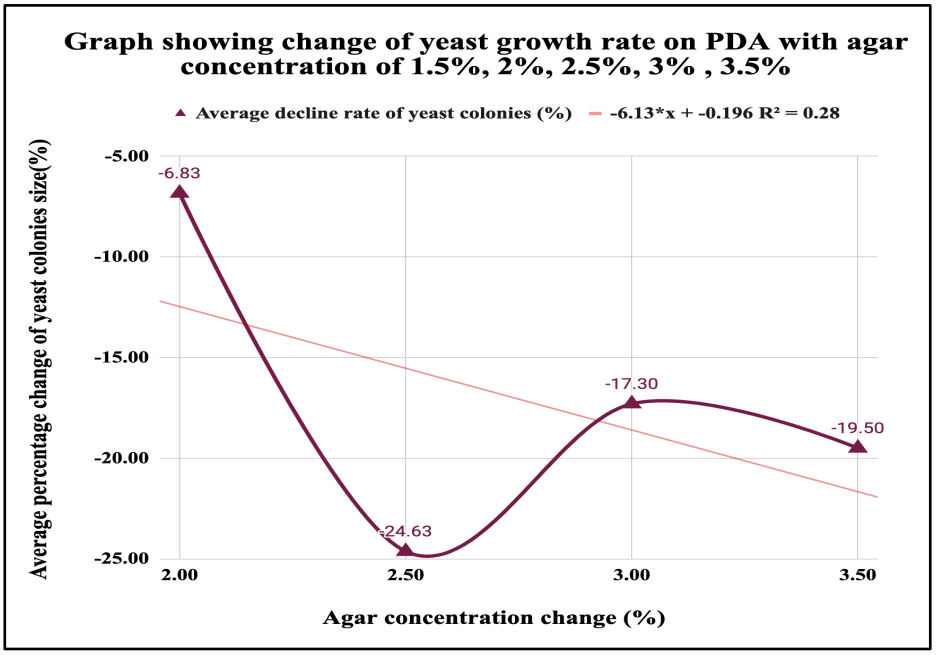
Processed Table 3 *showing average showing the relationship between agar concentration (1.5%, 2%, 2.5%, 3%, 3.5%) and yeast growth rate (%).*

Initial agar concentration (%)	Final agar concentration (%)	Change of growth rate in yeast colonies (%)
1.50	2.00	-6.83
2.00	2.50	-24.63
2.50	3.00	-17.30
3.00	3.50	-19.50

In order to put these changes in yeast growth into perspective, the mean percentage change of yeast growth size was calculated by the following formula, and the data were indicated by the processed Table 3 and Graph 3.

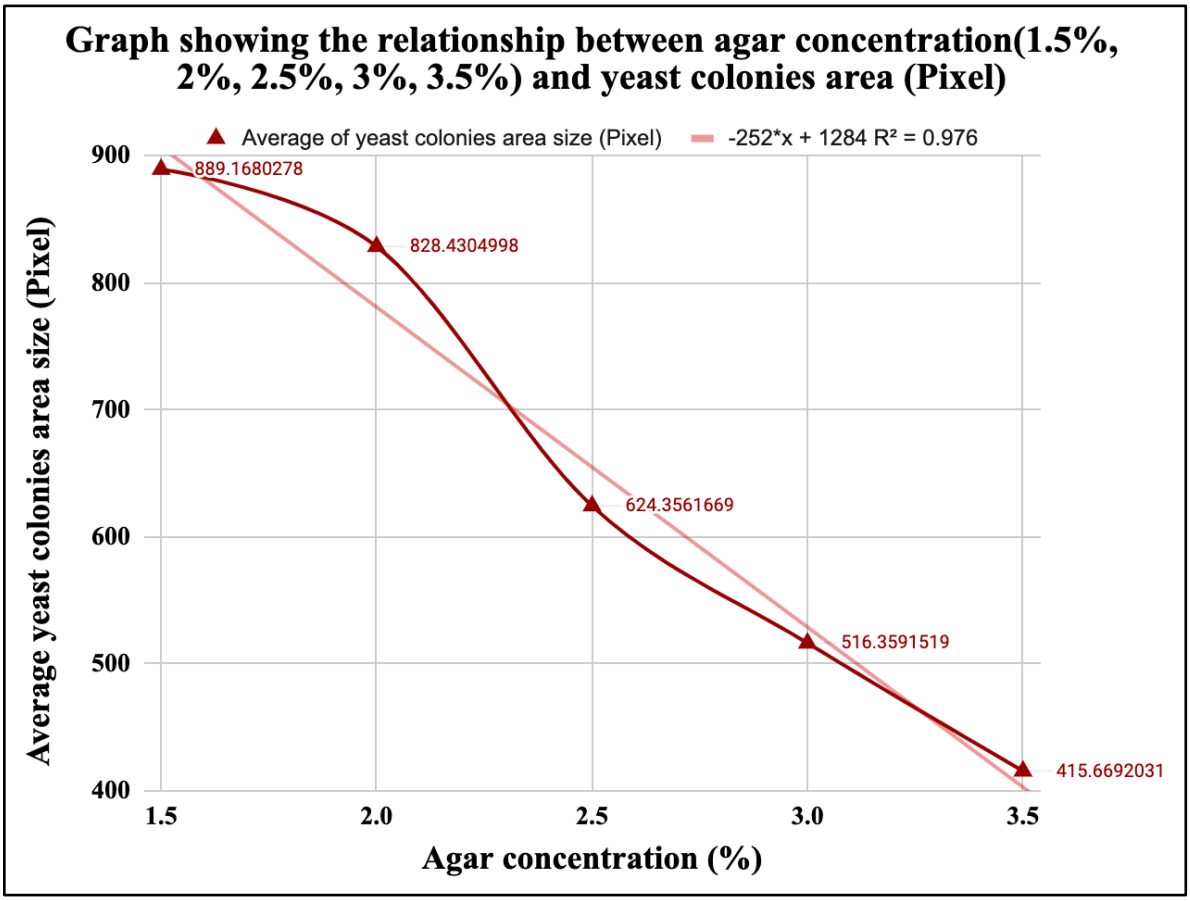
$$Change\ of\ Yeast\ growth\ rate = \frac{The\ Change\ of\ Yeast\ colony\ \ area\ \ after\ each\ increase\ of\ 0.5\%\ agar\ concentration\ in\ PDA\ media}{Yeast\ growth\ area\ in\ previous\ PDA\ media} \times 100\%$$

Graph 3.



Graph 3 demonstrates that there is a negatively downward trend between gar concentration and yeast area growth rate. However, the yeast growth rate change was the most (-24.63%) when agar concentration is within the range of 2% to 2.5%. Later, the percentage change of yeast colony area or size slightly increased to -17.30% when agar concentration increases from 2.5% to 3%.

Graph 4.



In Graph 4, as agar concentration increases from 1.5% to 3.5%, the yeast colony size decrease from 889.168 pixel to 414.668 pixel, which illustrates a negative correlation between the average yeast colony size and agar concentration.

Chapter III: Discussion

4.1 Conclusion

In conclusion, stronger environmental mechanical forces inhibit *S. cerevisiae*'s growth on harder matrix of the PDA media made with higher concentration of the agar. To elaborate, both Graph 1 and processed Table 1 showed that the mechanical properties of PDA media including resilience (N), hardness (N) and mechanical forces (N) positively correlated with higher agar concentration (%). From 1.5% to 3.5% agar concentration, the mechanical forces increased from 163.14N to 193.73N, indicating that higher agar concentration (%) resulted in harder or stronger mechanical force of PDA media. Specifically, both Figure 4 and 5 showed that a harder matrix medium or stronger mechanical force inhibits the yeast growth shown as smaller colonies supporting the hypothesis.

The qualitative data producing in-depth analysis of specific patterns from the observation identifies rich data that can lead to further research. As Graph 2(quantitative data) illustrates that the S. cerevisiae colony's size (pixel) was smaller when higher agar concentration was present, the relative area size (pixel) of the yeast colonies quantified by ImageJ Software provided the numerical measurement, and concluded that weaker mechanical forces actually foster yeasts' growth. It's evident that larger round distribution patterns of *S. cerevisiae* colonies grow on the softer 1.5% and 2% PDA media, and the smaller round colonies distribute on the harder 2.5%, 3% or 3.5% PDA media (where yeasts grow the worst). Graph 4 indicates that yeasts' development and growth capacity was negatively correlated with the environment's stiffness and surrounding mechanical force, in a way supporting the hypothesis that EMF suppresses the growth of walled

cells such as yeast, as the average colony area present a downward trend on the third day when increasing agar concentration from 1.5% to 3.5%.

Additionally, the coordinate (2.50, -24.63) shown in Graph 3 implies that yeasts grew the worst when in range of 2% to 2.5% agar concentration due to the lowest average area change rate, then it continues to decrease on PDA media with agar concentration as well as mechanical forces increasing. In Graph 2 and 3, stronger environmental mechanical forces produced by higher agar concentration will eventually curb the growth of walled cells such as S. cerevisiae, and its size decrease most in growth status occurs when agar concentration presents in the range of 2% to 2.5%. The hypothesis is accepted due to the negative correlation between yeasts colony size and agar concentration, which can also be linked to the research. Accordingly, Rojas and Huang (2018) reported that a hypoosmotic shock promoted by increasing mechanical forces will increase the turgor pressure and membrane tension, leading to transient inhibition of cell-wall growth via electrical depolarization. Moreover, it also clear to explain why 1.5 % to 2 % agar concentration is always and typically used to cultivate yeasts in the solid culture media, which is always helps to determine the colony characteristics of the isolates (such as colony morphology, hemolysis, pigment production, etc.) (Tankeshwar). Beside the laboratory, the yeasts are exposed to various EMF in their natural habitat, so Mishra (2022) mentioned that “yeast have evolved complex signaling networks to sense and respond to intrinsic and extrinsic mechanical forces”, which could be counted as an adaptive evolution. Consequently, this investigation did help us better understand the effects of sustained environmental mechanical forces on the growth of walled cells such as unicellular fungi which are exposed to a myriad of mechanical cues in their natural habitats.

The standard deviation of the raw data is calculated as it measures how far the data is from the mean, and it gives an insight of whether the data in one condition is spread out or not. As Graph 1 demonstrates, the high standard deviation (191.99 to 406.87) of the average mechanical forces reflects the large amount of variation in the data group, indicating that mechanical forces in the same agar concentration is significantly different, which is likely to be accounted for the unavoidable evaporation of matrix and its unequal thickness. Nonetheless, the hypothesis is still accepted as data of each trial is within the same range, illustrating an accurate and general trend. The investigation briefly and fundamentally builds the understanding and relationship between the interactions between walled cells and their environment.

4.2 Evaluation of Procedure

The experimental procedure is concise and easy to follow due to the simple methodology and uncomplicated materials required. It is also easy to operate due to the available access to required apparatus in university labs and the notion that it can be executed with materials, as the Texture Analysis Profile has a high force sensor accuracy, which is defined as the smallest amount of force that can be applied to the senor body required to cause a linear and repeatable variation in the voltage output (FUTEK). Besides, ImageJ Software elaborates the data of colony sizes clearly and more accurately, and supports the relationship through the quantitative data which helps observe the growing status of yeast colonies easier. The errors are minimized by repeating trials 10 times and calculating the standard deviation of raw data, to ensure the validity and reliability of the experiment. This investigation showed that mechanical forces changed by agar concentration, which simulates the environmental mechanical forces generated by different surfaces in yeasts' habitat, is likely to curb the growth of microbes such as yeast. The hypothesis

is accepted that when yeast is cultured on stiffer PDA media made with a higher range of agar concentration.

Nevertheless, strict requirements for handling the process of yeast cultures can be an issue whereas it is not a case for this investigation. As the major challenge, contamination of yeast culture is usually caused by an airborne route or by the contaminated flask or plate surface. In order to avoid it, the apparatus had to be carefully autoclaved by being sprayed or wiped with hypochlorite and ethanol, and contaminated plates and objects had to be disposed of immediately. Secondly, data collected from the experiment relies on a large proportion of human input which in turn creates a larger capacity of human error, and the inconsistency of data resulted in high standard deviation (Table 1 & 2). It can be addressed by increasing the trial of each concentration from 10 times to 100 times and then calculating its average. To maximize the forces sensor accuracy, the number of sites selected in the line of different circular diameters drawn on the plate bottoms can increase from 3 to 10 to increase data validity and percision, and then they can be measured by the Texture Analysis Profile (Figure 3-A). Thirdly, the high background presented in1.5%, 2%, 3%,3.5% in replicated 5 (#5) and 3%, 3.5% in replicated 4(#4) (Figure 5) caused by the uneven matrix thickness or photography will result in inaccurate identification of yeast colonies, which is measured by the ImageJ Software. It causes less accurate area data, so it is acceptable to cook the potato dextrose agar media for a longer time and set a uniform thickness of each plate to prevent uneven matrix, or photography in a location with abundant light. In addition, the systematic errors caused by the physical operation might happen in the calculated uncertainty such as hand-eye coordination (measuring cylinder, beakers, weight scale) that would result in inconsistent data recording, so it can be improved by

expanding the number of trials and/or changing the initial yeast number in the culture to test how environmental mechanical forces affect the yeasts' growth.

Works Cited

Science Buddies. “Agar and Its Use in Chemistry and Science.” Science Buddies, https://www.sciencebuddies.org/science-fair-projects/references/grow-microbes-agar. Accessed 17 Jan 2023.

Nobel Prize Organisation. “All Nobel Prizes 2021.” The Nobel Prize, https://www.nobelprize.org/all-nobel-prizes-2021/. Accessed 10 Oct 2022.

Atilgan, Erdinc, et al. “Morphogenesis of the Fission Yeast Cell through Cell Wall Expansion.” Current Biology, vol. 25, no. 16, 2015, pp. 2150–2157. Retrieved on Jun 28 2022 from, https://www.cell.com/current-biology/pdfExtended/S0960-9822(15)00786-1

Bayir E, Sendemir A, Missirlis YF. Mechanobiology of cells and cell systems, such as organoids. Biophys Rev. 2019 Oct;11(5):721-728. doi: 10.1007/s12551-019-00590-7. Epub 2019 Sep 9. PMID: 31502190; PMCID: PMC6815306.

Bruker. “Cell and Environmental Mechanics.” Bruker, https://www.bruker.com/en/applications/academia-life-science/cell-biology/cell-and-environmental-mechanics.html. Accessed 13 Mar 2023.

Forces in cell biology. Nat Cell Biol 19, 579 (2017)(n.d.).

https://doi.org/10.1038/ncb3552 Accessed Mar 13 2022

Guo, Jiangtao, and Zhenfeng Liu. “Progress on the Discoveries of Temperature and Touch Receptors: Interpretation of the 2021 Nobel Prize in Physiology or Medicine.” Chinese Science Bulletin, vol. 67, no. 6, 2021, pp. 572–580. https://www.nobelprize.org/uploads/2021/10/advanced-medicine-2021.pdf. Accessed Jul 25 2022

Kamath, R. S., and H. R. Bungay. “Growth of Yeast Colonies on Solid Media.” Microbiology, vol. 134, no. 11, 1988, pp. 3061–3069., https://reader.elsevier.com/reader/sd/pii/S0006349514003476?token=21001AC025494B7EBAE57A04A7491C1C30D93FDB457FB70D792E901A6B6012A5732E1CE4030D9979851DBE666C68E6BD&originRegion=eu-west-1&originCreation=20230115154615. Accessed Jul 11 2022

"Mechanical Forces Play Major Role in Regulating Cells." ScienceDaily, https://www.sciencedaily.com/releases/2013/03/130319201941.htm. Accessed Feb 27 2022

Mishra, Ranjan, et al. "Cells under Pressure: How Yeast Cells Respond to Mechanical Forces." Trends in Microbiology, vol. 30, no. 5, 2022, pp. 495–510. https://pubmed.ncbi.nlm.nih.gov/35000797/ Accessed Jun 28 2022

Neeli-Venkata, Ramakanth, et al. "Detection of Surface Forces by the Cell-Wall Mechanosensor WSC1 in Yeast." Developmental Cell, vol. 56, no. 20, 2021, https://doi.org/10.1016/j.devcel.2021.09.024. Accessed Jun 28 2022

Rojas, Enrique R, and Kerwyn Casey Huang. "Regulation of Microbial Growth by Turgor Pressure." Current Opinion in Microbiology, vol. 42, 2018, pp. 62–70. https://pubmed.ncbi.nlm.nih.gov/29125939/ Accessed Jun 28 2022

Rine, Jasper. "The Yeast Saccharomyces Cerevisiae in Molecular and Cellular Biology: A Smaller but Not Lower Eucaryote." American Zoologist, vol. 29, no. 2, 1989, pp. 605–16. JSTOR, http://www.jstor.org/stable/3883266. Accessed Jun 28 2022

Tankeshwar, Acharya. "Bacterial Culture Media: Classification, Types, Uses – Microbe Online." Microbe Online, 5 November 2022, https://microbeonline.com/types-of-bacteriological-culture-matrix/. Accessed 18 Jan 2023.

Appendices

Appendix A: Raw Table 1 shows average mechanical forces(N), hardness(N), resilience(N) with PDA media agar concentration of 1.5 % 2.0%, 2.5%, 3.0%, 3.5%. (gravity : g=9.806 65 m s^{-2})

Batch	Deepness (mm)	Spot	Mechanical force (g)	Hardness (g)	Resilience
	2	1	1452.861	1477.538	0.709
	2	2	1576.81	1670.585	0.667
1.5% Agar T1	2	3	1619.141	1705.799	0.664
	2	1	1671.79	1763.452	0.633
	2	2	1640.272	1735.194	0.643
1.5% Agar T2	2	3	1538.807	1620.139	0.672
	2	1	1664.869	1770.247	0.639
	2	2	1673.19	1771.946	0.641
1.5% Agar T3	2	3	1845.003	1969.136	0.606
	2	1	1783.653	1915.075	
	2	2	1873.479	2067.915	
2% Agar T1	2	3	1856.653	2013.648	
	2	1	1834.638	1873.49	0.743
	2	2	1770.534	1860.004	0.734
2% Agar T2	2	3	1932.143	2070.739	0.69
	2	1	1841.468	1943.58	0.634
	2	2	1848.722	2103.141	0.646
2% Agar T3	2	3	1878.805	2033.4	0.633
	2	1	1739.97	2123.78	0.426
2.5% Agar T1	2	2	1809.3	2033.48	0.33
	2	1	1973.5	2049.9	0.284
2.5% Agar T2	2	2	1845.5	1993.4	0.226
	2	1	1982.69	1983.4	0.751
	2	2	1892.89	2209.97	0.696
2.5% Agar T3	2	3	1946.97	1895.8	0.639
	2	1	1745.891	1938.4	
	2	2	1573.941	1622.205	0.894
3% Agar T1	2	3	2134.5	1839.48	0.976
	2	1	2190.327	2267.952	0.842
	2	2	2242.287	2319.12	
3% Agar T2	2	3	2180.352	2251.883	0.852
	2	1	1591.881	1623.743	0.881
	2	2	1993.49	1983.39	0.906
3 % Agar T3	2	3	1610.383	1653.322	0.889
	2	1	1393.52	1939.49	0.775
	2	2	1667.486	1711.813	
3.5% Agar T1	2	3	1556.276	1711.813	0.897
	2	1	2179.342	2261.811	0.844
	2	2	2334.5	1938.134	0.759
	2	3	2492.827	2632.501	0.743
3.5% agar T2	2	4	2898.226	3109.04	0.689
	2	1	1592.833	1930.39	0.848
	2	2	1893.59	2993.48	0.899
3.5% Agar T3	2	3	1903.62	2844.39	0.815

Appendix B: Raw Table 2 shows the yeast colony area on PDA with agar concentration of 1.5%, 2%, 2.5%, 3%, 3.5% (Trial 1).

Saccharomyces cerevisiae's colonies area on PDA with agar concentration of 1.5%, 2%, 2.5%, 3%, 3.5% (Trial 1)					
Colony label	Colony area on PDA with 1.5% agar concentration (Pixel)	Colony area on PDA with 2% agar concentration (Pixel)	Colony area on PDA with 2.5% agar concentration (Pixel)	Colony area on PDA with 3% agar concentration (Pixel)	Colony area on PDA with 3.5% agar concentration (Pixel)
1	2836	1556	1289	1182	961
2	2472	1521	1113	1166	930
3	2369	1472	1109	1156	927
4	1979	1458	1101	1080	924
5	1972	1406	1082	1074	918
6	1885	1395	1052	1056	906
7	1880	1367	1040	1051	901
8	1865	1355	1028	1017	880
9	1829	1305	1011	995	880
10	1817	1283	1010	991	872
11	1812	1272	1010	951	868
12	1805	1248	1002	944	822
13	1803	1238	961	940	812
14	1767	1230	952	940	810
15	1730	1213	942	902	809
16	1727	1210	940	901	798
17	1721	1188	929	901	795
18	1712	1185	922	894	772
19	1710	1166	918	892	751
20	1707	1161	911	878	736
21	1691	1153	910	871	734
22	1668	1151	904	869	731
23	1656	1150	901	837	728
24	1653	1145	893	827	723
25	1642	1139	892	823	720
26	1641	1134	886	820	713
27	1610	1115	884	814	704
28	1597	1111	882	813	702
29	1579	1109	879	811	701
30	1571	1109	877	809	696
31	1568	1101	875	804	695
32	1557	1096	873	801	692
33	1554	1093	872	799	691
34	1552	1090	872	794	690
35	1551	1087	868	790	686
36	1550	1078	867	784	681
37	1535	1077	867	781	677
38	1534	1073	855	776	676
39	1527	1073	850	776	676
40	1524	1072	849	772	674
41	1517	1068	844	770	673
42	1490	1067	844	769	669
43	1476	1066	842	760	664
44	1462	1066	840	760	664
45	1456	1063	832	758	652
46	1448	1059	831	757	652
47	1447	1055	830	748	650
48	1444	1051	827	748	644
49	1442	1051	824	743	644
50	1436	1047	824	732	641
51	1428	1045	821	723	641
52	1427	1042	816	719	639
53	1415	1039	816	716	635
54	1384	1038	814	715	633
55	1380	1035	813	712	632
56	1373	1034	809	712	630

57	1371	1033	806	711	627
58	1367	1022	805	710	620
59	1356	1022	805	710	610
60	1342	1019	803	710	601
61	1342	1012	802	709	596
62	1324	1010	785	709	590
63	1323	1008	783	706	587
64	1306	1008	778	702	587
65	1302	1004	777	692	583
66	1297	1002	768	690	582
67	1286	1001	767	690	582
68	1271	986	766	677	580
69	1263	985	758	666	577
70	1262	983	758	663	576
71	1255	981	756	649	571
72	1245	977	753	648	563
73	1242	975	752	644	559
74	1234	974	745	644	559
75	1233	963	739	637	559
76	1233	961	736	634	559
77	1233	960	735	634	551
78	1225	958	729	634	549
79	1224	957	717	627	544
80	1223	954	716	626	541
81	1189	953	709	622	532
82	1188	952	705	621	531
83	1181	951	704	620	526
84	1180	946	701	618	517
85	1161	944	701	615	516
86	1159	941	699	615	510
87	1157	936	698	593	508
88	1152	931	695	587	501
89	1152	925	686	582	500
90	1149	923	682	582	496
91	1147	921	680	579	495
92	1144	921	677	578	495
93	1138	918	669	577	494
94	1135	917	668	576	493
95	1123	915	668	576	491
96	1117	913	667	576	486
97	1115	912	662	574	480
98	1115	910	659	566	479
99	1113	901	655	565	476
100	1107	900	655	560	475
101	1096	900	652	557	460
102	1088	900	648	548	459
103	1088	897	644	545	456
104	1085	896	636	543	455
105	1084	895	636	542	453
106	1077	892	636	540	448
107	1069	890	635	539	448
108	1066	890	632	538	443
109	1064	887	626	537	440
110	1060	885	621	536	440
111	1043	880	621	534	439
112	1038	879	621	533	438
113	1037	879	621	529	438
114	1034	872	618	527	434
115	1032	870	615	526	433

2

116	1025	869	612	520	431
117	1024	862	611	520	429
118	1021	855	610	517	429
119	1021	853	607	514	426
120	1013	850	604	514	426
121	1010	849	602	511	426
122	1007	849	602	509	425
123	982	848	601	508	423
124	980	843	597	507	422
125	978	842	593	506	419
126	972	838	588	502	418
127	970	838	580	499	418
128	965	835	576	498	417
129	964	831	575	497	415
130	959	827	569	494	415
131	955	826	567	489	415
132	951	826	566	489	414
133	947	825	562	487	413
134	941	817	557	482	413
135	941	816	556	480	411
136	930	815	555	475	410
137	923	815	554	468	410
138	909	814	552	466	407
139	892	807	549	462	407
140	892	805	549	461	405
141	892	804	548	459	405
142	889	802	548	459	405
143	887	796	545	455	405
144	882	792	543	455	404
145	882	791	535	455	401
146	877	791	534	452	399
147	867	788	532	451	398
148	865	788	525	447	397
149	864	788	523	445	396
150	862	787	521	445	390
151	861	786	516	441	389
152	860	785	511	439	389
153	859	784	504	438	388
154	852	783	500	437	387
155	847	782	499	436	387
156	845	781	499	434	387
157	837	780	496	433	385
158	837	779	495	427	385
159	835	777	493	425	384
160	827	777	493	424	383
161	817	775	492	424	382
162	812	775	491	423	380
163	812	771	491	417	380
164	809	771	490	417	380
165	804	771	488	411	379
166	801	769	487	410	377
167	793	769	485	409	377
168	793	765	483	409	377
169	782	764	481	408	377
170	780	763	479	407	376
171	779	760	478	399	375
172	778	757	477	396	374
173	775	750	474	395	364
174	775	746	472	390	361

3

175	770	742	466	389	359
176	762	741	464	385	357
177	761	741	461	385	357
178	757	739	461	382	353
179	756	735	456	382	351
180	756	734	454	381	350
181	754	732	454	379	347
182	753	731	453	378	345
183	751	730	452	378	344
184	749	728	449	376	343
185	744	722	448	373	341
186	741	722	445	372	341
187	733	721	435	372	340
188	727	720	429	371	339
189	722	720	427	371	338
190	722	717	426	363	338
191	717	716	422	363	336
192	711	711	421	363	335
193	710	708	421	363	335
194	703	707	420	362	333
195	703	706	417	361	332
196	698	704	414	359	330
197	697	703	411	359	328
198	697	702	409	359	328
199	697	700	401	358	326
200	693	697	401	356	325
201	691	696	400	356	325
202	682	695	394	355	324
203	678	694	392	351	322
204	674	687	391	347	321
205	672	685	390	346	320
206	671	682	388	342	317
207	669	682	386	339	317
208	660	681	383	333	314
209	657	678	383	333	309
210	640	676	380	333	309
211	637	676	380	330	308
212	636	675	377	329	308
213	635	675	376	329	307
214	634	673	374	327	304
215	634	670	372	327	303
216	631	667	372	326	301
217	623	665	371	326	301
218	622	664	370	325	301
219	621	662	370	324	300
220	613	661	368	324	298
221	612	660	352	323	298
222	611	660	352	318	297
223	607	657	351	316	297
224	596	657	346	313	295
225	593	652	345	311	294
226	591	651	340	310	292
227	585	650	337	309	292
228	579	650	337	308	291
229	578	642	336	308	291
230	577	642	332	307	291
231	575	642	327	304	290
232	574	640	325	303	290
233	574	639	321	303	290

4

234	569	637	320	302	289
235	569	636	319	301	287
236	568	634	318	300	287
237	564	628	316	298	286
238	550	622	316	295	286
239	550	621	315	294	286
240	542	621	313	294	285
241	538	621	313	293	284
242	532	620	306	289	284
243	517	619	306	288	283
244	517	618	302	287	282
245	506	618	298	284	282
246	504	617	297	283	281
247	501	614	297	282	280
248	498	613	292	279	280
249	493	606	291	276	277
250	487	601	283	273	277
251	477	601	282	273	277
252	465	598	280	272	276
253	465	596	279	270	275
254	463	595	278	269	275
255	459	594	276	269	275
256	459	594	272	269	275
257	452	590	267	265	274
258	452	589	265	265	271
259	448	588	259	265	270
260	446	582	258	262	270
261	434	581	258	260	269
262	421	574	256	258	269
263	401	573	253	257	269
264	393	572	249	255	269
265	379	568	248	251	268
266	378	558	248	250	268
267	378	556	247	247	266
268	375	554	246	245	264
269	364	548	244	245	263
270	356	544	243	245	262
271	350	543	241	244	260
272	344	543	240	243	259
273	336	542	238	243	259
274	314	542	238	241	258
275	309	542	233	238	257
276	286	541	231	238	257
277	280	540	230	236	254
278	255	540	229	231	253
279	236	538	226	228	252
280	233	537	226	228	252
281	209	534	224	226	251
282	204	532	224	226	251
283	155	530	220	226	250
284	150	530	220	224	249
285	150	530	217	222	248
286	148	529	212	221	247
287	141	521	210	217	246
288	129	518	208	216	246
289	117	517	206	215	245
290	112	514	201	212	245
291	104	514	201	211	244
292	99	513	200	210	244

293	91	513	197	210	242
294	65	512	197	208	241
295	23	509	195	207	240
296	11	508	195	204	240
297	9	508	190	195	239
298	7	501	186	194	238
299	6	493	185	194	237
300		484	183	193	237
301		482	183	191	237
302		474	182	190	234
303		471	182	190	234
304		470	179	190	234
305		461	178	188	232
306		457	178	187	232
307		457	177	183	231
308		456	171	180	230
309		455	170	179	230
310		455	165	179	229
311		454	165	176	229
312		453	159	174	229
313		450	156	174	228
314		447	156	171	228
315		443	153	170	228
316		442	151	169	228
317		440	151	162	227
318		437	149	162	227
319		428	146	161	226
320		420	142	158	225
321		419	141	157	224
322		414	139	156	223
323		410	137	149	223
324		410	134	148	223
325		408	133	148	223
326		408	125	148	222
327		404	124	147	221
328		399	123	144	221
329		394	121	142	221
330		390	119	139	220
331		389	116	139	220
332		384	113	138	220
333		384	113	138	220
334		382	112	137	220
335		374	104	137	218
336		372	101	137	217
337		371	101	136	216
338		370	101	135	214
339		364	99	134	214
340		364	99	134	214
341		359	98	132	214
342		359	96	131	214
343		358	93	127	214
344		345	92	125	212
345		344	89	124	211
346		331	81	123	211
347		328	76	123	210
348		319	75	121	210
349		311	75	121	210
350		310	71	119	208
351		304	71	119	207

352		292	68	119	207
353		289	66	119	206
354		283	63	115	206
355		278	61	115	206
356		273	60	115	205
357		268	57	112	204
358		265	55	111	204
359		256	55	110	203
360		250	54	108	203
361		248	51	105	203
362		248	48	104	202
363		246	45	104	201
364		245	45	97	201
365		243	42	96	199
366		242	41	94	199
367		227	36	94	199
368		222	35	93	198
369		214	35	93	197
370		213	34	92	197
371		209	31	91	197
372		198	31	90	195
373		198	31	88	194
374		185	29	86	194
375		181	28	84	193
376		164	28	83	193
377		160	26	83	191
378		153	26	80	190
379		148	25	79	190
380		140	23	77	190
381		140	22	76	189
382		135	21	75	189
383		128	21	74	189
384		120	21	74	188
385		113	21	73	188
386		88	21	70	188
387		81	17	69	188
388		72	15	69	188
389		58	15	67	187
390		53	13	67	187
391		52	13	65	185
392		50	12	63	185
393		38	11	59	185
394	29	11		58	184
395	25	10		56	184
396	20	10		55	184
397	12	9		55	183
398	9	9		51	182
399	8	9		51	182
400	8	9		50	181
401	8	8		47	181
402	8	7		47	181
403	7	7		45	180
404	7	7		42	180
405	7	7		41	180
406	7	6		40	179
407		5		39	176
408		5		33	176
409		5		31	174
410				29	172

411				28	172
412				28	171
413				26	171
414				25	170
415				25	170
416				25	169
417				20	169
418				20	168
419				19	167
420				18	166
421				18	163
422				17	162
423				16	162
424				16	160
425				12	160
426				12	159
427				12	158
428				11	158
429				11	157
430				11	157
431				11	156
432				10	156
433				10	155
434				9	155
435				8	155
436				8	154
437				7	152
438				7	151
439				7	151
440				6	150
441					150
442					150
443					149
444					147
445					146
446					146
447					145
448					143
449					142
450					142
451					142
452					141
453					140
454					139
455					139
456					137
457					137
458					137
459					136
460					136
461					136
462					135
463					135
464					135
465					132
466					132
467					131
468					130
469					130

470					129
471					129
472					129
473					129
474					128
475					125
476					124
477					124
478					123
479					123
480					123
481					122
482					121
483					121
484					119
485					118
486					118
487					118
488					117
489					117
490					117
491					117
492					117
493					116
494					116
495					115
496					115
497					114
498					113
499					112
500					111
501					110
502					109
503					109
504					109
505					106
506					106
507					106
508					106
509					105
510					103
511					102
512					102
513					102
514					102
515					101
516					101
517					101
518					101
519					100
520					99
521					98
522					98
523					97
524					97
525					96
526					96
527					96
528					96

529					95
530					95
531					95
532					94
533					94
534					94
535					92
536					92
537					92
538					91
539					91
540					90
541					90
542					89
543					89
544					88
545					87
546					87
547					87
548					86
549					85
550					84
551					84
552					83
553					82
554					82
555					82
556					82
557					81
558					81
559					81
560					81
561					80
562					80
563					78
564					78
565					76
566					76
567					75
568					74
569					73
570					72
571					72
572					72
573					72
574					72
575					71
576					69
577					68
578					67
579					66
580					65
581					63
582					62
583					62
584					60
585					59
586					59
587					57

588					57
589					57
590					56
591					55
592					55
593					55
594					54
595					53
596					53
597					53
598					51
599					51
600					51
601					50
602					50
603					50
604					49
605					49
606					48
607					48
608					47
609					47
610					46
611					46
612					46
613					46
614					45
615					44
616					43
617					43
618					43
619					43
620					43
621					42
622					42
623					42
624					42
625					41
626					41
627					41
628					40
629					40
630					39
631					39
632					38
633					38
634					38
635					37
636					37
637					37
638					37
639					37
640					36
641					36
642					36
643					35
644					35
645					34
646					34

Appendix C: Raw Table 3 shows the yeast colony area on PDA with agar concentration of 1.5%, 2%, 2.5%, 3%, 3.5% (Trial 2).

Saccharomyces cerevisiae's colonies area on PDA with agar concentration of 1.5%, 2%, 2.5%, 3%, 3.5% (Trial 2)					
Colony label	Colony area on PDA with 1.5% agar concentration (Pixel)	Colony area on PDA with 2% agar concentration (Pixel)	Colony area on PDA with 2.5% agar concentration (Pixel)	Colony area on PDA with 3% agar concentration (Pixel)	Colony area on PDA with 3.5% agar concentration (Pixel)
1	8769	6926	4051	3327	3448
2	6028	5554	4003	3179	3179
3	5731	5418	3856	3166	3038
4	5446	5351	3437	3118	2570
5	5300	5012	3407	2768	2469
6	5121	4937	3348	2697	2394
7	4560	4760	3305	2495	2301
8	4466	4658	3279	2469	2256
9	4341	4602	3272	2445	2218
10	4332	4581	3132	2405	2014
11	4325	4525	3069	2403	1989
12	4324	4405	3048	2356	1954
13	4264	4373	3012	2339	1946
14	4159	4373	2987	2301	1935
15	4145	4328	2979	2297	1905
16	4142	4308	2967	2256	1892
17	4080	4294	2959	2255	1873
18	4015	4259	2942	2200	1870
19	4007	4239	2898	2195	1858
20	3976	4164	2866	2164	1841
21	3947	4161	2813	2163	1837
22	3933	4127	2805	2147	1832
23	3905	4069	2798	2088	1832
24	3878	4053	2780	2086	1805
25	3874	4018	2705	2055	1781
26	3854	4006	2696	2033	1780
27	3847	3878	2681	2005	1778
28	3826	3859	2676	2004	1778
29	3825	3840	2675	1996	1766
30	3806	3800	2615	1992	1759
31	3798	3791	2606	1989	1741
32	3767	3764	2575	1977	1719
33	3764	3758	2549	1966	1714
34	3751	3757	2532	1953	1711
35	3648	3736	2527	1944	1705
36	3646	3721	2526	1935	1699
37	3636	3695	2523	1929	1689
38	3611	3685	2502	1907	1678
39	3601	3624	2474	1892	1674
40	3574	3591	2431	1877	1668
41	3546	3581	2418	1843	1666
42	3538	3503	2406	1841	1665
43	3529	3472	2398	1837	1653
44	3505	3467	2372	1833	1653
45	3484	3464	2368	1825	1645
46	3455	3439	2367	1825	1641
47	3442	3423	2360	1818	1630

48	3430	3391	2355	1818	1627
49	3430	3375	2348	1807	1619
50	3422	3319	2327	1805	1618
51	3411	3313	2286	1780	1611
52	3388	3300	2266	1759	1574
53	3346	3295	2242	1752	1564
54	3338	3274	2241	1745	1563
55	3296	3262	2232	1740	1562
56	3282	3241	2226	1738	1560
57	3273	3158	2219	1734	1554
58	3257	3142	2206	1723	1533
59	3250	3133	2203	1719	1532
60	3217	3132	2198	1717	1526
61	3176	3126	2184	1714	1515
62	3166	3107	2177	1712	1513
63	3162	3106	2176	1711	1489
64	3148	3077	2154	1705	1489
65	3140	3074	2148	1704	1486
66	3109	3065	2145	1699	1485
67	3101	3034	2143	1679	1485
68	3083	3020	2139	1674	1480
69	3074	3016	2138	1666	1473
70	3064	3014	2125	1658	1472
71	3063	3013	2124	1654	1471
72	3056	2997	2123	1653	1471
73	3048	2985	2111	1649	1469
74	3040	2968	2110	1644	1450
75	3028	2966	2105	1641	1443
76	3025	2952	2095	1634	1441
77	3023	2931	2088	1634	1440
78	3018	2907	2050	1630	1440
79	3003	2896	2047	1629	1439
80	2992	2891	2043	1619	1439
81	2988	2856	2040	1619	1438
82	2963	2846	2037	1618	1434
83	2949	2837	2032	1612	1432
84	2943	2830	2020	1611	1425
85	2918	2824	2020	1608	1422
86	2899	2823	2018	1598	1421
87	2888	2821	2014	1595	1420
88	2883	2819	2012	1581	1413
89	2875	2801	1999	1580	1408
90	2866	2777	1997	1574	1408
91	2864	2776	1990	1563	1406
92	2851	2770	1985	1559	1404
93	2848	2762	1976	1548	1402
94	2841	2755	1958	1547	1401
95	2819	2752	1953	1545	1397
96	2811	2752	1949	1541	1392
97	2795	2749	1940	1533	1389
98	2793	2732	1934	1532	1381

2

99	2775	2731	1930	1529	1364
100	2773	2730	1900	1526	1360
101	2755	2718	1898	1524	1356
102	2745	2710	1892	1523	1354
103	2723	2699	1890	1521	1353
104	2721	2689	1876	1519	1352
105	2720	2671	1875	1519	1349
106	2719	2669	1859	1517	1345
107	2715	2657	1855	1516	1339
108	2708	2657	1854	1515	1336
109	2705	2651	1850	1512	1332
110	2705	2649	1838	1503	1329
111	2701	2632	1836	1485	1328
112	2688	2619	1830	1484	1327
113	2672	2616	1829	1483	1326
114	2656	2606	1826	1480	1321
115	2654	2598	1822	1478	1321
116	2649	2594	1821	1469	1317
117	2648	2558	1820	1469	1316
118	2638	2556	1820	1464	1315
119	2622	2528	1819	1464	1314
120	2620	2516	1813	1450	1314
121	2599	2516	1799	1450	1312
122	2569	2499	1793	1444	1310
123	2567	2491	1781	1444	1303
124	2565	2487	1780	1441	1294
125	2557	2482	1771	1440	1293
126	2553	2477	1763	1440	1292
127	2550	2467	1762	1439	1291
128	2547	2458	1758	1438	1290
129	2545	2445	1749	1438	1288
130	2545	2439	1735	1435	1286
131	2544	2434	1727	1432	1278
132	2541	2423	1727	1428	1277
133	2539	2410	1722	1426	1268
134	2537	2405	1713	1425	1267
135	2534	2397	1710	1421	1258
136	2523	2397	1707	1408	1253
137	2518	2391	1705	1406	1252
138	2515	2385	1689	1402	1252
139	2508	2370	1687	1401	1245
140	2507	2357	1685	1401	1244
141	2490	2342	1680	1393	1240
142	2480	2330	1676	1390	1240
143	2467	2328	1673	1382	1238
144	2440	2327	1656	1365	1238
145	2430	2314	1650	1365	1234
146	2415	2309	1650	1360	1234
147	2413	2304	1647	1352	1229
148	2412	2295	1645	1336	1228
149	2411	2284	1632	1332	1226

3

150	2410	2269	1631	1332	1223
151	2407	2253	1624	1329	1222
152	2406	2248	1624	1326	1221
153	2396	2240	1621	1325	1221
154	2373	2238	1604	1321	1220
155	2364	2231	1603	1313	1220
156	2358	2221	1602	1310	1218
157	2353	2214	1600	1300	1211
158	2352	2214	1597	1298	1210
159	2347	2194	1588	1296	1210
160	2343	2193	1585	1291	1210
161	2342	2193	1571	1287	1203
162	2341	2188	1568	1285	1202
163	2338	2186	1565	1278	1200
164	2335	2183	1544	1277	1197
165	2316	2178	1542	1276	1188
166	2315	2164	1538	1266	1188
167	2301	2156	1536	1261	1182
168	2300	2136	1535	1259	1182
169	2299	2129	1531	1259	1182
170	2297	2124	1530	1253	1181
171	2271	2123	1526	1252	1175
172	2270	2117	1526	1250	1162
173	2248	2115	1525	1250	1160
174	2241	2114	1513	1244	1160
175	2237	2092	1511	1240	1159
176	2226	2092	1510	1237	1159
177	2220	2091	1508	1230	1157
178	2218	2078	1494	1229	1153
179	2200	2059	1493	1226	1153
180	2189	2059	1487	1225	1153
181	2184	2053	1483	1223	1151
182	2180	2049	1483	1218	1150
183	2173	2031	1470	1216	1144
184	2162	2023	1468	1214	1141
185	2161	2018	1467	1210	1134
186	2153	1997	1466	1208	1134
187	2152	1989	1466	1201	1128
188	2151	1984	1457	1200	1128
189	2150	1980	1454	1198	1124
190	2144	1968	1453	1184	1123
191	2142	1967	1452	1182	1122
192	2140	1966	1451	1182	1122
193	2135	1961	1448	1179	1121
194	2134	1943	1436	1179	1119
195	2123	1942	1431	1175	1117
196	2108	1937	1429	1175	1115
197	2105	1935	1429	1174	1109
198	2104	1935	1427	1167	1109
199	2091	1932	1426	1164	1109
200	2089	1918	1423	1158	1108

4

201	2081	1917	1423	1155	1107
202	2079	1916	1419	1153	1105
203	2075	1914	1419	1153	1105
204	2067	1912	1416	1151	1103
205	2066	1908	1415	1150	1103
206	2058	1904	1412	1145	1102
207	2054	1895	1408	1140	1101
208	2050	1881	1408	1138	1100
209	2032	1877	1407	1138	1097
210	2024	1874	1404	1132	1096
211	1999	1863	1398	1124	1095
212	1995	1854	1393	1122	1092
213	1993	1852	1384	1117	1091
214	1989	1850	1381	1113	1088
215	1983	1846	1378	1109	1087
216	1972	1845	1372	1109	1087
217	1967	1845	1369	1107	1082
218	1965	1838	1369	1106	1081
219	1959	1829	1365	1105	1079
220	1959	1828	1360	1101	1075
221	1944	1827	1354	1099	1070
222	1940	1822	1350	1092	1067
223	1919	1821	1348	1087	1066
224	1918	1807	1346	1086	1063
225	1904	1806	1344	1082	1060
226	1898	1801	1340	1079	1057
227	1892	1790	1333	1077	1051
228	1889	1764	1332	1073	1049
229	1885	1750	1330	1071	1048
230	1884	1741	1330	1065	1047
231	1861	1741	1330	1063	1045
232	1854	1739	1329	1060	1045
233	1853	1725	1327	1059	1045
234	1849	1713	1326	1051	1044
235	1847	1710	1321	1049	1040
236	1847	1704	1320	1047	1039
237	1829	1699	1317	1045	1038
238	1824	1697	1310	1045	1038
239	1822	1694	1310	1043	1037
240	1819	1684	1307	1042	1037
241	1814	1683	1307	1042	1037
242	1810	1682	1291	1037	1036
243	1802	1681	1291	1030	1032
244	1793	1679	1289	1029	1029
245	1789	1676	1289	1028	1028
246	1783	1673	1288	1016	1027
247	1779	1668	1281	1012	1026
248	1773	1668	1269	1004	1025
249	1770	1659	1264	994	1017
250	1758	1654	1262	991	1012
251	1755	1653	1262	985	1011

5

252	1734	1652	1260	985	1011
253	1717	1649	1248	983	1010
254	1709	1647	1244	979	1006
255	1701	1644	1239	978	1004
256	1697	1643	1233	969	1004
257	1692	1635	1230	968	1002
258	1680	1635	1228	963	998
259	1673	1622	1227	963	993
260	1652	1620	1224	960	991
261	1648	1617	1221	948	991
262	1643	1606	1215	947	989
263	1636	1603	1212	941	987
264	1626	1602	1211	930	985
265	1597	1602	1209	927	983
266	1580	1600	1208	927	982
267	1578	1593	1203	925	982
268	1569	1591	1199	924	981
269	1567	1585	1193	921	980
270	1566	1577	1189	920	980
271	1561	1575	1189	917	977
272	1559	1564	1189	915	971
273	1556	1563	1187	914	971
274	1554	1558	1182	912	969
275	1543	1554	1180	910	968
276	1542	1551	1178	906	962
277	1541	1551	1174	898	962
278	1531	1550	1173	895	960
279	1530	1550	1172	892	959
280	1526	1542	1168	888	957
281	1522	1542	1151	880	954
282	1520	1540	1147	880	949
283	1517	1525	1145	876	947
284	1514	1523	1145	875	947
285	1509	1516	1144	874	946
286	1496	1516	1141	873	945
287	1493	1513	1138	871	945
288	1491	1512	1138	870	941
289	1489	1512	1138	868	938
290	1475	1505	1134	868	938
291	1456	1498	1134	868	936
292	1456	1498	1131	863	936
293	1454	1493	1122	862	934
294	1452	1493	1120	861	933
295	1452	1484	1119	858	932
296	1446	1481	1119	858	932
297	1445	1479	1106	851	927
298	1444	1478	1104	850	927
299	1444	1472	1102	848	926
300	1440	1472	1100	847	925
301	1432	1472	1098	843	924
302	1432	1472	1096	831	920

6

303	1429	1463	1091	831	918
304	1424	1460	1083	829	917
305	1416	1456	1082	828	916
306	1415	1449	1078	824	916
307	1414	1447	1076	823	915
308	1413	1444	1075	822	911
309	1409	1441	1075	818	910
310	1407	1435	1064	811	908
311	1407	1433	1062	811	908
312	1404	1431	1062	810	908
313	1403	1430	1048	805	908
314	1403	1428	1047	804	906
315	1394	1424	1037	798	902
316	1391	1423	1037	798	899
317	1387	1422	1030	796	895
318	1385	1420	1029	791	894
319	1382	1417	1025	788	892
320	1379	1416	1022	786	890
321	1379	1410	1018	785	888
322	1374	1409	1010	785	887
323	1372	1403	1008	780	886
324	1370	1396	1000	773	885
325	1369	1395	1000	770	884
326	1366	1394	1000	768	882
327	1360	1384	996	768	881
328	1360	1383	986	761	880
329	1351	1376	981	761	877
330	1345	1369	981	761	876
331	1341	1364	977	758	872
332	1339	1359	969	758	871
333	1339	1355	969	756	870
334	1336	1350	966	753	868
335	1326	1347	965	751	865
336	1323	1343	954	745	863
337	1315	1343	950	743	859
338	1311	1333	944	742	858
339	1311	1333	941	742	855
340	1308	1332	938	740	852
341	1308	1332	932	738	852
342	1307	1326	929	736	850
343	1294	1322	926	734	849
344	1293	1310	926	733	847
345	1291	1304	922	729	847
346	1289	1303	914	729	845
347	1287	1300	913	724	843
348	1280	1295	913	722	842
349	1269	1293	912	715	839
350	1261	1291	909	715	837
351	1259	1290	906	703	837
352	1258	1277	897	700	833
353	1255	1275	897	700	833

7

456	883	824	628	432	695
457	881	798	627	432	694
458	874	798	627	431	693
459	870	796	615	429	692
460	869	791	613	426	691
461	868	787	613	426	688
462	868	786	610	416	687
463	867	786	606	412	685
464	865	778	606	411	684
465	864	770	605	406	683
466	862	770	602	402	683
467	855	769	599	395	682
468	855	767	595	390	681
469	849	761	594	388	680
470	846	761	593	385	679
471	841	757	591	378	679
472	839	755	590	376	679
473	838	755	588	374	678
474	837	748	583	372	678
475	836	744	581	372	676
476	835	741	577	367	676
477	832	740	577	359	676
478	832	729	576	359	675
479	829	728	575	357	671
480	827	726	574	352	671
481	825	722	570	350	671
482	824	720	570	350	669
483	823	720	567	350	668
484	815	717	566	343	666
485	811	716	565	338	663
486	802	711	565	336	662
487	800	708	562	336	662
488	796	703	557	336	661
489	795	700	556	329	661
490	795	700	552	328	659
491	793	698	551	328	658
492	791	696	549	325	656
493	783	696	544	324	653
494	781	695	543	324	652
495	781	695	539	322	652
496	781	694	539	315	650
497	779	693	536	314	650
498	774	688	531	314	649
499	774	687	527	305	647
500	773	684	527	304	647
501	768	680	526	300	641
502	766	678	526	293	641
503	765	676	524	293	638
504	758	672	524	293	636
505	753	672	514	284	636
506	751	668	511	282	634

10

507	750	664	510	278	632
508	748	663	508	277	630
509	746	657	508	271	630
510	744	656	507	271	626
511	740	654	502	270	626
512	725	651	500	269	623
513	724	650	494	266	618
514	700	649	493	263	616
515	694	645	492	261	616
516	691	642	491	259	615
517	687	641	491	257	614
518	686	636	486	257	613
519	684	634	481	256	613
520	679	631	481	251	611
521	676	622	481	251	608
522	674	613	479	250	607
523	672	611	475	249	606
524	669	608	474	249	606
525	662	608	467	246	606
526	660	605	466	245	604
527	660	602	461	244	604
528	657	602	460	243	600
529	655	594	458	236	600
530	654	591	452	236	599
531	653	590	452	236	599
532	653	589	449	235	599
533	652	588	448	230	597
534	652	586	446	228	595
535	652	583	443	225	594
536	650	580	443	219	594
537	649	578	441	211	593
538	642	576	438	209	591
539	634	575	436	209	591
540	629	574	434	209	591
541	627	569	433	205	590
542	624	564	431	204	588
543	622	563	429	204	588
544	620	562	426	200	587
545	617	560	426	198	586
546	612	558	423	197	582
547	606	557	422	195	579
548	598	555	419	191	579
549	598	551	418	191	579
550	596	548	417	189	579
551	592	546	409	186	576
552	590	545	407	186	574
553	588	543	407	184	573
554	587	539	402	178	572
555	587	539	401	175	571
556	586	538	396	174	571
557	581	535	387	173	571

11

558	580	530	384	171	564
559	580	528	384	169	562
560	580	528	383	168	561
561	572	524	383	167	559
562	568	524	381	165	558
563	561	521	375	164	558
564	556	517	374	164	554
565	554	516	367	164	549
566	553	516	365	162	549
567	553	512	364	161	547
568	549	508	364	160	546
569	545	506	361	160	545
570	543	505	360	160	545
571	539	499	354	157	545
572	538	497	353	156	543
573	537	497	351	156	542
574	534	494	351	155	542
575	533	494	351	153	541
576	522	485	344	152	541
577	522	485	343	151	540
578	520	484	342	148	540
579	518	484	330	145	536
580	518	483	326	144	536
581	518	480	323	142	536
582	509	478	319	142	535
583	503	478	316	137	534
584	503	474	314	134	533
585	501	473	312	134	530
586	495	471	307	133	530
587	493	470	304	132	530
588	493	470	302	131	530
589	491	464	299	131	528
590	489	462	299	124	527
591	488	462	292	122	525
592	488	462	291	116	518
593	487	461	285	115	518
594	485	455	280	114	516
595	481	455	265	113	516
596	476	455	263	112	516
597	473	454	262	110	515
598	473	454	257	104	514
599	467	454	246	100	512
600	466	446	241	99	508
601	463	440	234	96	508
602	462	440	234	88	508
603	455	437	230	87	503
604	454	432	229	86	503
605	452	429	228	86	503
606	452	426	224	85	502
607	451	422	222	85	502
608	450	418	217	81	501

12

609	448	417	215	80	500
610	448	414	212	79	499
611	445	412	207	76	496
612	443	410	205	75	494
613	441	409	203	74	493
614	441	405	200	74	487
615	440	404	199	73	484
616	437	401	196	73	482
617	436	400	185	72	481
618	430	400	177	71	481
619	424	399	175	71	479
620	415	398	172	65	477
621	403	396	171	61	476
622	402	395	170	56	475
623	402	394	170	51	475
624	401	393	170	51	473
625	401	392	166	50	473
626	400	388	165	50	472
627	399	388	160	48	463
628	398	385	160	47	462
629	398	385	157	47	461
630	395	385	156	45	461
631	394	382	149	45	460
632	394	381	147	45	457
633	392	381	144	44	456
634	385	380	141	43	454
635	381	379	138	43	454
636	380	375	137	39	453
637	380	373	136	39	452
638	378	367	134	32	452
639	373	367	134	31	451
640	368	367	133	30	451
641	368	363	132	30	447
642	366	362	127	30	447
643	363	362	123	28	447
644	362	361	121	26	443
645	361	361	120	25	439
646	360	359	119	24	439
647	359	356	119	24	438
648	358	356	115	23	438
649	353	355	114	23	436
650	353	355	113	23	436
651	350	355	111	22	434
652	346	354	110	21	434
653	346	353	104	21	432
654	344	352	101	21	432
655	342	350	100	20	431
656	340	349	99	20	431
657	339	349	99	20	429
658	337	348	96	20	429
659	336	347	92	19	428

13

660	333	347	91	18	426
661	332	344	87	18	425
662	332	343	85	18	424
663	332	342	85	17	418
664	331	340	83	17	418
665	330	338	83	17	416
666	330	337	80	17	416
667	328	336	79	17	416
668	327	336	76	16	415
669	325	335	76	16	413
670	323	334	68	16	413
671	323	334	65	15	412
672	322	330	62	15	412
673	321	327	60	14	411
674	320	325	59	14	410
675	319	325	59	14	408
676	319	325	59	14	407
677	318	324	59	14	400
678	317	324	57	14	398
679	316	322	55	14	395
680	314	322	53	13	394
681	313	319	52	13	390
682	313	314	52	13	390
683	313	313	51	13	389
684	310	313	51	13	388
685	308	312	50	13	385
686	305	311	47	12	384
687	303	310	47	12	383
688	299	309	46	12	381
689	296	308	45	12	379
690	295	307	44	12	379
691	294	302	43	12	379
692	292	301	40	12	378
693	289	297	39	12	375
694	284	296	39	11	375
695	281	295	36	11	373
696	280	295	35	10	366
697	280	294	35	10	365
698	279	294	34	10	364
699	278	293		10	364
700	277	293			363
701	277	291			362
702	274	291			361
703	273	290			361
704	270	287			360
705	269	284			359
706	268	283			358
707	268	280			357
708	267	280			354
709	263	280			353
710	259	279			353

14

711	259	279			352
712	258	274			351
713	258	271			350
714	257	270			349
715	253	270			349
716	252	269			346
717	251	269			346
718	247	269			343
719	246	268			343
720	243	268			343
721	241	267			341
722	240	267			341
723	239	267			340
724	238	267			339
725	237	266			336
726	235	266			336
727	234	265			335
728	234	264			334
729	233	264			332
730	230	264			330
731	229	263			329
732	224	262			325
733	223	261			324
734	222	260			324
735	222	259			324
736	222	259			322
737	221	259			321
738	217	258			319
739	216	256			314
740	213	256			312
741	211	255			309
742	211	253			309
743	210	249			306
744	210	248			305
745	209	248			304
746	208	247			304
747	207	247			300
748	207	246			298
749	205	245			297
750	204	244			297
751	202	244			293
752	201	243			293
753	201	242			293
754	200	242			291
755	199	242			290
756	198	241			285
757	195	241			284
758	195	239			280
759	195	238			279
760	194	238			279
761	193	238			278

15

762	191	236			278
763	190	236			278
764	189	233			277
765	189	233			274
766	189	232			274
767	187	231			271
768	186	231			267
769	184	230			265
770	184	229			264
771	184	228			264
772	183	225			264
773	182	225			263
774	182	225			261
775	182	224			260
776	181	222			258
777	179	222			257
778	178	220			257
779	177	216			254
780	177	216			254
781	176	215			253
782	175	214			253
783	175	213			251
784	172	212			251
785	171	212			250
786	171	212			250
787	170	211			249
788	170	209			249
789	170	207			246
790	170	206			246
791	170	205			245
792	167	204			244
793	166	204			244
794	163	202			243
795	161	202			243
796	157	202			242
797	157	201			241
798	155	201			240
799	154	201			238
800	154	200			236
801	152	199			236
802	151	199			236
803	150	199			234
804	149	198			232
805	149	197			231
806	148	196			230
807	147	195			230
808	145	195			230
809	145	194			229
810	145	194			225
811	144	193			225
812	143	193			224

16

813	142	192			224
814	142	192			222
815	142	192			222
816	141	191			219
817	141	190			218
818	139	190			216
819	138	190			212
820	137	189			211
821	137	188			211
822	137	188			210
823	137	187			210
824	137	187			209
825	137	186			209
826	136	186			209
827	136	184			207
828	136	183			206
829	134	183			200
830	133	182			198
831	133	181			195
832	132	181			195
833	132	179			195
834	132	179			194
835	132	177			194
836	131	177			193
837	131	177			192
838	130	175			191
839	129	175			191
840	128	173			191
841	128	172			189
842	127	171			189
843	126	171			189
844	125	171			186
845	125	169			186
846	124	169			185
847	123	169			185
848	123	167			184
849	122	167			184
850	122	166			182
851	122	166			179
852	122	165			176
853	121	165			175
854	121	164			175
855	120	162			174
856	119	162			174
857	118	161			172
858	117	161			172
859	117	161			171
860	117	161			171
861	116	161			169
862	116	161			167
863	115	159			165

17

864	114	159			164
865	114	159			164
866	114	158			162
867	113	158			160
868	113	154			160
869	113	154			160
870	112	153			157
871	112	152			157
872	111	151			156
873	110	151			154
874	110	150			153
875	110	148			151
876	108	147			149
877	108	147			147
878	107	146			146
879	107	146			146
880	107	145			145
881	106	144			144
882	106	143			144
883	106	142			144
884	105	141			142
885	104	140			142
886	104	138			141
887	103	137			139
888	102	135			138
889	101	135			137
890	101	135			136
891	100	134			135
892	100	133			135
893		133			133
894		132			133
895		132			131
896		131			130
897		130			130
898		130			124
899		130			124
900		130			121
901		129			116
902		129			116
903		129			115
904		129			115
905		129			115
906		127			114
907		127			114
908		126			113
909		126			111
910		125			110
911		125			110
912		125			110
913		124			109
914		123			108

18

915		120			107
916		119			104
917		117			101
918		116			100
919		116			96
920		114			96
921		114			96
922		114			93
923		113			92
924		113			92
925		112			89
926		110			87
927		110			87
928		108			87
929		108			86
930		107			86
931		107			84
932		107			84
933		107			84
934		105			84
935		104			83
936		103			81
937		103			80
938		102			79
939		101			79
940		101			78
941		101			76
942		100			76
943		100			74
944		100			74
945		100			73
946		98			73
947		98			72
948		97			70
949		97			70
950		96			67
951		96			64
952		95			63
953		95			62
954		95			62
955		94			62
956		93			62
957		93			60

19

Appendix D: Raw Table 4 shows the yeast colony area on PDA with agar concentration of 1.5%, 2%, 2.5%, 3%, 3.5% (Trial 3).

Saccharomyces cerevisiae's colonies area on PDA with agar concentration of 1.5%, 2%, 2.5%, 3%, 3.5% (Trial 3)					
Colony label	Colony area on PDA with 1.5% agar concentration (Pixel)	Colony area on PDA with 2% agar concentration (Pixel)	Colony area on PDA with 2.5% agar concentration (Pixel)	Colony area on PDA with 3% agar concentration (Pixel)	Colony area on PDA with 3.5% agar concentration (Pixel)
1	4465	3501	2643	2011	2071
2	4465	3501	2643	2011	2071
3	4318	3349	2516	1985	1928
4	4199	3264	2285	1917	1881
5	3898	3223	2218	1889	1876
6	3675	3092	2172	1826	1728
7	3623	3062	2134	1714	1692
8	3534	2983	2075	1681	1664
9	3471	2868	2007	1672	1633
10	3458	2856	2001	1627	1606
11	3427	2809	1986	1588	1603
12	3360	2790	1985	1540	1596
13	3359	2775	1975	1538	1579
14	3325	2662	1958	1535	1569
15	3322	2657	1867	1533	1519
16	3300	2656	1698	1515	1506
17	3238	2648	1697	1514	1483
18	3229	2624	1694	1501	1469
19	3186	2595	1676	1490	1450
20	3164	2552	1671	1474	1421
21	3149	2524	1669	1473	1420
22	3145	2519	1667	1441	1417
23	3120	2507	1663	1420	1409
24	3111	2482	1634	1416	1392
25	3105	2479	1633	1415	1388
26	3057	2467	1631	1413	1384
27	3048	2446	1626	1412	1364
28	3041	2441	1614	1406	1358
29	3039	2426	1589	1403	1345
30	2994	2422	1588	1387	1326
31	2974	2414	1581	1371	1323
32	2946	2406	1575	1369	1320
33	2946	2403	1567	1368	1316
34	2941	2385	1564	1366	1311
35	2906	2368	1562	1352	1310
36	2905	2367	1559	1349	1306
37	2904	2362	1551	1348	1302
38	2892	2357	1547	1342	1285
39	2885	2356	1544	1339	1285
40	2879	2347	1542	1338	1284
41	2875	2339	1533	1336	1280
42	2872	2327	1519	1335	1280
43	2869	2315	1516	1334	1275
44	2868	2304	1508	1329	1274
45	2829	2294	1503	1328	1272
46	2824	2292	1502	1316	1272
47	2823	2288	1494	1305	1256
48	2814	2287	1485	1305	1255

49	2813	2281	1484	1294	1244
50	2808	2277	1482	1292	1229
51	2779	2275	1481	1288	1228
52	2770	2265	1480	1287	1225
53	2752	2262	1469	1285	1225
54	2749	2261	1462	1285	1225
55	2748	2247	1462	1284	1220
56	2742	2238	1458	1283	1209
57	2733	2224	1458	1281	1209
58	2718	2221	1458	1281	1205
59	2716	2220	1457	1280	1171
60	2696	2219	1452	1278	1167
61	2686	2211	1443	1276	1163
62	2676	2207	1434	1276	1153
63	2643	2205	1431	1276	1153
64	2640	2145	1430	1275	1139
65	2632	2145	1429	1273	1130
66	2627	2144	1420	1270	1126
67	2589	2143	1416	1268	1121
68	2586	2141	1416	1265	1114
69	2567	2126	1416	1260	1111
70	2546	2124	1412	1238	1105
71	2546	2123	1411	1234	1104
72	2541	2109	1410	1228	1103
73	2536	2099	1406	1227	1101
74	2522	2078	1405	1225	1101
75	2517	2068	1404	1225	1090
76	2508	2066	1401	1222	1078
77	2506	2061	1399	1221	1074
78	2506	2051	1397	1220	1066
79	2504	2046	1390	1218	1056
80	2500	2045	1386	1217	1044
81	2499	2043	1381	1217	1028
82	2498	2029	1379	1215	1026
83	2496	2024	1375	1215	1018
84	2479	2024	1374	1215	1018
85	2471	2018	1374	1211	1015
86	2469	2008	1372	1210	1011
87	2468	1996	1369	1194	1003
88	2466	1990	1364	1191	988
89	2462	1987	1360	1191	974
90	2459	1980	1356	1188	969
91	2459	1980	1354	1188	967
92	2457	1975	1354	1185	964
93	2456	1972	1351	1183	957
94	2452	1963	1350	1183	955
95	2448	1959	1340	1182	944
96	2445	1958	1336	1181	942
97	2445	1958	1333	1180	941
98	2440	1949	1331	1179	941
99	2437	1946	1330	1176	939

2

100	2433	1939	1326	1176	939
101	2428	1932	1326	1174	936
102	2422	1929	1321	1171	933
103	2415	1903	1321	1162	933
104	2414	1902	1320	1161	929
105	2412	1897	1320	1158	927
106	2411	1883	1319	1158	915
107	2395	1881	1312	1155	914
108	2392	1872	1297	1155	911
109	2389	1867	1292	1151	910
110	2389	1866	1291	1151	909
111	2379	1864	1289	1149	907
112	2375	1864	1284	1148	907
113	2373	1863	1283	1148	903
114	2372	1862	1282	1148	903
115	2371	1861	1281	1146	900
116	2371	1860	1279	1143	900
117	2366	1859	1272	1141	895
118	2352	1854	1271	1139	893
119	2351	1847	1271	1139	891
120	2348	1845	1269	1137	889
121	2347	1845	1267	1137	889
122	2338	1836	1266	1136	883
123	2325	1833	1265	1133	883
124	2324	1831	1260	1131	883
125	2321	1823	1260	1127	876
126	2319	1823	1258	1124	875
127	2316	1820	1251	1122	874
128	2314	1815	1250	1119	874
129	2312	1810	1249	1118	874
130	2303	1808	1245	1118	872
131	2301	1803	1243	1114	870
132	2300	1799	1240	1111	870
133	2299	1791	1234	1108	868
134	2297	1784	1227	1102	868
135	2290	1777	1226	1099	867
136	2286	1771	1223	1098	866
137	2272	1765	1222	1098	865
138	2271	1764	1220	1097	863
139	2268	1764	1220	1094	863
140	2257	1759	1217	1093	861
141	2253	1752	1215	1093	859
142	2249	1751	1211	1093	858
143	2248	1750	1208	1092	856
144	2244	1748	1208	1091	855
145	2243	1737	1207	1091	855
146	2232	1735	1206	1085	853
147	2227	1731	1205	1083	852
148	2223	1728	1200	1081	852
149	2206	1727	1200	1076	851
150	2189	1723	1199	1075	849

3

151	2172	1721	1192	1075	847
152	2162	1718	1191	1073	845
153	2161	1716	1190	1073	845
154	2159	1707	1189	1072	842
155	2153	1706	1188	1059	839
156	2150	1696	1184	1058	835
157	2147	1690	1184	1052	835
158	2145	1687	1183	1051	834
159	2138	1686	1181	1050	834
160	2137	1685	1179	1050	832
161	2136	1675	1178	1050	832
162	2136	1667	1178	1050	831
163	2134	1662	1177	1046	831
164	2129	1655	1165	1042	830
165	2112	1644	1160	1041	829
166	2112	1642	1156	1039	825
167	2103	1641	1153	1037	822
168	2102	1640	1150	1034	821
169	2097	1639	1149	1033	820
170	2095	1636	1147	1033	815
171	2094	1634	1141	1032	813
172	2093	1631	1135	1030	810
173	2091	1629	1132	1029	809
174	2082	1629	1132	1029	808
175	2075	1628	1131	1028	803
176	2074	1627	1125	1026	800
177	2073	1627	1125	1024	800
178	2071	1626	1124	1022	799
179	2071	1615	1119	1020	798
180	2069	1607	1106	1020	798
181	2069	1601	1104	1019	797
182	2066	1599	1104	1019	790
183	2060	1598	1102	1017	789
184	2058	1595	1090	1017	788
185	2058	1594	1088	1014	788
186	2054	1593	1086	1011	785
187	2050	1592	1080	1010	781
188	2048	1576	1080	1008	780
189	2047	1575	1079	1007	780
190	2045	1575	1078	1005	780
191	2040	1572	1075	1004	773
192	2031	1569	1075	1001	773
193	2027	1565	1070	999	772
194	2025	1543	1070	997	771
195	2018	1539	1069	994	769
196	2015	1538	1063	994	767
197	2013	1537	1060	991	766
198	2013	1531	1056	991	765
199	2009	1529	1052	990	763
200	2004	1524	1052	988	760
201	1999	1523	1052	988	758

4

202	1993	1519	1050	986	755
203	1982	1506	1040	985	755
204	1981	1505	1039	983	754
205	1979	1503	1038	983	754
206	1975	1501	1037	979	750
207	1975	1494	1035	978	748
208	1973	1493	1031	972	747
209	1968	1477	1031	972	745
210	1967	1475	1030	971	745
211	1965	1471	1028	971	745
212	1958	1465	1027	970	743
213	1955	1453	1020	969	740
214	1949	1447	1018	969	738
215	1945	1438	1012	968	737
216	1937	1436	1011	967	736
217	1934	1432	1006	966	736
218	1932	1432	1006	964	735
219	1927	1432	1003	963	735
220	1926	1426	999	961	734
221	1925	1426	997	961	733
222	1919	1424	997	960	732
223	1917	1421	996	959	731
224	1902	1419	993	958	731
225	1894	1418	992	958	731
226	1893	1410	991	957	729
227	1884	1405	991	955	729
228	1884	1400	989	955	729
229	1881	1392	986	954	728
230	1879	1391	985	952	726
231	1873	1387	985	952	725
232	1870	1385	983	951	725
233	1868	1377	982	950	725
234	1866	1375	980	950	722
235	1861	1370	979	946	722
236	1858	1368	978	945	721
237	1857	1363	978	944	721
238	1853	1360	977	942	721
239	1852	1357	976	942	720
240	1852	1354	971	942	720
241	1843	1353	970	938	717
242	1843	1351	964	936	717
243	1840	1346	963	932	717
244	1835	1329	961	931	716
245	1833	1324	961	928	715
246	1829	1320	960	928	714
247	1825	1318	959	925	713
248	1824	1317	956	924	711
249	1822	1316	951	923	709
250	1821	1307	950	922	707
251	1820	1307	948	918	705
252	1819	1306	948	916	704

5

253	1816	1304	943	915	703
254	1814	1304	942	912	697
255	1813	1302	938	911	696
256	1812	1298	936	911	695
257	1810	1296	935	911	693
258	1809	1294	933	909	692
259	1804	1289	933	908	692
260	1794	1285	932	903	692
261	1793	1285	930	903	691
262	1792	1284	924	902	690
263	1790	1281	920	899	689
264	1790	1275	919	899	689
265	1789	1273	919	899	689
266	1782	1270	917	898	687
267	1781	1262	917	893	686
268	1772	1261	917	893	685
269	1770	1260	915	893	685
270	1767	1257	915	891	685
271	1767	1257	914	891	684
272	1766	1257	913	891	682
273	1765	1252	913	889	680
274	1764	1251	908	887	679
275	1763	1236	908	885	678
276	1761	1235	904	883	676
277	1757	1234	904	881	675
278	1753	1232	904	881	674
279	1750	1232	904	880	671
280	1742	1231	902	878	669
281	1741	1229	900	876	668
282	1740	1225	897	876	666
283	1729	1222	894	876	666
284	1728	1216	888	871	664
285	1725	1214	887	870	664
286	1724	1210	886	870	662
287	1723	1205	883	869	660
288	1714	1201	880	869	660
289	1702	1192	878	868	657
290	1702	1188	874	865	657
291	1700	1185	873	862	656
292	1699	1184	872	861	655
293	1693	1184	871	859	655
294	1693	1182	870	857	655
295	1682	1178	868	853	651
296	1679	1176	866	852	651
297	1674	1173	865	851	650
298	1669	1167	864	848	650
299	1668	1166	863	846	649
300	1663	1162	863	846	649
301	1663	1161	857	845	648
302	1661	1161	855	845	648
303	1645	1160	853	842	644

6

304	1639	1159	852	842	643
305	1629	1157	851	842	643
306	1629	1156	850	842	642
307	1604	1150	846	842	641
308	1602	1150	845	841	640
309	1599	1149	842	840	640
310	1599	1136	842	839	640
311	1597	1134	839	838	637
312	1594	1131	839	838	637
313	1589	1128	838	837	637
314	1587	1127	837	836	636
315	1583	1127	836	835	635
316	1583	1116	830	832	634
317	1578	1115	829	832	631
318	1576	1114	825	830	631
319	1571	1114	822	829	627
320	1566	1110	821	829	626
321	1564	1110	817	829	625
322	1564	1106	814	828	624
323	1556	1098	814	828	623
324	1546	1096	814	827	623
325	1546	1094	812	826	622
326	1544	1093	810	825	621
327	1536	1093	809	825	620
328	1536	1092	806	824	620
329	1534	1091	805	824	616
330	1524	1082	803	821	615
331	1522	1082	803	821	615
332	1522	1082	803	819	613
333	1517	1080	799	818	612
334	1515	1075	797	818	611
335	1511	1073	796	818	609
336	1510	1073	793	817	609
337	1509	1067	793	816	609
338	1509	1057	791	815	609
339	1505	1054	788	815	608
340	1504	1047	788	813	608
341	1504	1047	785	813	607
342	1501	1047	783	813	602
343	1500	1046	783	812	601
344	1486	1043	782	812	601
345	1478	1042	781	811	598
346	1477	1041	781	808	597
347	1465	1030	780	806	597
348	1454	1029	779	803	596
349	1453	1029	778	801	596
350	1451	1027	777	800	596
351	1450	1026	775	800	593
352	1450	1022	774	800	592
353	1446	1018	773	799	591
354	1445	1017	772	799	590

7

355	1442	1017	770	799	589
356	1440	1016	768	799	589
357	1439	1014	766	798	589
358	1435	1010	762	798	588
359	1434	1008	761	795	587
360	1419	1006	760	794	586
361	1404	1005	759	790	586
362	1400	1004	756	789	586
363	1400	1003	755	789	584
364	1397	1002	755	786	581
365	1396	1002	754	783	580
366	1376	998	753	782	580
367	1367	998	753	782	580
368	1366	996	752	781	579
369	1360	994	752	779	576
370	1358	992	749	778	574
371	1357	992	746	777	573
372	1355	992	745	775	573
373	1355	989	745	774	572
374	1342	988	744	773	571
375	1331	984	744	772	571
376	1329	983	743	771	566
377	1325	980	741	771	566
378	1314	979	741	770	565
379	1313	979	739	768	564
380	1312	978	739	768	564
381	1310	978	736	765	563
382	1305	978	735	764	563
383	1301	977	734	764	562
384	1298	974	734	762	561
385	1296	974	733	762	560
386	1294	968	733	762	557
387	1290	963	731	760	556
388	1284	958	731	759	556
389	1284	957	731	758	555
390	1279	956	726	756	555
391	1278	956	726	755	554
392	1275	956	726	754	554
393	1275	955	726	754	554
394	1271	954	724	753	552
395	1269	950	723	752	551
396	1268	949	721	750	549
397	1266	943	720	748	547
398	1258	943	719	747	547
399	1234	942	718	745	545
400	1225	942	717	745	545
401	1224	941	715	745	544
402	1220	939	715	744	543
403	1219	935	714	744	541
404	1214	934	707	740	539
405	1203	933	706	738	537

8

406	1198	933	706	737	537
407	1195	931	705	736	536
408	1194	931	704	736	536
409	1187	923	704	733	535
410	1186	921	702	731	535
411	1184	920	700	728	534
412	1181	917	698	726	533
413	1179	916	696	725	532
414	1172	915	696	724	532
415	1163	909	695	724	531
416	1162	908	694	724	530
417	1161	906	693	723	529
418	1161	904	692	722	528
419	1161	899	692	721	526
420	1159	899	689	720	525
421	1159	895	688	719	524
422	1153	895	688	718	524
423	1147	894	686	718	523
424	1125	894	686	716	523
425	1124	892	685	713	522
426	1114	891	684	712	522
427	1108	891	682	710	520
428	1104	889	681	709	520
429	1102	889	679	708	520
430	1095	884	676	707	520
431	1095	883	676	707	517
432	1090	880	676	706	517
433	1088	878	675	705	516
434	1087	878	671	703	515
435	1087	876	669	699	515
436	1081	875	669	699	514
437	1080	873	669	696	514
438	1078	872	668	694	514
439	1075	868	667	689	514
440	1073	866	666	687	511
441	1072	865	665	687	511
442	1067	863	665	684	508
443	1060	863	664	683	508
444	1048	862	664	683	508
445	1045	862	663	677	508
446	1043	861	661	676	508
447	1038	861	660	676	506
448	1031	858	658	674	505
449	1028	856	658	673	504
450	1022	856	655	672	504
451	1017	855	655	669	504
452	1017	854	655	663	504
453	1015	853	653	662	504
454	1004	852	653	662	502
455	1002	851	651	662	502
456	998	851	645	661	502

9

457	991	851	644	660	501
458	991	849	644	657	501
459	990	848	644	656	499
460	989	845	643	652	498
461	987	845	642	648	498
462	977	844	642	646	498
463	975	843	641	643	498
464	974	842	641	641	498
465	963	842	641	640	494
466	963	841	639	639	494
467	961	839	639	638	492
468	956	837	636	636	491
469	956	837	635	633	491
470	953	837	635	633	489
471	951	836	635	633	489
472	949	834	635	630	487
473	942	830	634	628	487
474	941	830	633	621	485
475	933	829	630	617	485
476	931	825	627	615	484
477	922	825	626	613	484
478	918	824	623	609	483
479	918	824	619	607	482
480	913	823	619	605	482
481	912	822	619	604	482
482	909	821	617	604	481
483	905	820	615	601	480
484	903	819	614	600	477
485	903	818	612	596	477
486	900	817	612	594	476
487	899	816	611	592	476
488	882	815	611	592	476
489	877	815	610	591	475
490	873	813	608	589	475
491	872	812	608	589	474
492	868	807	608	588	474
493	868	806	607	586	472
494	867	805	604	586	470
495	862	803	604	584	469
496	862	803	601	582	467
497	861	801	600	581	467
498	852	801	599	580	466
499	844	800	598	569	464
500	841	800	598	567	464
501	830	799	597	565	463
502	810	797	596	563	463
503	803	795	595	561	462
504	783	794	593	560	462
505	782	793	592	560	461
506	777	793	591	555	461
507	768	792	589	555	461

10

508	760	789	589	554	460
509	752	788	588	554	460
510	746	788	587	547	459
511	744	787	587	543	457
512	727	786	585	541	457
513	725	784	585	537	456
514	722	783	584	527	456
515	717	782	583	525	455
516	715	782	583	515	452
517	713	781	581	510	452
518	710	780	581	507	451
519	695	779	580	506	451
520	692	776	580	503	451
521	688	773	577	500	450
522	670	772	573	496	447
523	670	772	572	496	447
524	665	772	571	491	447
525	654	772	570	489	447
526	634	771	570	489	446
527	633	769	569	485	444
528	633	769	569	482	444
529	632	768	569	482	444
530	630	768	566	482	439
531	628	767	564	482	437
532	621	766	563	480	436
533	610	764	562	479	435
534	590	762	562	477	434
535	589	761	561	474	433
536	588	759	558	473	432
537	584	757	556	469	431
538	583	752	556	463	429
539	564	747	556	460	428
540	550	747	555	456	427
541	545	744	555	454	427
542	540	742	554	447	426
543	539	740	552	446	426
544	522	740	550	444	426
545	522	739	549	443	426
546	520	739	549	442	426
547	519	738	549	439	425
548	517	738	549	427	423
549	514	738	547	427	423
550	511	736	545	426	421
551	507	734	544	425	421
552	504	733	544	425	421
553	494	733	543	423	418
554	494	732	542	420	418
555	489	732	539	419	418
556	483	730	539	418	416
557	481	730	538	415	415
558	471	729	537	414	415

11

559	471	724	537	392	414
560	469	721	537	392	414
561	445	720	536	391	414
562	443	720	535	388	413
563	426	720	535	382	413
564	426	719	534	381	412
565	420	717	534	378	412
566	415	717	528	361	412
567	408	716	527	351	411
568	405	715	527	347	410
569	403	715	526	344	407
570	401	715	525	326	406
571	383	714	525	323	406
572	383	713	524	320	405
573	375	712	524	312	405
574	375	710	523	306	404
575	373	710	523	293	403
576	371	710	522	292	403
577	364	708	521	291	402
578	350	707	517	286	402
579	345	707	517	277	400
580	343	705	517	271	400
581	341	704	516	269	399
582	338	701	514	262	397
583	337	701	513	262	395
584	336	699	510	258	394
585	334	698	510	258	394
586	328	696	509	246	393
587	327	695	508	234	391
588	327	694	507	227	388
589	324	690	506	215	388
590	323	687	506	208	388
591	321	683	506	207	388
592	320	683	505	201	387
593	318	681	504	198	387
594	315	680	502	197	387
595	313	677	500	193	384
596	311	675	500	189	383
597	311	674	499	185	382
598	307	673	499	184	381
599	306	671	499	183	381
600	301	670	498	179	379
601	297	668	498	176	378
602	285	666	498	174	378
603	282	664	497	173	377
604	277	661	497	168	377
605	275	660	497	168	376
606	262	658	496	166	376
607	261	656	495	165	374
608	260	654	495	165	373
609	256	653	494	156	373

12

610	250	650	493	155	373
611	244	647	493	154	371
612	241	645	493	151	369
613	238	644	493	144	365
614	237	643	492	143	365
615	234	640	489	142	365
616	233	639	488	138	365
617	228	633	488	133	364
618	225	631	488	132	364
619	222	628	488	130	363
620	222	628	487	130	362
621	220	626	484	128	362
622	218	625	484	127	360
623	215	624	481	126	359
624	210	624	481	124	359
625	204	624	480	123	359
626	197	623	480	122	359
627	197	621	480	116	358
628	196	620	479	114	358
629	190	617	478	113	356
630	190	616	477	113	356
631	188	614	476	111	355
632	187	614	476	108	354
633	186	614	476	107	353
634	183	613	476	106	350
635	182	613	476	106	348
636	180	612	475	105	347
637	178	610	474	105	347
638	170	609	473	105	346
639	169	609	472	104	346
640	169	607	472	104	345
641	164	606	470	103	345
642	155	606	467	103	344
643	154	606	467	97	343
644	148	605	460	93	342
645	146	604	458	93	342
646	144	602	458	93	340
647	142	602	458	89	340
648	142	602	455	88	340
649	141	601	455	86	338
650	140	601	455	86	338
651	139	600	454	85	337
652	136	600	454	84	337
653	134	599	454	82	335
654	130	597	454	81	335
655	130	597	453	80	334
656	129	597	452	78	334
657	129	597	452	77	331
658	126	596	451	77	330
659	125	595	450	75	329
660	118	593	450	75	328

13

661	117	590	449	74	328
662	117	589	448	74	326
663	117	587	448	74	326
664	115	586	447	73	326
665	114	585	447	72	326
666	114	584	447	71	324
667	114	582	445	70	323
668	113	582	443	69	322
669	113	582	443	69	322
670	113	582	441	68	322
671	111	581	440	66	322
672	111	579	438	66	321
673	111	579	434	65	319
674	111	579	433	64	319
675	111	578	433	63	319
676	107	578	432	61	319
677	106	576	429	59	319
678	106	576	427	58	319
679	105	576	427	57	318
680	104	575	425	56	318
681	104	574	425	56	317
682	104	574	422	55	317
683	102	573	422	55	315
684	100	572	422	55	314
685	100	571	422	51	313
686	99	571	421	50	312
687	96	569	421	49	311
688	95	567	421	48	311
689	95	565	420	47	311
690	95	564	420	47	308
691	95	564	420	47	305
692	93	564	419	46	305
693	92	563	416	46	304
694	92	563	415	44	304
695	91	562	415	44	304
696	91	557	415	43	302
697	90	557	415	42	301
698	90	555	414	42	301
699	86	554	413	41	300
700	85	554	413	41	300
701	84	554	412	40	300
702	83	554	412	40	300
703	83	552	412	40	299
704	82	551	411	40	299
705	82	551	411	39	299
706	81	551	411	38	298
707	80	547	410	38	298
708	79	546	410	38	298
709	76	545	410	37	298
710	76	545	408	35	297
711	75	545	408	35	295

14

712	73	543	406	35	294
713	73	542	405	35	292
714	70	542	404	35	291
715	67	540	404	34	290
716	66	539	400	33	289
717	64	535	400	32	289
718	62	533	399	32	289
719	61	533	398	31	288
720	59	532	398	30	287
721	59	531	397	30	287
722	59	530	396	30	286
723	56	530	396	29	285
724	56	529	395	29	284
725	55	528	395	29	284
726	52	524	395	29	283
727	52	522	393	29	283
728	52	522	392	29	282
729	52	521	389	28	280
730	51	519	389	28	277
731	51	519	388	28	275
732	50	519	387	28	275
733	50	518	386	27	274
734	48	517	385	27	269
735	48	516	385	27	268
736	48	515	385	27	267
737	47	514	385	27	267
738	44	514	384	27	266
739	44	512	384	26	265
740	43	512	383	26	264
741	43	511	383	26	262
742	43	511	381	26	262
743	42	510	378	25	260
744	41	510	378	25	260
745	41	509	378	25	260
746	39	509	377	24	260
747	38	508	374	24	258
748	37	503	373	24	258
749	34	501	373	23	258
750	31	501	373	23	257
751	29	501	372	23	256
752	29	499	372	23	255
753	26	496	371	23	250
754	25	495	370	22	250
755	23	494	370	22	249
756	21	494	369	22	247
757	21	492	368	21	243
758	21	492	367	21	241
759		489	364	21	240
760		489	363	20	240
761		489	362	20	239
762		487	360	20	239

15

763		487	360	20	238
764		485	360	19	237
765		485	360	19	236
766		485	359	19	234
767		481	358	19	234
768		479	358	19	233
769		478	357	18	231
770		477	356	18	231
771		475	356	18	231
772		475	355	18	231
773		473	353	18	230
774		473	352	17	229
775		473	352	17	228
776		472	351	17	228
777		471	351	17	227
778		470	350	17	227
779		468	350	16	226
780		466	349	16	224
781		466	349	16	222
782		466	347	16	222
783		466	347	16	221
784		465	347	16	220
785		465	346	16	218
786		464	345	16	218
787		462	345	16	217
788		462	345	15	217
789		462	343	15	217
790		461	343	15	209
791		460	342	15	209
792		460	342	15	208
793		460	342	14	208
794		460	341	14	207
795		457	339	14	206
796		455	339	14	204
797		453	339	13	204
798		452	339	13	204
799		451	338	13	201
800		450	338		201
801		450	338		201
802		450	338		201
803		450	335		201
804		449	334		198
805		448	334		198
806		447	333		197
807		447	333		197
808		445	332		197
809		444	332		196
810		441	331		194
811		441	331		193
812		440	331		193
813		438	330		192

16

814		437	329		192
815		436	328		191
816		433	328		191
817		433	326		190
818		433	326		189
819		432	325		187
820		431	324		186
821		431	324		186
822		430	323		185
823		430	323		185
824		430	323		184
825		428	320		183
826		427	319		182
827		427	317		182
828		427	317		179
829		426	317		178
830		425	316		177
831		425	316		176
832		424	314		175
833		421	314		174
834		419	313		173
835		418	313		173
836		414	313		170
837		413	313		166
838		413	310		166
839		411	309		165
840		411	306		163
841		409	306		163
842		409	305		162
843		409	305		161
844		409	304		160
845		408	302		159
846		408	302		158
847		408	302		157
848		406	299		157
849		406	298		157
850		406	298		157
851		405	298		157
852		405	297		156
853		403	297		156
854		403	297		156
855		403	296		156
856		402	295		156
857		401	294		155
858		399	293		154
859		398	292		153
860		398	291		153
861		394	290		151
862		394	290		151
863		393	289		151
864		390	289		150

17

865		389	289		150
866		388	288		148
867		387	288		148
868		387	287		148
869		385	286		147
870		382	286		144
871		382	285		144
872		381	284		143
873		380	284		143
874		380	284		141
875		380	283		140
876		380	282		139
877		379	279		139
878		379	279		139
879		379	277		138
880		379	277		137
881		378	276		137
882		378	275		136
883		377	275		136
884		377	274		135
885		376	274		134
886		376	274		134
887		375	273		134
888		373	273		134
889		373	272		133
890		373	270		132
891		371	269		132
892		371	268		131
893		370	268		130
894		370	268		130
895		369	268		130
896		368	268		129
897		368	267		129
898		368	266		128
899		368	266		127
900		368	265		127
901		366	265		127
902		364	264		127
903		364	261		126
904		362	261		125
905		362	261		125
906		361	258		125
907		360	258		124
908		358	258		124
909		357	257		124
910		357	256		123
911		355	256		122
912		354	256		122
913		353	256		122
914		353	256		122
915		352	255		122

18

916		350	255		122
917		350	254		120
918		349	253		120
919		348	252		119
920		347	252		119
921		347	252		118
922		345	250		118
923		343	250		117
924		343	249		116
925		342	249		116
926		342	248		116
927		341	247		116
928		341	246		115
929		341	244		115
930		339	243		114
931		338	243		113
932		334	241		113
933		334	241		113
934		334	241		113
935		333	240		112
936		332	239		112
937		331	236		112
938		331	235		112
939		330	235		112
940		328	234		112
941		326	233		111
942		324	233		111
943		321	232		111
944		320	231		110
945		319	231		110
946		319	231		110
947		319	231		110
948		319	231		110
949		318	230		110
950		317	229		109
951		314	229		109
952		314	228		109
953		313	228		108
954		312	228		107
955		311	228		107
956		311	227		106
957		310	225		106
958		307	223		105
959		307	223		104
960		306	223		104
961		306	222		104
962		305	222		104
963		305	221		103
964		304	221		102
965		303	221		102
966		303	221		99

19

967		303	221		99
968		302	220		99
969		301	219		99
970		301	218		98
971		299	218		97
972		296	218		96
973		296	217		95
974		294	217		95
975		294	216		95
976		293	216		94
977		293	216		93
978		291	215		93
979		290	214		93
980		286	209		92
981		286	208		92
982		286	208		91
983		285	206		90
984		284	205		90
985		284	204		87
986		284	204		87
987		284	204		86
988		283	204		86
989		283	203		85
990		282	202		85
991		281	201		85
992		281	201		84
993		279	200		84
994		278	200		84
995		277	199		83
996		276	196		83
997		276	195		83
998		272	194		82
999		271	194		82
1000		269	192		82
1001		269	192		81
1002		269	191		80
1003		268	191		80
1004		268	191		80
1005		267	191		80
1006		266	190		79
1007		266	189		79
1008		266	188		78
1009		263	187		78
1010		263	187		77
1011		263	187		77
1012		260	187		76
1013		259	185		76
1014		259	184		76
1015		259	183		75
1016		258	182		75
1017		257	182		75

20

1018		257	182		75
1019		257	180		74
1020		255	180		74
1021		255	179		73
1022		254	177		73
1023		251	176		73
1024		251	176		73
1025		251	176		73
1026		251	176		72
1027		250	175		72
1028		249	175		72
1029		249	174		71
1030		249	174		71
1031		248	173		70
1032		246	172		70
1033		246	169		69
1034		245	169		68
1035		245	168		68
1036		243	167		68
1037		243	166		68
1038		241	166		67
1039		241	165		66
1040		241	164		65
1041		239	163		64
1042		239	162		64
1043		238	162		63
1044		237	161		62
1045		237	160		62
1046		236	160		61
1047		236	159		61
1048		235	158		61
1049		233	157		61
1050		233	157		60
1051		233	156		60
1052		232	155		60
1053		232	155		60
1054		231	155		59
1055		231	154		59
1056		231	154		59
1057		229	154		59
1058		227	154		58
1059		226	154		58
1060		226	153		57
1061		225	153		57
1062		224	152		57
1063		224	152		57
1064		224	151		57
1065		223	150		56
1066		222	150		56
1067		221	150		55
1068		220	149		55

21

1069		220	149		54
1070		219	149		54
1071		218	148		53
1072		218	148		53
1073		218	147		53
1074		215	146		52
1075		215	146		52
1076		215	146		52
1077		215	146		52
1078		214	145		52
1079		212	145		51
1080		211	145		51
1081		211	145		51
1082		210	144		51
1083		210	144		51
1084		210	144		51
1085		208	144		51
1086		207	143		50
1087		207	143		50
1088		207	143		50
1089		207	142		50
1090		206	142		50
1091		205	141		49
1092		204	141		49
1093		204	141		49
1094		203	140		49
1095		203	140		49
1096		203	139		48
1097		202	139		48
1098		202	138		48
1099		200	138		48
1100		200	138		48
1101		200	137		48
1102		198	137		47
1103		197	136		47
1104		196	135		47
1105		196	135		47
1106		196	135		46
1107		196	134		46
1108		194	134		46
1109		193	134		46
1110		193	134		46
1111		192	134		45
1112		192	133		45
1113		192	132		45
1114		191	131		45
1115		190	131		44
1116		188	130		44
1117		188	130		44
1118		187	130		43
1119		187	129		43

22

1120		186	128		43
1121		186	128		43
1122		186	128		43
1123		185	128		43
1124		185	127		43
1125		184	127		41
1126		184	127		41
1127		184	127		41
1128		183	126		40
1129		181	126		40
1130		180	126		40
1131		180	126		40
1132		179	125		40
1133		176	125		40
1134		176	124		39
1135		176	124		39
1136		176	124		39
1137		175	123		39
1138		174	123		39
1139		174	122		39
1140		173	122		39
1141		173	122		39
1142		172	122		39
1143		172	122		38
1144		171	121		38
1145		169	121		38
1146		169	120		38
1147		168	119		38
1148		166	119		37
1149		166	119		37
1150		166	119		37
1151		165	118		37
1152		165	118		37
1153		165	117		37
1154		164	117		37
1155		164	116		36
1156		164	116		36
1157		164	116		35
1158		163	115		35
1159		163	114		35
1160		163	114		35
1161		162	114		34
1162		162	114		34
1163		162	114		34
1164		161	113		34
1165		160	113		33
1166		160	113		33
1167		160	113		33
1168		160	111		33
1169		159	111		33
1170		159	110		32

23

1171		159	110		32
1172		158	109		32
1173		157	109		32
1174		157	108		32
1175		157	108		32
1176		156	108		32
1177		155	108		32
1178		155	107		32
1179		155	107		32
1180		155	106		32
1181		155	106		32
1182		153	106		32
1183		153	105		31
1184		153	105		31
1185		152	105		31
1186		152	104		31
1187		152	104		31
1188		151	103		30
1189		150	103		30
1190		150	102		30
1191		150	102		30
1192		149	102		30
1193		149	101		29
1194		148	101		29
1195		145	100		29
1196		145	100		29
1197		145	100		29
1198		143	100		29
1199		142	100		29
1200		140	100		28
1201		140	100		28
1202		140	99		28
1203		140	99		28
1204		139	98		28
1205		139	98		28
1206		138	97		28
1207		138	97		28
1208		138	96		28
1209		138	96		27
1210		138	96		27
1211		137	96		26
1212		137	96		26
1213		136	96		26
1214		136	96		26
1215		135	96		26
1216		134	95		26
1217		134	95		26
1218		133	95		26
1219		132	94		26
1220		132	94		25
1221		132	94		25

24

1222		132	94		25
1223		131	94		25
1224		130	93		25
1225		130	93		25
1226		130	93		25
1227		130	93		25
1228		130	93		25
1229		129	92		25
1230		128	92		25
1231		127	91		24
1232		127	91		24
1233		127	91		24
1234		127	91		24
1235		127	89		24
1236		127	89		24
1237		126	89		24
1238		126	89		23
1239		126	89		23
1240		125	88		23
1241		125	87		23
1242		125	87		23
1243		125	87		23
1244		124	86		23
1245		124	86		23
1246		124	86		23
1247		123	86		23
1248		123	85		23
1249		123	85		23
1250		123	84		22
1251		122	84		22
1252		122	84		22
1253		121	83		22
1254		120	83		22
1255		120	83		22
1256		120	82		22
1257		120	82		22
1258		119	82		22
1259		118	82		22
1260		118	82		22
1261		118	81		22
1262		117	81		22
1263		117	81		21
1264		117	81		
1265		116	80		
1266		116	80		
1267		115	79		
1268		115	78		
1269		114	78		
1270		114	77		
1271		114	77		
1272		114	76		

25

1273		113	76		
1274		112	75		
1275		112	75		
1276		111	75		
1277		111	75		
1278		111	73		
1279		110	73		
1280		110	73		
1281		109	73		
1282		108	73		
1283		107	72		
1284		107	72		
1285		106	72		
1286		106	71		
1287		105	71		
1288		105	71		
1289		105	71		
1290		104	70		
1291		104	70		
1292		103	70		
1293		102	70		
1294		100	70		
1295		100	70		
1296		98	70		
1297		98	69		
1298		98	69		
1299		95	69		
1300		94	69		
1301		93	69		
1302		93	69		
1303		92	68		
1304		92	68		
1305		92	68		
1306		92	67		
1307		91	67		
1308		91	67		
1309		91	66		
1310		90	66		
1311		90	66		
1312		90	66		
1313		90	65		
1314		90	65		
1315		90	65		

Appendix E: Raw table3 showing the yeast colony area on PDA with agar concentration of 1.5%, 2%, 2.5%, 3%, 3.5% (Trial 4).

Saccharomyces cerevisiae's colonies area on PDA with agar concentration of 1.5%, 2%, 2.5%, 3%, 3.5% (Trial 4)					
Colony label	Colony area on PDA with 1.5% agar concentration (Pixel)	Colony area on PDA with 2% agar concentration (Pixel)	Colony area on PDA with 2.5% agar concentration (Pixel)	Colony area on PDA with 3% agar concentration (Pixel)	Colony area on PDA with 3.5% agar concentration (Pixel)
1	4676	3883	3201	2617	2235
2	4566	3502	3006	2354	2117
3	4427	3224	2878	2236	2114
4	3990	3110	2835	2232	2110
5	3852	3087	2741	2044	1958
6	3818	3068	2487	2006	1939
7	3619	3057	2474	1962	1916
8	3536	3041	2468	1949	1880
9	3349	2993	2412	1887	1806
10	3314	2939	2386	1872	1794
11	3297	2837	2310	1871	1786
12	3162	2821	2298	1824	1742
13	3086	2820	2293	1813	1731
14	3072	2804	2201	1786	1620
15	2951	2793	2182	1774	1610
16	2908	2739	2169	1767	1609
17	2848	2679	2100	1764	1592
18	2833	2660	2100	1755	1570
19	2821	2657	2089	1721	1553
20	2775	2657	2016	1680	1472
21	2748	2655	2012	1668	1459
22	2542	2653	2002	1663	1440
23	2515	2613	1995	1661	1439
24	2485	2609	1983	1659	1427
25	2482	2596	1979	1636	1420
26	2471	2553	1974	1634	1405
27	2389	2546	1954	1620	1357
28	2366	2514	1904	1614	1350
29	2301	2507	1903	1607	1340
30	2250	2498	1896	1598	1319
31	2248	2495	1881	1586	1294
32	2240	2486	1858	1531	1235
33	2240	2485	1853	1529	1223
34	2234	2469	1831	1510	1213
35	2220	2440	1824	1501	1199
36	2218	2430	1820	1459	1195
37	2141	2416	1811	1450	1187
38	2141	2357	1792	1444	1187
39	2125	2340	1780	1439	1177
40	2112	2328	1747	1432	1176
41	2097	2319	1735	1425	1161
42	2082	2290	1734	1418	1135
43	2018	2286	1714	1415	1135
44	2014	2281	1710	1405	1129
45	2010	2267	1708	1404	1125
46	1967	2262	1688	1402	1113
47	1930	2256	1683	1395	1112
48	1900	2246	1621	1391	1108
49	1899	2231	1590	1391	1081
50	1891	2225	1574	1381	1078

51	1861	2211	1558	1375	1072
52	1853	2206	1549	1374	1069
53	1850	2180	1530	1372	1068
54	1849	2162	1528	1371	1066
55	1839	2159	1528	1363	1051
56	1832	2159	1528	1361	1043
57	1806	2156	1518	1346	1040
58	1789	2147	1512	1340	1040
59	1781	2116	1490	1339	1039
60	1762	2115	1482	1329	1034
61	1724	2100	1481	1322	1023
62	1697	2091	1480	1318	1014
63	1678	2090	1478	1316	1014
64	1675	2086	1477	1301	1011
65	1662	2083	1472	1301	1007
66	1660	2071	1467	1300	1006
67	1651	2063	1465	1300	1004
68	1650	2053	1464	1295	993
69	1644	2047	1408	1287	991
70	1640	2039	1402	1286	976
71	1638	2031	1401	1282	976
72	1630	2031	1388	1278	968
73	1619	2031	1380	1274	967
74	1599	2027	1368	1267	964
75	1593	2017	1363	1264	963
76	1573	2003	1352	1264	962
77	1569	1996	1342	1258	952
78	1527	1989	1308	1254	950
79	1526	1952	1303	1252	949
80	1507	1949	1301	1249	948
81	1499	1938	1300	1245	942
82	1497	1898	1296	1243	940
83	1496	1886	1295	1216	931
84	1461	1858	1294	1215	930
85	1457	1852	1290	1215	927
86	1450	1844	1290	1209	921
87	1439	1841	1287	1208	917
88	1434	1835	1280	1196	917
89	1394	1835	1265	1196	910
90	1368	1825	1261	1192	910
91	1355	1819	1261	1182	909
92	1353	1800	1257	1178	897
93	1347	1796	1254	1178	895
94	1338	1788	1251	1172	889
95	1334	1780	1248	1170	889
96	1331	1772	1238	1167	888
97	1316	1771	1236	1166	888
98	1315	1769	1226	1165	880
99	1306	1752	1222	1164	874
100	1289	1740	1218	1160	872
101	1283	1740	1215	1153	871
102	1279	1730	1199	1151	869
103	1273	1725	1198	1149	868
104	1270	1722	1194	1147	867

2

105	1270	1721	1194	1146	867
106	1262	1714	1193	1142	866
107	1255	1709	1188	1138	862
108	1254	1698	1183	1136	861
109	1250	1697	1183	1135	860
110	1235	1696	1182	1133	858
111	1233	1695	1175	1130	851
112	1230	1681	1173	1130	848
113	1216	1679	1171	1122	846
114	1216	1676	1161	1121	839
115	1212	1675	1160	1121	839
116	1203	1651	1157	1121	824
117	1178	1650	1152	1112	822
118	1168	1648	1149	1108	822
119	1160	1641	1147	1106	819
120	1158	1641	1147	1101	818
121	1151	1640	1146	1101	812
122	1146	1637	1129	1100	809
123	1139	1635	1129	1099	808
124	1135	1633	1121	1099	807
125	1127	1632	1119	1092	803
126	1127	1632	1116	1090	803
127	1124	1626	1116	1089	800
128	1121	1624	1108	1086	799
129	1118	1622	1104	1085	791
130	1112	1616	1101	1082	784
131	1111	1602	1094	1081	774
132	1105	1601	1090	1075	767
133	1103	1600	1074	1072	766
134	1101	1600	1074	1071	759
135	1093	1596	1067	1070	758
136	1087	1595	1066	1070	757
137	1085	1585	1064	1069	755
138	1067	1583	1062	1063	752
139	1065	1574	1058	1061	750
140	1063	1568	1050	1057	741
141	1063	1564	1049	1057	738
142	1057	1554	1047	1052	738
143	1049	1546	1036	1051	737
144	1038	1542	1029	1046	732
145	1037	1532	1024	1046	728
146	1031	1530	1023	1037	725
147	1022	1529	1021	1036	724
148	1019	1524	1017	1028	724
149	1017	1521	1007	1028	724
150	1015	1510	1004	1028	723
151	993	1510	1002	1025	721
152	992	1510	999	1023	721
153	991	1506	998	1023	711
154	982	1504	992	1023	709
155	973	1499	985	1016	709
156	972	1495	975	1015	708
157	967	1494	964	1013	707
158	954	1492	958	1012	705

3

159	953	1488	957	1010	701
160	946	1486	956	1009	694
161	946	1485	948	1004	694
162	945	1484	938	1004	692
163	942	1483	936	999	692
164	938	1473	930	996	690
165	936	1462	924	996	690
166	920	1456	922	994	689
167	918	1454	919	993	689
168	911	1451	918	986	689
169	904	1450	914	981	689
170	903	1446	912	978	689
171	901	1446	901	973	688
172	897	1445	897	973	686
173	894	1433	896	972	686
174	894	1432	893	968	684
175	884	1431	892	966	680
176	883	1429	882	961	679
177	875	1429	880	960	673
178	875	1426	879	960	672
179	862	1418	871	959	672
180	858	1413	852	958	671
181	849	1406	844	957	667
182	830	1404	843	957	666
183	828	1403	842	955	666
184	826	1403	842	954	665
185	824	1402	839	953	665
186	819	1401	831	952	664
187	814	1393	825	950	663
188	810	1386	821	949	662
189	809	1384	820	949	662
190	807	1381	819	949	662
191	806	1381	818	946	662
192	803	1371	815	944	661
193	803	1367	812	944	660
194	798	1362	807	944	656
195	795	1362	804	943	655
196	795	1361	799	939	653
197	786	1361	795	938	653
198	777	1360	795	937	650
199	775	1356	788	936	649
200	772	1352	782	933	649
201	769	1352	778	933	648
202	763	1348	772	931	648
203	762	1347	772	930	647
204	761	1346	770	929	647
205	761	1345	762	928	644
206	761	1344	761	927	644
207	760	1342	757	926	642
208	760	1339	756	925	641
209	758	1335	753	925	639
210	756	1331	750	921	639
211	756	1323	742	918	636
212	755	1315	738	910	636

4

213	754	1312	736	909	636
214	754	1309	734	908	635
215	753	1308	726	901	634
216	749	1304	725	896	632
217	748	1294	722	894	632
218	748	1293	721	894	631
219	744	1286	717	894	630
220	737	1282	716	892	629
221	735	1274	715	890	627
222	732	1271	710	889	626
223	732	1268	709	889	625
224	730	1267	706	888	625
225	728	1264	704	888	624
226	728	1256	701	887	624
227	724	1244	701	885	624
228	724	1243	700	881	621
229	721	1241	700	881	620
230	717	1234	699	879	617
231	710	1231	695	879	616
232	709	1221	695	875	613
233	702	1220	691	874	610
234	697	1219	687	872	609
235	695	1215	681	872	609
236	694	1209	679	871	608
237	692	1207	679	871	608
238	690	1206	678	871	607
239	689	1205	674	870	606
240	687	1199	671	867	605
241	687	1196	668	865	605
242	684	1186	665	863	605
243	679	1176	648	863	604
244	678	1171	641	860	604
245	677	1171	635	858	604
246	672	1170	635	856	602
247	672	1164	632	856	601
248	668	1157	624	854	600
249	663	1149	619	853	598
250	662	1144	617	853	596
251	661	1139	615	853	595
252	657	1135	615	852	592
253	656	1129	615	852	591
254	654	1127	614	847	590
255	653	1123	613	847	590
256	652	1121	612	847	588
257	649	1119	612	842	586
258	648	1119	611	841	586
259	644	1119	611	836	585
260	643	1114	609	834	585
261	640	1106	605	834	584
262	637	1103	594	829	583
263	636	1102	588	828	581
264	634	1101	582	828	579
265	634	1098	582	828	576
266	634	1094	579	819	575

5

267	629	1092	577	818	573
268	627	1090	572	816	573
269	626	1089	570	815	572
270	626	1086	569	814	571
271	625	1086	568	813	569
272	619	1084	567	809	569
273	618	1082	566	809	564
274	617	1081	563	806	563
275	616	1081	562	806	562
276	613	1081	561	803	562
277	612	1074	560	801	562
278	612	1074	560	797	561
279	606	1071	558	794	558
280	603	1070	551	792	557
281	601	1062	546	791	556
282	600	1061	542	789	556
283	598	1060	539	786	551
284	597	1060	535	785	551
285	594	1051	534	785	551
286	594	1046	534	784	549
287	593	1045	533	783	549
288	592	1043	530	783	546
289	592	1043	529	780	545
290	591	1040	528	780	544
291	591	1035	527	779	544
292	590	1029	525	779	544
293	588	1028	518	779	543
294	588	1023	516	778	539
295	584	1021	515	778	538
296	583	1019	514	773	537
297	583	1018	514	773	537
298	582	1015	513	770	537
299	575	1014	513	766	537
300	573	1012	511	765	536
301	572	1012	507	763	534
302	570	1010	503	761	532
303	566	1007	501	761	532
304	564	1003	500	759	531
305	563	1000	497	759	531
306	563	994	497	754	530
307	562	989	492	754	530
308	556	977	490	753	529
309	556	976	488	751	527
310	555	975	478	750	525
311	552	968	472	748	524
312	546	964	470	747	523
313	545	963	470	747	523
314	543	960	468	746	522
315	541	958	465	743	521
316	541	956	465	742	517
317	537	949	463	742	516
318	536	946	461	740	513
319	532	945	460	739	512
320	529	943	459	737	510

6

321	528	941	459	735	510
322	527	940	456	734	509
323	525	939	455	733	508
324	525	937	454	728	507
325	523	935	450	728	506
326	523	932	447	727	506
327	522	929	446	727	506
328	522	927	446	726	504
329	519	926	443	725	503
330	519	924	441	725	502
331	519	917	441	725	501
332	518	915	439	725	500
333	517	913	439	725	498
334	516	908	437	722	498
335	514	907	434	720	497
336	514	907	432	718	497
337	514	902	429	718	495
338	513	900	428	717	494
339	513	896	424	717	490
340	511	894	422	714	490
341	510	894	422	713	488
342	506	888	421	712	487
343	503	887	421	711	487
344	499	881	418	711	485
345	495	877	418	707	485
346	494	875	417	706	484
347	493	873	416	704	484
348	491	865	415	702	483
349	491	855	409	702	481
350	489	854	409	701	480
351	488	853	408	700	480
352	488	852	406	699	479
353	486	849	404	699	477
354	481	847	402	699	477
355	480	841	401	696	476
356	480	834	401	696	475
357	480	832	399	694	475
358	479	825	398	694	474
359	479	825	397	692	473
360	477	824	395	691	471
361	470	822	394	690	471
362	469	821	393	690	470
363	469	820	391	688	470
364	465	818	390	688	468
365	465	816	385	687	465
366	464	815	381	687	465
367	463	813	381	686	465
368	458	813	380	685	464
369	456	810	378	684	463
370	456	804	378	683	462
371	453	804	375	683	461
372	451	801	374	681	460
373	450	791	373	678	460
374	450	790	372	678	460

7

375	448	786	370	677	459
376	446	779	369	675	459
377	445	772	368	675	458
378	445	772	368	674	457
379	444	765	359	673	456
380	442	765	359	673	455
381	442	760	356	672	454
382	439	759	356	671	453
383	437	759	356	670	452
384	436	758	353	669	452
385	436	758	353	668	449
386	434	754	353	668	448
387	433	753	351	666	448
388	432	752	350	666	448
389	432	752	349	664	448
390	431	750	348	664	447
391	430	749	347	662	447
392	428	746	345	661	447
393	423	746	345	659	446
394	423	742	343	659	446
395	422	741	342	659	445
396	420	738	342	655	445
397	420	736	341	655	444
398	419	734	341	655	444
399	419	731	341	653	444
400	415	729	339	652	444
401	411	729	338	646	443
402	411	724	335	645	443
403	408	721	335	644	442
404	407	721	334	643	441
405	407	721	331	642	440
406	406	713	328	640	439
407	406	713	325	639	437
408	402	712	323	633	436
409	398	710	322	632	436
410	397	708	322	631	433
411	397	705	319	630	433
412	396	705	319	629	427
413	395	702	318	629	427
414	394	697	317	626	426
415	392	695	316	622	426
416	390	695	314	622	426
417	389	692	312	622	424
418	387	691	308	622	423
419	387	690	305	619	423
420	386	688	304	619	423
421	386	688	304	617	422
422	385	686	303	614	418
423	385	673	302	614	418
424	385	671	301	609	417
425	384	669	299	608	417
426	384	668	298	606	414
427	382	664	295	606	411
428	381	664	294	601	410

8

429	381	655	294	600	409
430	378	655	291	599	409
431	375	652	289	598	408
432	375	651	289	598	408
433	374	648	286	597	407
434	374	648	284	596	406
435	373	647	284	594	405
436	372	646	283	594	405
437	370	645	281	594	403
438	368	645	277	593	401
439	367	644	277	593	401
440	367	643	275	593	399
441	366	638	274	593	398
442	366	638	274	592	397
443	365	636	273	589	397
444	364	629	273	588	397
445	364	625	272	587	397
446	364	621	271	586	396
447	363	619	271	583	395
448	359	618	270	583	394
449	358	615	270	581	394
450	355	615	267	581	393
451	355	612	267	580	392
452	353	611	267	580	392
453	352	607	266	579	392
454	350	605	266	579	391
455	350	598	263	577	390
456	350	598	263	576	390
457	347	590	259	575	390
458	346	589	259	571	389
459	345	588	258	570	389
460	344	587	256	570	388
461	342	579	253	569	387
462	337	577	251	562	386
463	337	571	250	560	385
464	337	569	247	560	385
465	336	564	246	559	383
466	336	563	244	558	383
467	333	563	244	557	383
468	332	555	244	557	383
469	330	553	239	556	382
470	330	552	233	556	382
471	329	550	232	556	382
472	328	548	230	552	381
473	327	540	230	552	380
474	325	540	229	551	380
475	324	540	229	551	380
476	323	535	225	550	379
477	322	531	223	549	378
478	320	526	221	549	378
479	320	523	220	549	378
480	320	522	220	548	378
481	320	521	220	547	377
482	319	519	219	546	376

9

483	318	515	218	544	375
484	317	511	215	543	375
485	316	509	214	541	372
486	315	505	213	540	372
487	314	505	211	540	372
488	314	504	211	539	371
489	313	504	211	538	370
490	312	502	210	538	369
491	310	496	210	536	367
492	309	489	207	536	367
493	308	488	206	535	366
494	307	484	206	535	365
495	307	483	205	535	365
496	306	480	204	533	365
497	306	477	200	531	365
498	305	472	199	530	364
499	304	466	198	528	364
500	303	465	197	527	363
501	302	465	195	525	362
502	302	464	194	524	361
503	301	463	194	523	360
504	301	462	193	519	360
505	298	461	189	516	360
506	298	456	189	515	360
507	297	454	187	514	360
508	296	454	182	510	359
509	296	450	182	509	359
510	296	449	181	507	359
511	296	443	180	506	359
512	295	438	179	506	359
513	293	433	177	504	357
514	292	430	176	501	357
515	290	428	176	500	356
516	289	428	175	499	356
517	289	426	174	498	356
518	289	420	174	497	355
519	286	419	173	497	354
520	286	415	172	496	353
521	285	415	171	495	352
522	285	408	170	494	352
523	285	407	170	494	351
524	285	403	168	494	349
525	285	402	168	492	348
526	284	400	162	492	347
527	283	399	161	491	346
528	282	394	160	488	346
529	281	393	159	488	346
530	281	392	159	487	344
531	281	392	157	482	344
532	281	389	156	481	343
533	278	384	156	479	342
534	277	384	154	479	342
535	275	384	154	479	340
536	275	383	151	478	340

10

537	274	376	148	476	339
538	274	375	146	475	339
539	273	374	145	475	339
540	272	374	144	475	339
541	272	374	142	472	339
542	271	368	142	472	339
543	271	366	142	470	338
544	270	362	139	469	338
545	270	362	139	467	338
546	269	360	139	466	337
547	269	359	137	463	337
548	268	357	136	462	337
549	267	353	135	462	336
550	266	353	135	462	335
551	265	351	134	462	334
552	265	347	133	460	333
553	264	346	128	460	333
554	263	342	128	458	330
555	263	340	127	457	330
556	263	339	126	454	329
557	261	338	126	453	326
558	260	335	126	453	325
559	259	333	120	453	325
560	259	332	120	451	325
561	259	330	117	450	323
562	258	329	113	450	323
563	257	329	113	448	323
564	257	326	113	446	322
565	256	325	110	445	321
566	255	321	109	445	321
567	255	318	108	445	320
568	254	318	108	445	319
569	254	318	108	444	318
570	254	309	103	441	318
571	252	309	101	439	316
572	252	308	101	435	316
573	251	306	100	432	316
574	249	304	93	430	315
575	249	302	93	430	315
576	249	302	91	429	315
577	249	302	90	429	314
578	248	295	89	429	314
579	246	295	85	429	314
580	246	295	84	428	313
581	245	295	83	424	313
582	244	290	82	424	312
583	244	290	82	423	312
584	242	289	80	423	310
585	242	288	80	422	310
586	237	288	79	422	310
587	237	285	76	421	309
588	235	281	76	421	309
589	235	280	74	420	309
590	233	278	72	418	308

11

591	232	278	72	418	307
592	231	277	72	418	307
593	229	277	69	416	306
594	229	276	66	415	304
595	229	275	64	413	304
596	228	273	64	413	304
597	227	268	62	412	303
598	227	262	62	405	302
599	226	260	60	405	302
600	225	258	55	405	301
601	224	256	54	404	301
602	224	255	54	402	301
603	221	255	53	397	299
604	221	255	52	396	298
605	221	251	52	395	298
606	221	248	51	394	298
607	220	246	49	394	297
608	219	245	48	394	296
609	217	244	46	394	296
610	216	243	44	393	295
611	215	234	42	392	294
612	215	233	41	388	294
613	215	229	40	387	293
614	214	228	39	387	292
615	214	223	38	387	292
616	214	220	38	387	291
617	213	214	37	387	291
618	213	213		383	290
619	213	212		383	289
620	213	206		382	289
621	212	206		382	288
622	212	205		381	288
623	212	203		381	287
624	211	203		380	286
625	211	202		380	286
626	210	201		379	286
627	210	198		379	285
628	209	188		375	285
629	208	186		372	285
630	208	182		371	284
631	206	182		370	283
632	206	177		366	282
633	204	176		365	282
634	204	175		364	281
635	203	175		364	281
636	203	174		364	281
637	201	171		362	281
638	199	170		361	279
639	197	169		360	278
640	197	167		359	278
641	196	164		359	277
642	196	162		358	276
643	195	162		357	276
644	195	160		356	275

12

645	195	160		352	275
646	194	159		349	275
647	193	158		348	275
648	193	156		346	275
649	193	154		345	274
650	193	151		343	274
651	192	148		343	273
652	192	145		340	272
653	192	144		339	271
654	191	141		339	271
655	190	140		338	270
656	190	140		338	270
657	190	138		330	270
658	190	137		329	269
659	190	134		329	269
660	189	129		329	269
661	188	126		328	268
662	187	126		328	268
663	187	125		327	268
664	187	124		326	267
665	187	123		323	267
666	187	122		321	264
667	187	118		321	264
668	186	116		320	264
669	185	116		320	264
670	185	109		318	262
671	184	109		316	261
672	183	106		313	261
673	182	102		313	260
674	182	98		312	260
675	182	97		312	260
676	181	93		311	260
677	180	93		309	259
678	180	91		307	259
679	179	89		303	258
680	179	88		302	257
681	178	87		301	257
682	178	86		301	257
683	178	83		300	257
684	178	83		300	255
685	176	83		299	255
686	176	81		298	254
687	176	76		296	254
688	175	76		296	254
689	175	76		296	254
690	175	73		296	253
691	175	72		295	253
692	174	70		295	253
693	173	69		294	253
694	173	68		293	252
695	173	65		293	252
696	173	62		292	252
697	172	58		292	252
698	170	57		292	252

13

699	170	55		290	252
700	170	54		289	251
701	170	52		289	251
702	170	51		288	251
703	169	51		288	251
704	169	50		287	251
705	169	50		286	251
706	168	48		286	250
707	167	48		286	250
708	167	47		285	249
709	167	47		284	248
710	167	44		284	247
711	166	44		283	246
712	165	44		282	246
713	164	41		281	246
714	163	40		280	245
715	162	40		280	245
716	162	37		280	245
717	162	36		277	244
718	162	36		277	244
719	161	35		276	244
720	161	34		276	243
721	161	33		275	243
722	159	32		275	241
723	159	32		274	241
724	159			272	239
725	157			272	238
726	157			271	237
727	157			270	237
728	157			270	237
729	157			269	236
730	156			269	234
731	156			269	234
732	156			269	234
733	155			269	234
734	155			268	233
735	155			267	232
736	152			266	232
737	152			266	231
738	152			265	231
739	151			265	230
740	151			264	230
741	149			264	230
742	148			262	229
743	148			260	229
744	148			260	229
745	147			260	229
746	146			259	228
747	145			259	228
748	144			259	228
749	143			258	227
750	143			258	227
751	143			258	227
752	143			258	226

14

753	142			257	226
754	142			257	226
755	141			257	226
756	140			256	225
757	139			256	225
758	139			256	224
759	138			255	224
760	137			255	224
761	137			254	224
762	137			254	223
763	137			254	223
764	137			254	223
765	137			253	223
766	136			253	223
767	136			252	222
768	135			252	222
769	134			250	222
770	133			250	222
771	133			249	221
772	132			249	221
773	132			247	221
774	131			246	220
775	130			245	219
776	130			245	219
777	130			245	219
778	129			245	219
779	129			245	219
780	128			244	218
781	128			244	218
782	128			242	218
783	127			241	218
784	126			241	218
785	126			241	218
786	126			241	218
787	125			240	218
788	123			240	218
789	123			240	217
790	123			240	216
791	123			238	216
792	122			237	215
793	122			237	214
794	122			237	213
795	122			236	213
796	121			234	212
797	121			233	212
798	120			233	211
799	119			233	211
800	118			233	210
801	118			233	210
802	117			232	209
803	117			232	209
804	117			231	209
805	116			231	208
806	116			231	208

15

807	116			231	208
808	116			231	208
809	116			231	207
810	116			230	207
811	115			230	207
812	115			229	207
813	114			229	207
814	114			228	206
815	114			228	206
816	113			226	206
817	112			226	206
818	112			225	206
819	109			225	205
820	107			225	205
821	107			225	205
822	106			225	204
823	105			223	204
824	105			222	204
825	105			222	203
826	104			222	202
827	103			221	202
828	103			221	202
829	103			220	201
830	102			219	201
831	102			219	200
832	102			219	200
833	101			219	200
834	100			218	200
835	99			218	199
836	99			217	199
837	99			217	199
838	98			216	199
839	98			216	198
840	97			216	198
841	96			216	198
842	96			216	198
843	96			215	197
844	96			215	197
845	95			213	197
846	95			213	196
847	94			213	195
848	94			212	195
849	93			212	195
850	93			211	194
851	93			211	194
852	92			211	193
853	91			211	193
854	91			210	193
855	91			210	193
856	91			210	193
857	90			208	193
858	90			208	193
859	90			208	193
860	90			207	193

16

861	88			207	192
862	88			207	192
863	88			207	192
864	88			206	191
865	87			206	191
866	87			206	190
867	87			206	190
868	87			205	189
869	86			205	188
870	86			205	188
871	86			204	188
872	86			203	188
873	85			203	187
874	85			203	187
875	85			203	186
876	85			202	186
877	85			202	186
878	84			202	186
879	84			202	186
880	84			202	185
881	84			201	185
882	84			201	185
883	83			201	185
884	83			201	185
885	83			200	185
886	82			200	185
887	82			199	184
888	82			198	183
889	82			198	183
890	81			197	183
891	81			197	182
892	81			197	182
893	80			197	182
894	79			197	182
895	79			195	181
896	79			194	181
897	79			194	181
898	79			193	181
899	79			193	180
900	79			193	180
901	78			193	180
902	78			192	180
903	78			192	180
904	78			192	179
905	78			191	179
906	78			191	178
907	77			191	178
908	77			191	178
909	77			191	178
910	77			190	178
911	76			190	177
912	76			189	177
913	76			189	177
914	76			189	176

17

915	75			189	176
916	75			189	176
917	75			188	176
918	75			188	176
919	74			188	176
920	74			188	175
921	74			188	175
922	74			187	175
923	74			187	175
924	73			186	175
925	72			185	175
926	72			185	175
927	72			184	175
928	71			184	174
929	70			183	173
930	70			183	173
931	70			183	173
932	69			182	173
933	69			182	173
934	68			182	173
935	68			182	172
936	68			181	172
937	67			181	172
938	66			180	172
939	65			180	172
940	65			180	171
941	65			180	171
942	64			180	171
943	64			179	171
944	64			179	171
945	63			179	170
946	63			179	170
947	63			178	170
948	63			178	170
949	63			177	170
950	62			177	170
951	61			177	169
952	61			177	169
953	61			176	169
954	60			176	169
955	60			176	168
956	60			176	168
957	60			175	168
958	60			175	168
959	60			174	168
960	59			174	168
961	59			173	167
962	58			173	167
963	58			172	167
964	58			172	166
965	58			172	166
966	58			172	166
967	58			172	165
968	58			171	165

18

969	56			171	165
970	56			171	165
971	55			170	165
972	55			170	165
973	55			170	165
974	55			170	164
975	54			169	164
976	54			169	164
977	54			169	164
978	54			169	163
979	54			168	163
980	54			168	162
981	54			168	162
982	54			168	161
983	54			167	160
984	54			167	160
985	53			166	160
986				166	160
987				166	160
988				166	159
989				166	159
990				166	158
991				166	158
992				166	158
993				165	158
994				165	157
995				165	157
996				165	157
997				164	157
998				164	157
999				164	157
1000				164	157
1001				163	156
1002				162	156
1003				162	156
1004				161	156
1005				161	156
1006				161	156
1007				161	155
1008				161	155
1009				160	155
1010				160	155
1011				160	155
1012				160	155
1013				160	155
1014				160	155
1015				160	155
1016				159	154
1017				159	154
1018				159	154
1019				158	154
1020				158	153
1021				158	153
1022				158	153

19

1023				158	153
1024				157	153
1025				157	152
1026				157	152
1027				157	152
1028				157	152
1029				156	152
1030				155	152
1031				155	152
1032				155	151
1033				154	151
1034				154	151
1035				154	151
1036				154	151
1037				153	151
1038				153	150
1039				153	150
1040				153	150
1041				152	150
1042				152	150
1043				151	150
1044				150	149
1045				150	149
1046				150	149
1047				149	149
1048				149	149
1049				149	148
1050				149	148
1051				148	148
1052				148	148
1053				148	148
1054				147	147
1055				147	146
1056				147	146
1057				147	146
1058				146	146
1059				146	146
1060				146	146
1061				146	146
1062				146	146
1063				145	146
1064				145	146
1065				145	145
1066				145	145
1067				145	145
1068				145	145
1069				145	145
1070				145	144
1071				144	144
1072				144	144
1073				144	144
1074				143	144
1075				143	144
1076				143	144

20

1077				143	144
1078				142	143
1079				142	143
1080				142	143
1081				142	143
1082				142	143
1083				141	143
1084				141	142
1085				141	142
1086				141	142
1087				141	142
1088				141	142
1089				140	142
1090				139	142
1091				139	142
1092				139	142
1093				139	142
1094				139	141
1095				138	141
1096				138	141
1097				138	141
1098				138	141
1099				138	141
1100				137	141
1101				137	141
1102				137	140
1103				137	140
1104				136	140
1105				136	140
1106				136	140
1107				135	140
1108				135	139
1109				135	139
1110				135	139
1111				135	139
1112				135	139
1113				135	138
1114				135	138
1115				135	138
1116				135	138
1117				135	138
1118				135	138
1119				134	138
1120				134	138
1121				134	138
1122				134	138
1123				134	138
1124				134	138
1125				134	137
1126				134	137
1127				134	137
1128				134	136
1129				134	136
1130				133	136

21

1239				118	120
1240				118	120
1241				117	120
1242				117	119
1243				117	119
1244				117	119
1245				117	119
1246				116	119
1247				116	119
1248				116	119
1249				116	118
1250				116	118
1251				116	118
1252				116	117
1253				116	117
1254				116	117
1255				116	117
1256				116	117
1257				115	117
1258				115	117
1259				115	116
1260				115	116
1261				115	116
1262				115	116
1263				115	116
1264				114	116
1265				114	116
1266				114	116
1267				114	116
1268				114	116
1269				114	116
1270				114	116
1271				113	116
1272				113	115
1273				113	115
1274				113	115
1275				113	115
1276				113	115
1277				113	115
1278				113	115
1279				113	114
1280				112	114
1281				112	114
1282				112	114
1283				112	114
1284				112	114
1285				112	114
1286				112	114
1287				112	114
1288				112	114
1289				111	113
1290				111	113
1291				111	113
1292				111	113

24

1293				111	113
1294				111	113
1295				111	113
1296				111	112
1297				111	112
1298				111	112
1299				111	112
1300				111	112
1301				111	112
1302				110	112
1303				110	111
1304				110	111
1305				110	111
1306				110	111
1307				110	111
1308				110	110
1309				110	110
1310				110	110
1311				110	110
1312				109	110
1313				109	110
1314				109	109
1315				109	109
1316				109	109
1317				109	109
1318				109	109
1319				109	109
1320				108	108
1321				108	108
1322				108	108
1323				108	108
1324				108	108
1325				107	108
1326				107	108
1327				107	108
1328				107	108
1329				107	108
1330				107	108
1331				107	108
1332				106	107
1333				106	107
1334				106	107
1335				106	107
1336				106	107
1337				106	107
1338				106	107
1339				106	107
1340				106	107
1341				105	107
1342				105	107
1343				105	106
1344				105	106
1345				105	106
1346				105	106

25

1347				105	106
1348				105	106
1349				105	106
1350				105	106
1351				105	106
1352				105	106
1353				105	106
1354				104	105
1355				104	105
1356				104	105
1357				104	105
1358				104	105
1359				104	105
1360				104	105
1361				104	104
1362				104	104
1363				104	104
1364				104	104
1365				104	104
1366				104	104
1367				103	104
1368				103	103
1369				103	103
1370				103	103
1371				103	103
1372				103	103
1373				103	103
1374				103	103
1375				103	103
1376				102	103
1377				102	103
1378				102	102
1379				102	102
1380				102	102
1381				102	102
1382				102	102
1383				102	102
1384				101	102
1385				101	102
1386				101	102
1387				101	102
1388				101	101
1389				101	101
1390				101	101
1391				101	101
1392				101	101
1393				101	101
1394				101	101
1395				101	101
1396				101	101
1397				101	101
1398				101	101
1399				100	101
1400				100	101

26

1401				100	101
1402				100	101
1403				100	101
1404				100	101
1405				100	101
1406				100	101
1407				100	100
1408				99	100
1409				99	100
1410				99	100
1411				99	100
1412				99	100
1413				99	100
1414				99	100
1415				99	100
1416				99	100
1417				99	100
1418				99	100
1419				98	100
1420				98	100
1421				98	99
1422				98	99
1423				98	99
1424				98	99
1425				98	99
1426				98	99
1427				98	99
1428				98	99
1429				98	99
1430				97	99
1431				97	99
1432				97	98
1433				97	98
1434				97	98
1435				97	98
1436				97	98
1437				97	98
1438				97	98
1439				97	98
1440				97	98
1441				97	98
1442				97	97
1443				97	97
1444				97	97
1445				97	97
1446				97	97
1447				96	97
1448				96	97
1449				96	97
1450				96	97
1451				96	97
1452				96	97
1453				96	97
1454				96	97

27

1455				96	96
1456				96	96
1457				96	96
1458				96	96
1459				95	96
1460				95	96
1461				95	96
1462				95	96
1463				95	96
1464				95	96
1465				95	96
1466				95	96
1467				95	96
1468				95	96
1469				95	96
1470				94	96
1471				94	95
1472				94	95
1473				94	95
1474				94	95
1475				94	95
1476				94	95
1477				94	95
1478				94	95
1479				94	95
1480				94	95
1481				94	95
1482				93	95
1483				93	95
1484				93	95
1485				93	94
1486				93	94
1487				93	94
1488				93	94
1489				93	94
1490				93	94
1491				93	94
1492				93	94
1493				93	94
1494				92	94
1495				92	94
1496				92	93
1497				92	93
1498				92	93
1499				92	93
1500				92	93
1501				92	93
1502				92	93
1503				92	93
1504				92	93
1505				92	92
1506				91	92
1507				91	92
1508				91	92

28

1509				91	92
1510				91	92
1511				91	92
1512				91	92
1513				91	92
1514				91	92
1515				91	92
1516				91	92
1517				91	92
1518				91	92
1519				91	92
1520				91	92
1521				91	92
1522				91	91
1523				91	91
1524				91	91
1525				90	91
1526				90	91
1527				90	91
1528				90	91
1529				90	91
1530				90	91
1531				90	91
1532				90	91
1533				90	91
1534				90	90
1535				90	90
1536				90	90
1537				90	90
1538				90	90
1539				89	90
1540				89	90
1541				89	90
1542				89	90
1543				89	90
1544				89	90
1545				89	90
1546				89	90
1547				89	90
1548				89	90
1549				89	90
1550				88	89
1551				88	89
1552				88	89
1553				88	89
1554				88	89
1555				88	89
1556				88	89
1557				88	89
1558				88	89
1559				88	89
1560				88	89
1561				88	89
1562				88	88

29

1671				80	80
1672				80	80
1673				80	80
1674				80	80
1675				80	80
1676				80	80
1677				80	80
1678				80	80
1679				80	80
1680				80	80
1681				79	80
1682				79	80
1683				79	80
1684				79	79
1685				79	79
1686				79	79
1687				79	79
1688				79	79
1689				79	79
1690				79	79
1691				79	79
1692				79	79
1693				79	79
1694				78	79
1695				78	79
1696				78	79
1697				78	79
1698				78	79
1699				78	79
1700				78	79
1701				78	79
1702				78	79
1703				78	79
1704				78	79
1705				78	79
1706				78	79
1707				78	79
1708				78	78
1709				78	78
1710				78	78
1711				78	78
1712				77	78
1713				77	78
1714				77	78
1715				77	78
1716				77	78
1717				77	78
1718				77	78
1719				77	78
1720				77	78
1721				77	78
1722				77	78
1723				77	78
1724				77	78

32

1725				76	78
1726				76	77
1727				76	77
1728				76	77
1729				76	77
1730				76	77
1731				76	77
1732				76	77
1733				76	77
1734				76	77
1735				76	77
1736				76	77
1737				76	76
1738				76	76
1739				75	76
1740				75	76
1741				75	76
1742				75	76
1743				75	76
1744				75	76
1745				75	76
1746				75	76
1747				75	76
1748				75	76
1749				75	76
1750				75	76
1751				75	76
1752				75	76
1753				75	75
1754				75	75
1755				74	75
1756				74	75
1757				74	75
1758				74	75
1759				74	75
1760				74	75
1761				74	75
1762				74	74
1763				74	74
1764				74	74
1765				74	74
1766				74	74
1767				74	74
1768				74	74
1769				74	74
1770				74	74
1771				74	74
1772				74	74
1773				74	74
1774				74	74
1775				74	74
1776				74	74
1777				74	73
1778				73	73

33

Appendix F: Raw Table 4 shows the yeast colony area on PDA with agar concentration of 1.5%, 2%, 2.5%, 3%, 3.5% (Trial 5).

Saccharomyces cerevisiae's colonies area on PDA with agar concentration of 1.5%, 2%, 2.5%, 3%, 3.5% (Trial 5)					
Colony label	Colony area on PDA with 1.5% agar concentration (Pixel)	Colony area on PDA with 2% agar concentration (Pixel)	Colony area on PDA with 2.5% agar concentration (Pixel)	Colony area on PDA with 3% agar concentration (Pixel)	Colony area on PDA with 3.5% agar concentration (Pixel)
1	4718	3909	3125	2945	2364
2	4675	3906	2757	2482	2272
3	4593	3873	2740	2458	2258
4	4348	3822	2650	2424	2196
5	4262	3693	2643	2411	2063
6	4228	3505	2606	2404	2043
7	4039	3298	2558	2280	2034
8	3900	3274	2467	2166	2033
9	3881	3183	2461	2005	1908
10	3748	3160	2397	1974	1897
11	3562	3158	2349	1963	1846
12	3363	3114	2332	1959	1820
13	3349	3053	2291	1949	1807
14	3160	3025	2228	1936	1737
15	3112	3012	2189	1933	1732
16	3074	2999	2154	1913	1707
17	3059	2977	2151	1788	1698
18	3044	2970	2109	1734	1687
19	3017	2918	2102	1722	1684
20	2986	2918	2075	1695	1681
21	2933	2915	2063	1693	1675
22	2917	2908	2063	1677	1647
23	2904	2889	2062	1675	1628
24	2901	2854	2049	1568	1619
25	2752	2844	2028	1562	1619
26	2752	2768	2017	1554	1619
27	2741	2748	1985	1552	1593
28	2735	2699	1976	1552	1589
29	2727	2694	1965	1526	1572
30	2702	2690	1963	1506	1568
31	2690	2684	1962	1493	1562
32	2671	2667	1954	1488	1543
33	2635	2664	1917	1479	1517
34	2579	2593	1892	1477	1514
35	2535	2581	1870	1447	1509
36	2505	2569	1869	1427	1464
37	2502	2563	1868	1415	1455
38	2501	2519	1822	1405	1434
39	2491	2519	1806	1395	1403
40	2476	2512	1799	1367	1398
41	2465	2490	1788	1321	1395
42	2433	2485	1786	1319	1390
43	2389	2481	1766	1308	1388
44	2386	2479	1758	1303	1380
45	2382	2471	1756	1299	1379
46	2380	2467	1745	1292	1373
47	2361	2461	1742	1287	1370
48	2349	2458	1726	1257	1347

49	2334	2451	1721	1242	1340
50	2315	2387	1695	1238	1338
51	2242	2386	1682	1236	1338
52	2236	2369	1678	1229	1336
53	2198	2347	1675	1216	1334
54	2197	2344	1666	1202	1328
55	2188	2331	1663	1200	1319
56	2180	2318	1634	1194	1319
57	2157	2317	1634	1190	1316
58	2155	2312	1611	1182	1312
59	2140	2306	1610	1178	1308
60	2120	2299	1604	1171	1298
61	2115	2296	1597	1167	1291
62	2101	2284	1588	1164	1287
63	2095	2281	1583	1161	1281
64	2079	2259	1574	1160	1278
65	2038	2251	1573	1159	1266
66	2032	2243	1566	1145	1260
67	2028	2222	1566	1139	1251
68	2008	2221	1563	1131	1251
69	1976	2212	1554	1131	1247
70	1935	2201	1550	1128	1246
71	1912	2199	1531	1122	1244
72	1889	2190	1525	1120	1225
73	1878	2185	1513	1118	1220
74	1834	2170	1508	1107	1219
75	1826	2168	1500	1100	1218
76	1783	2166	1500	1095	1217
77	1781	2163	1498	1089	1212
78	1778	2154	1494	1076	1211
79	1771	2151	1487	1074	1209
80	1764	2147	1487	1074	1208
81	1764	2146	1475	1071	1187
82	1754	2144	1470	1061	1182
83	1737	2142	1469	1055	1172
84	1717	2128	1467	1043	1170
85	1699	2104	1461	1042	1166
86	1684	2104	1457	1037	1162
87	1678	2102	1453	1036	1153
88	1668	2095	1448	1035	1152
89	1664	2079	1442	1021	1143
90	1664	2077	1431	1020	1140
91	1659	2075	1431	999	1140
92	1650	2069	1423	996	1138
93	1650	2063	1410	993	1136
94	1644	2054	1400	985	1129
95	1644	2036	1380	973	1129
96	1628	2025	1378	971	1124
97	1626	2022	1377	969	1118
98	1607	2007	1372	967	1115
99	1571	1999	1367	965	1111

2

100	1568	1993	1362	961	1109
101	1551	1989	1360	960	1109
102	1547	1978	1349	952	1103
103	1545	1965	1340	944	1101
104	1530	1949	1330	944	1101
105	1524	1944	1328	943	1094
106	1521	1940	1325	942	1093
107	1515	1933	1324	937	1092
108	1511	1930	1324	936	1091
109	1500	1927	1311	934	1089
110	1497	1924	1292	933	1089
111	1485	1917	1284	928	1086
112	1453	1913	1283	922	1081
113	1451	1904	1283	921	1079
114	1446	1902	1280	917	1078
115	1444	1897	1275	911	1077
116	1439	1894	1259	907	1077
117	1406	1892	1256	902	1060
118	1381	1884	1254	897	1050
119	1376	1881	1254	881	1047
120	1371	1879	1254	877	1042
121	1364	1858	1250	871	1039
122	1361	1858	1237	868	1037
123	1360	1854	1236	864	1035
124	1345	1854	1232	862	1032
125	1320	1851	1231	859	1030
126	1306	1848	1220	853	1026
127	1290	1847	1219	851	1023
128	1287	1842	1214	848	1023
129	1273	1836	1214	848	1022
130	1262	1828	1210	846	1022
131	1251	1821	1193	841	1021
132	1245	1820	1191	841	1015
133	1229	1817	1191	838	1015
134	1226	1805	1190	834	1014
135	1216	1803	1189	830	1009
136	1187	1794	1188	827	1009
137	1158	1792	1183	823	1004
138	1158	1784	1174	823	1004
139	1144	1784	1172	813	998
140	1121	1781	1171	813	994
141	1094	1772	1163	812	991
142	1084	1764	1162	812	989
143	1071	1746	1156	807	988
144	1057	1745	1145	807	984
145	1045	1738	1143	806	984
146	1035	1735	1142	806	983
147	1033	1730	1131	805	983
148	1031	1729	1128	802	975
149	1027	1728	1128	799	972
150	1024	1727	1125	799	971

3

151	1015	1725	1124	797	970
152	998	1722	1123	796	970
153	992	1721	1122	793	969
154	986	1718	1120	792	966
155	975	1712	1117	788	965
156	970	1706	1117	788	964
157	970	1705	1113	785	963
158	967	1704	1109	785	961
159	959	1701	1097	784	961
160	944	1698	1094	783	960
161	941	1697	1089	779	958
162	940	1688	1087	776	957
163	930	1688	1087	770	954
164	929	1674	1084	765	951
165	925	1670	1083	765	951
166	924	1667	1083	764	948
167	921	1662	1081	763	941
168	907	1649	1080	758	940
169	902	1649	1079	757	937
170	896	1641	1078	756	933
171	894	1640	1076	754	925
172	894	1638	1074	744	921
173	890	1632	1071	740	919
174	888	1627	1066	739	919
175	873	1614	1055	737	910
176	871	1614	1050	736	910
177	868	1610	1048	733	909
178	866	1610	1044	732	909
179	866	1608	1044	731	906
180	861	1605	1043	729	905
181	859	1594	1041	727	903
182	857	1590	1040	726	902
183	856	1588	1038	726	900
184	854	1587	1035	723	897
185	846	1587	1033	723	896
186	844	1585	1030	722	894
187	823	1558	1025	721	889
188	816	1556	1021	719	889
189	815	1551	1016	719	889
190	809	1548	1007	717	883
191	809	1538	1001	716	881
192	809	1536	994	715	881
193	807	1528	990	713	880
194	801	1526	988	711	875
195	799	1522	984	711	868
196	783	1498	984	703	863
197	781	1493	983	702	857
198	779	1493	982	701	857
199	778	1491	982	698	856
200	777	1490	977	698	856
201	770	1487	972	695	855

4

202	769	1487	969	691	852
203	762	1483	967	691	851
204	757	1478	966	688	848
205	755	1477	964	683	847
206	751	1468	961	683	842
207	744	1462	956	681	842
208	743	1459	954	681	832
209	742	1458	950	680	829
210	741	1456	946	679	828
211	735	1443	945	679	828
212	728	1441	944	678	826
213	726	1440	932	677	825
214	724	1436	930	673	824
215	719	1418	926	672	823
216	716	1409	926	667	819
217	715	1407	922	663	816
218	715	1406	920	662	814
219	712	1405	911	662	813
220	712	1399	907	661	811
221	707	1387	906	661	807
222	707	1381	904	655	802
223	692	1381	896	655	802
224	689	1380	892	653	801
225	689	1373	890	651	798
226	684	1373	889	647	796
227	680	1365	881	643	792
228	680	1364	880	642	791
229	676	1353	874	642	787
230	675	1352	874	641	785
231	656	1350	873	639	785
232	655	1344	872	639	784
233	648	1340	869	639	781
234	647	1339	868	639	780
235	645	1338	855	634	778
236	645	1333	853	633	772
237	642	1328	843	633	772
238	640	1321	840	633	772
239	639	1318	836	631	770
240	622	1310	834	630	770
241	621	1305	815	628	769
242	610	1302	813	628	764
243	606	1293	808	626	763
244	606	1281	803	623	758
245	603	1279	802	623	757
246	600	1273	796	621	756
247	598	1270	794	612	755
248	598	1268	793	611	750
249	596	1259	793	610	749
250	591	1254	782	609	748
251	586	1252	779	609	747
252	583	1244	776	608	746

5

355	415	825	500	494	590
356	413	824	499	494	589
357	412	818	495	493	586
358	410	813	495	493	586
359	409	811	494	492	585
360	407	808	494	490	585
361	405	807	493	487	582
362	404	801	491	486	582
363	404	801	490	485	581
364	403	789	486	485	575
365	401	787	483	483	574
366	401	787	481	482	572
367	398	784	481	481	572
368	396	763	480	481	571
369	395	762	473	481	566
370	395	756	469	480	563
371	394	753	468	479	562
372	394	751	467	479	558
373	394	750	465	478	556
374	393	749	465	477	554
375	393	746	463	477	554
376	392	745	459	471	552
377	391	741	458	470	550
378	391	741	457	470	549
379	391	736	455	470	548
380	390	728	454	469	547
381	390	726	451	469	541
382	388	722	450	469	539
383	387	722	450	467	539
384	386	720	445	467	537
385	384	716	440	467	536
386	383	714	440	467	534
387	381	711	439	466	531
388	380	703	435	466	531
389	378	702	433	466	530
390	375	699	429	464	529
391	375	696	428	464	529
392	372	691	428	462	528
393	372	690	425	461	525
394	370	686	425	461	525
395	369	682	424	460	520
396	368	682	421	460	519
397	366	676	420	457	518
398	364	673	418	454	513
399	363	663	414	454	512
400	362	662	413	451	511
401	361	662	412	451	511
402	359	660	408	451	510
403	359	660	405	450	510
404	359	660	402	450	509
405	358	658	401	449	508

8

406	357	655	398	448	506
407	356	655	398	447	504
408	355	655	396	446	503
409	355	648	396	443	503
410	354	647	396	443	502
411	353	641	396	441	501
412	353	639	394	441	500
413	352	636	392	441	500
414	350	623	391	440	499
415	348	622	383	440	496
416	348	620	383	440	495
417	348	619	382	439	493
418	348	616	382	438	491
419	347	616	382	437	488
420	347	605	380	437	488
421	346	603	379	437	486
422	345	600	378	437	485
423	343	599	374	436	483
424	343	597	372	436	482
425	340	592	371	436	481
426	340	591	369	436	480
427	339	591	368	436	480
428	339	590	368	435	478
429	338	581	366	434	476
430	338	578	365	434	476
431	338	576	363	433	475
432	338	575	363	433	474
433	337	573	362	433	474
434	337	571	360	432	473
435	334	570	360	432	472
436	334	568	359	431	469
437	334	568	358	429	468
438	333	564	357	429	466
439	332	553	355	429	461
440	331	553	353	429	460
441	330	551	353	429	460
442	330	547	353	428	459
443	327	545	351	427	458
444	327	542	350	427	455
445	327	539	350	426	454
446	325	539	347	425	454
447	324	529	347	425	452
448	323	528	347	424	451
449	323	527	346	422	451
450	322	524	342	422	450
451	322	522	341	421	450
452	321	522	340	421	448
453	321	521	339	421	448
454	320	520	339	420	446
455	320	518	338	420	445
456	320	517	337	418	443

9

253	581	1243	774	608	746
254	578	1238	767	607	743
255	578	1237	763	607	741
256	570	1230	760	606	741
257	569	1228	758	605	733
258	568	1223	756	602	732
259	568	1222	751	600	732
260	566	1220	750	599	731
261	564	1218	748	598	728
262	558	1214	745	596	726
263	558	1213	736	596	725
264	554	1211	736	595	724
265	552	1210	733	594	722
266	552	1208	731	592	722
267	551	1204	730	589	722
268	549	1196	725	589	721
269	543	1192	724	588	719
270	541	1192	722	587	713
271	537	1189	718	586	713
272	536	1185	713	585	710
273	532	1182	712	585	709
274	531	1181	712	584	708
275	527	1178	708	584	708
276	526	1144	703	581	707
277	526	1140	700	580	707
278	524	1135	700	579	705
279	523	1126	696	579	703
280	522	1124	694	578	702
281	518	1117	693	576	699
282	516	1112	693	576	699
283	515	1096	691	574	693
284	512	1090	687	572	692
285	511	1083	685	571	689
286	507	1082	685	570	688
287	504	1077	679	569	688
288	499	1074	678	567	684
289	499	1066	678	565	683
290	497	1052	673	565	682
291	492	1051	672	564	680
292	492	1049	671	564	679
293	490	1048	658	563	677
294	490	1046	657	561	677
295	484	1044	649	561	668
296	484	1041	649	561	668
297	482	1033	649	560	664
298	481	1021	647	558	664
299	480	1011	646	558	663
300	478	1010	641	557	660
301	477	1008	634	556	659
302	476	1004	633	554	658
303	474	1004	632	554	658

6

304	474	994	628	553	656
305	473	991	625	553	655
306	470	990	622	552	655
307	470	987	621	552	653
308	468	986	615	551	650
309	467	986	614	551	649
310	467	980	613	551	647
311	466	977	604	549	647
312	465	972	603	549	645
313	463	970	602	549	645
314	463	965	600	548	644
315	461	962	592	548	642
316	460	959	589	547	641
317	460	949	581	543	640
318	459	947	578	543	638
319	457	946	577	542	637
320	455	945	575	542	637
321	454	942	574	542	630
322	453	935	570	537	626
323	451	932	569	536	625
324	446	926	565	536	625
325	445	920	562	531	625
326	445	918	560	530	624
327	444	915	559	529	624
328	444	912	558	529	621
329	441	911	545	529	620
330	441	909	543	527	619
331	441	897	543	527	618
332	440	892	542	524	618
333	439	889	542	523	618
334	439	883	538	520	616
335	438	879	537	520	615
336	437	878	534	519	614
337	437	862	534	519	613
338	435	861	534	519	612
339	435	859	532	517	611
340	432	855	532	516	610
341	432	854	527	515	607
342	432	853	527	514	607
343	431	852	527	513	606
344	431	852	523	513	605
345	430	851	523	511	604
346	429	849	522	508	604
347	428	848	517	506	602
348	428	846	517	505	601
349	424	845	515	505	600
350	421	840	512	503	599
351	420	838	509	500	596
352	419	830	509	497	595
353	416	827	505	497	593
354	415	826	500	496	591

7

457	320	516	337	417	443
458	319	515	335	417	441
459	319	511	334	416	440
460	318	507	334	416	440
461	318	506	333	415	439
462	318	504	333	415	439
463	317	504	331	414	438
464	317	503	331	413	436
465	317	501	327	412	436
466	316	498	326	411	436
467	316	496	324	411	434
468	315	493	323	411	434
469	315	490	319	411	432
470	314	483	318	410	432
471	314	482	313	408	431
472	314	477	312	408	430
473	314	474	311	407	429
474	312	474	311	407	428
475	310	473	310	407	428
476	310	469	307	406	427
477	307	467	302	406	427
478	307	466	301	404	426
479	307	463	299	404	426
480	307	463	299	404	425
481	306	460	296	402	424
482	306	457	295	401	421
483	306	456	294	399	418
484	305	450	294	398	414
485	305	450	293	397	414
486	304	449	291	397	411
487	304	448	290	395	410
488	303	447	289	395	409
489	302	447	288	395	409
490	302	446	288	393	408
491	301	446	288	393	408
492	300	442	287	393	405
493	300	442	287	393	405
494	299	440	285	392	404
495	298	440	284	391	404
496	297	437	282	391	404
497	296	436	282	389	404
498	295	436	282	388	403
499	295	434	282	388	401
500	294	430	282	388	400
501	294	428	281	387	399
502	294	427	279	386	397
503	293	427	275	386	395
504	292	427	272	386	394
505	291	426	272	385	391
506	289	425	272	384	389
507	288	425	271	384	388

10

508	288	423	270	383	388
509	288	422	269	383	386
510	287	421	269	381	386
511	287	421	269	380	386
512	286	416	268	379	384
513	286	414	267	378	383
514	285	410	265	378	382
515	285	409	264	377	381
516	285	409	264	377	380
517	284	408	263	377	379
518	284	407	261	376	378
519	283	404	261	375	377
520	282	402	260	374	377
521	281	401	257	374	377
522	281	401	256	374	376
523	281	400	255	373	376
524	279	396	254	372	375
525	279	395	252	371	375
526	279	395	251	369	375
527	277	393	251	369	375
528	277	392	251	369	374
529	277	392	247	368	373
530	277	391	247	367	372
531	277	391	245	367	372
532	276	391	243	367	370
533	275	391	243	366	368
534	275	390	243	365	367
535	274	389	241	365	367
536	274	389	241	364	365
537	272	389	241	363	365
538	272	388	237	363	364
539	272	387	232	362	364
540	271	386	231	362	363
541	270	384	231	360	362
542	270	382	230	358	361
543	270	382	228	358	361
544	269	380	227	357	361
545	269	378	226	357	360
546	269	376	226	356	360
547	268	375	226	355	360
548	268	375	225	354	356
549	267	373	220	354	356
550	267	372	220	353	356
551	266	372	219	353	356
552	266	370	219	353	355
553	266	370	219	350	350
554	265	370	218	349	350
555	263	369	218	348	348
556	263	368	217	347	346
557	263	367	215	347	345
558	263	366	214	346	344

11

559	263	364	214	345	343
560	262	364	212	345	343
561	262	364	212	345	343
562	262	363	211	345	342
563	262	361	208	344	342
564	262	360	207	342	340
565	261	359	207	341	340
566	261	358	206	338	339
567	260	357	206	338	339
568	260	356	206	337	338
569	260	356	206	337	335
570	260	353	204	337	334
571	259	350	204	336	334
572	259	347	203	335	332
573	259	347	203	335	328
574	259	346	203	335	327
575	259	345	203	334	325
576	256	344	198	332	325
577	256	344	196	331	324
578	256	343	194	329	324
579	255	341	194	329	324
580	254	339	192	329	324
581	254	337	191	328	323
582	254	335	191	327	323
583	254	335	191	327	323
584	253	335	190	327	322
585	253	334	190	326	322
586	253	334	189	325	321
587	252	332	189	325	320
588	251	332	189	325	320
589	251	331	189	324	319
590	251	330	188	322	318
591	250	329	188	322	316
592	250	329	187	321	314
593	250	328	185	321	314
594	249	327	185	321	314
595	249	325	182	321	314
596	249	325	181	321	313
597	249	323	178	321	313
598	249	322	177	320	313
599	248	322	175	318	311
600	248	322	174	317	311
601	248	321	173	317	310
602	248	321	173	317	309
603	248	320	173	317	309
604	248	318	172	317	308
605	248	316	172	316	308
606	246	316	170	316	308
607	246	315	170	315	305
608	246	315	168	315	304
609	246	314	167	315	304

12

610	246	314	166	314	303
611	246	313	165	314	302
612	245	313	165	313	301
613	245	312	164	311	301
614	245	312	164	311	301
615	244	312	162	311	301
616	244	308	162	311	301
617	244	308	161	310	300
618	244	308	160	309	300
619	243	304	160	308	300
620	243	304	158	307	299
621	242	304	158	307	299
622	242	302	157	306	298
623	242	301	156	306	298
624	242	301	155	306	297
625	241	301	155	306	296
626	241	300	155	305	295
627	241	299	155	304	294
628	241	299	152	304	294
629	240	298	152	303	294
630	240	298	152	303	292
631	239	298	149	303	292
632	239	298	148	302	292
633	239	296	147	302	291
634	239	296	147	302	290
635	238	295	146	300	289
636	238	291	146	300	289
637	237	291	144	299	287
638	237	290	143	298	287
639	237	290	143	297	286
640	237	290	143	296	285
641	237	289	143	296	285
642	236	289	142	296	284
643	236	288	142	296	284
644	236	287	140	296	283
645	236	286	140	295	283
646	235	286	139	294	281
647	234	286	138	293	281
648	234	286	138	293	281
649	234	285	137	293	281
650	234	284	137	293	280
651	234	283	136	292	280
652	233	282	134	292	280
653	233	282	133	291	280
654	233	282	131	290	277
655	233	281	131	289	277
656	232	281	130	289	276
657	232	280	129	287	275
658	232	280	128	287	275
659	232	279	127	287	275
660	231	278	127	286	275

13

661	230	278	127	286	274
662	229	277	126	286	274
663	229	276	125	286	273
664	229	276	125	286	273
665	229	275	125	286	273
666	227	275	125	286	272
667	227	275	125	286	272
668	226	275	122	285	271
669	226	275	121	285	271
670	226	274	121	285	271
671	226	274	120	285	270
672	225	273	120	284	270
673	225	273	120	284	269
674	225	273	119	283	268
675	224	271	118	283	268
676	224	271	118	281	267
677	222	271	118	281	267
678	222	270	117	280	266
679	222	269	117	279	266
680	222	269	115	279	266
681	221	268	115	279	266
682	221	268	115	278	265
683	221	267	113	278	264
684	221	267	112	278	263
685	221	267	112	277	263
686	220	266	111	277	262
687	220	265	110	277	262
688	220	265	109	277	261
689	219	265	109	276	261
690	219	263	109	275	261
691	219	261	108	274	260
692	219	261	106	274	259
693	219	261	106	274	259
694	218	260	106	274	259
695	218	260	106	273	259
696	217	259	106	273	258
697	217	259	105	272	256
698	217	257	105	272	256
699	217	256	105	272	255
700	216	256	105	272	255
701	216	256	103	271	255
702	215	255	103	270	255
703	215	255	103	270	254
704	215	254	103	270	254
705	214	254	103	269	253
706	213	253	103	269	252
707	212	253	102	268	252
708	212	253	102	268	251
709	212	252	102	268	250
710	211	252	101	268	250
711	210	252	101	268	250

14

712	210	251	100	268	249
713	210	251	100	268	249
714	210	250	99	267	249
715	210	250	99	267	249
716	210	250	98	266	248
717	209	249	98	266	247
718	208	249	98	266	247
719	208	248	98	264	247
720	208	247	97	264	247
721	208	246	97	263	247
722	208	246	96	263	246
723	208	246	95	263	246
724	207	245	95	263	246
725	207	245	94	263	245
726	207	245	94	263	245
727	206	244	93	262	244
728	206	243	93	261	243
729	206	240	93	261	242
730	206	239	92	259	241
731	205	239	92	259	241
732	205	238	92	256	239
733	204	238	92	256	239
734	204	237	91	255	238
735	203	236	91	255	238
736	203	236	90	255	238
737	203	234	89	255	236
738	203	234	89	255	236
739	202	234	88	253	235
740	202	234	88	253	235
741	201	233	88	253	235
742	201	232	88	253	235
743	201	231	88	253	234
744	201	231	88	253	234
745	199	231	87	252	234
746	199	231	87	252	233
747	199	230	87	251	233
748	199	230	86	251	231
749	198	229	86	251	230
750	198	229	86	251	230
751	198	229	86	251	229
752	198	229	85	250	229
753	198	227	84	249	229
754	197	227	84	248	228
755	197	227	84	247	228
756	197	227	84	245	228
757	196	225	84	244	228
758	195	224	83	244	227
759	195	224	83	243	227
760	195	224	83	243	227
761	195	224	82	242	227
762	195	224	82	242	226

15

763	195	223	82	242	226
764	194	223	82	242	226
765	194	222	81	242	226
766	194	221	80	241	225
767	194	221	80	241	224
768	194	220	80	240	224
769	193	220	79	240	224
770	193	220	79	239	224
771	193	219	78	239	224
772	193	219	78	238	223
773	193	218	77	238	223
774	193	218	77	237	222
775	193	217	77	237	222
776	193	217	77	237	222
777	192	217	77	237	222
778	192	216	77	236	222
779	192	216	76	236	222
780	191	216	76	236	222
781	191	216	75	236	221
782	191	216	75	235	220
783	191	215	75	235	220
784	191	214	75	235	220
785	191	214	75	234	219
786	191	214	74	234	219
787	191	214	74	233	219
788	190	214	74	233	218
789	190	214	74	233	218
790	190	213	73	233	218
791	190	213	72	233	218
792	190	212	72	233	218
793	190	212	71	232	217
794	190	211	71	232	217
795	190	211	70	231	217
796	189	210	70	231	216
797	189	210	70	231	216
798	189	210	69	231	215
799	189	210	69	230	215
800	189	210	69	230	214
801	189	209	69	229	214
802	189	209	69	229	213
803	189	209	69	229	212
804	189	209	69	228	212
805	188	208	69	228	212
806	188	208	69	228	211
807	188	208	68	228	211
808	188	208	67	227	209
809	188	207	67	227	209
810	187	207	67	227	209
811	187	207	66	226	209
812	186	206	66	226	208
813	186	205	66	226	208

16

814	186	205	65	226	208
815	186	205	64	226	207
816	186	205	63	226	207
817	185	204	63	226	207
818	185	204	63	225	207
819	185	204	63	225	207
820	185	203	62	225	207
821	185	203	62	225	207
822	185	203	61	224	206
823	184	202	61	224	204
824	184	202	61	224	204
825	184	202	60	224	203
826	184	201	60	223	203
827	184	201	60	223	203
828	184	201	59	223	203
829	184	201	59	222	203
830	183	201	59	221	202
831	183	200	59	221	201
832	183	200	59	221	201
833	183	199	59	220	200
834	182	199	58	220	200
835	182	199	58	220	200
836	182	198	57	219	199
837	181	198	57	218	198
838	181	197	57	217	198
839	181	197	57	216	198
840	181	196	56	216	198
841	181	195	56	215	197
842	180	195	56	215	197
843	180	195	56	215	196
844	180	194	56	214	196
845	180	194	56	213	196
846	180	194	56	213	195
847	180	194	55	213	195
848	179	194	55	213	195
849	179	194	55	213	194
850	178	193	55	213	194
851	178	193	54	212	194
852	178	193	54	212	194
853	177	192	53	212	193
854	177	192	53	211	193
855	177	192	53	211	192
856	177	192	53	210	192
857	176	192	52	210	191
858	176	192	52	210	191
859	176	192	52	210	190
860	176	191	52	210	190
861	176	191	51	210	189
862	175	190	51	210	188
863	175	190	51	209	188
864	175	190	51	209	188

17

865	174	189	51	209	188
866	174	189	50	209	188
867	174	188	50	208	188
868	173	188	50	208	187
869	173	188	49	207	187
870	173	187	49	207	187
871	173	187	49	207	187
872	173	187	49	206	187
873	173	187	49	206	186
874	172	187	48	205	186
875	172	186	48	205	186
876	172	186	48	205	186
877	171	186	48	205	186
878	171	186	48	205	185
879	171	185	48	205	183
880	171	185	47	205	183
881	171	185	186	204	183
882	171	184	186	204	182
883	171	184	185	204	182
884	171	184	185	204	181
885	171	184	185	204	181
886	171	184	184	203	180
887	171	183	184	203	180
888	170	183	184	203	180
889	170	183	184	203	180
890	170	183	184	203	179
891	170	182	183	203	179
892	170	182	183	202	178
893	170	181	183	202	178
894	170	181	183	201	178
895	170	181	182	201	178
896	169	181	182	201	178
897	169	180	181	201	177
898	169	180	181	201	177
899	169	180	181	201	177
900	169	180	181	200	176
901	168	179	180	200	176
902	168	179	180	200	176
903	168	179	180	199	176
904	167	179	180	199	175
905	167	178	179	199	175
906	167	178	179	199	174
907	167	178	179	198	174
908	166	177	179	198	174
909	166	177	178	198	174
910	166	177	178	198	174
911	166	177	178	197	172
912	166	176	177	197	172
913	166	176	177	196	172
914	166	176	177	195	171
915	165	176	177	195	171

18

916	165	176	176	195	171
917	165	175	176	195	170
918	165	175	176	194	170
919	165	174	176	194	169
920	165	174	176	194	169
921	164	174	175	194	169
922	164	174	175	194	168
923	164	174	174	193	167
924	164	174	174	193	167
925	164	174	174	193	167
926	163	173	174	193	166
927	163	173	174	193	166
928	163	173	174	192	165
929	162	172	174	191	165
930	161	172	173	191	165
931	161	172	173	191	165
932	161	172	173	190	164
933	161	171	172	190	164
934	160	171	172	190	164
935	160	171	172	190	164
936	160	170	172	190	164
937	160	170	171	190	163
938	160	170	171	189	163
939	159	169	171	189	162
940	159	169	170	189	162
941	159	169	170	189	162
942	158	169	170	189	162
943	158	168	169	189	162
944	158	168	169	189	162
945	158	167	169	188	161
946	158	167	169	188	161
947	158	167	168	187	161
948	158	167	168	186	160
949	158	166	167	186	160
950	158	166	167	185	160
951	158	166	167	185	160
952	157	166	167	185	160
953	157	166	166	185	159
954	157	165	166	184	159
955	157	165	166	184	159
956	156	165	166	183	159
957	156	165	166	183	158
958	156	165	165	183	158
959	156	164	165	182	158
960	156	164	165	182	158
961	156	164	165	181	158
962	156	164	165	181	157
963	156	164	164	181	157
964	156	164	164	181	156
965	156	163	164	181	156
966	155	162	164	181	156

19

967	155	162	164	181	156
968	155	162	164	181	156
969	155	162	163	180	155
970	154	162	162	180	155
971	154	161	162	179	155
972	153	161	162	179	155
973	153	161	162	179	155
974	153	161	162	179	155
975	153	160	161	179	155
976	153	160	161	178	155
977	153	160	161	178	155
978	152	160	161	178	155
979	152	160	160	178	155
980	152	160	160	178	154
981	152	159	160	177	154
982	152	159	160	177	154
983	152	159	160	177	154
984	151	158	160	176	154
985	151	158	159	176	153
986	151	157	159	176	153
987	151	157	159	176	153
988	150	157	158	175	153
989	150	156	158	175	152
990	150	156	157	175	152
991	150	156	157	175	152
992	150	156	157	175	152
993	149	155	156	175	151
994	149	155	156	174	151
995	149	155	156	174	151
996	149	155	156	174	151
997	149	155	155	173	151
998	149	155	155	173	151
999	149	154	155	173	151
1000	149	154	155	173	150
1001	149	154	155	173	150
1002	149	154	155	173	150
1003	148	154	154	173	150
1004	148	154	154	173	150
1005	147	154	154	172	150
1006	147	154	154	171	150
1007	147	154	154	171	150
1008	147	154	154	171	150
1009	147	154	154	170	149
1010	147	153	154	170	149
1011	147	153	154	170	148
1012	147	153	154	170	148
1013	146	153	154	170	148
1014	146	153	153	170	148
1015	146	153	153	170	148
1016	146	152	153	170	148
1017	146	152	153	170	148

20

1018	145	152	153	169	148
1019	145	151	153	169	147
1020	145	151	152	168	147
1021	145	151	152	168	147
1022	144	151	152	166	147
1023	144	151	151	166	147
1024	143	150	151	166	146
1025	143	150	151	166	146
1026	143	150	151	166	145
1027	143	150	151	166	145
1028	143	150	150	166	145
1029	143	149	150	166	144
1030	143	149	150	166	144
1031	143	149	150	165	144
1032	142	149	150	165	144
1033	142	149	149	164	143
1034	142	149	149	164	143
1035	142	148	149	164	142
1036	142	148	149	164	142
1037	142	148	149	164	142
1038	142	147	149	164	142
1039	142	147	148	164	142
1040	141	147	148	163	141
1041	141	147	148	163	141
1042	141	147	147	163	141
1043	141	146	147	163	141
1044	141	146	147	163	141
1045	141	146	147	162	141
1046	141	146	147	162	140
1047	141	146	146	162	140
1048	141	146	146	162	140
1049	141	145	146	162	140
1050	140	145	146	162	140
1051	140	145	146	162	140
1052	140	145	146	161	140
1053	140	144	145	161	139
1054	140	144	145	161	139
1055	140	144	145	161	139
1056	140	143	145	160	139
1057	140	143	144	160	139
1058	140	143	144	160	139
1059	140	143	144	160	139
1060	140	142	143	160	139
1061	140	142	143	160	138
1062	140	142	143	160	138
1063	139	142	143	159	138
1064	139	142	142	159	138
1065	139	142	142	159	138
1066	139	141	142	159	138
1067	139	141	142	159	138
1068	139	141	142	159	137

21

1069	139	140	142	159	137
1070	139	140	141	159	137
1071	138	140	141	159	137
1072	138	139	141	159	136
1073	138	139	140	159	136
1074	138	139	140	159	136
1075	138	138	140	158	136
1076	138	138	139	158	136
1077	138	138	139	158	136
1078	137	138	139	157	135
1079	137	138	138	157	135
1080	137	138	138	157	135
1081	137	138	138	157	135
1082	137	137	138	157	135
1083	136	137	138	157	135
1084	136	137	138	157	135
1085	136	137	138	156	134
1086	136	137	137	156	133
1087	136	137	137	156	133
1088	136	137	137	155	133
1089	136	136	137	155	132
1090	135	136	137	155	132
1091	135	136	137	155	132
1092	135	136	137	155	132
1093	135	136	136	154	132
1094	134	136	136	154	132
1095	134	135	136	154	132
1096	134	135	136	154	132
1097	134	135	136	154	132
1098	134	135	136	154	132
1099	134	135	135	154	131
1100	133	134	135	154	131
1101	133	134	135	153	131
1102	133	133	135	153	131
1103	132	133	135	153	131
1104	132	133	134	153	131
1105	132	133	134	152	131
1106	132	133	133	152	131
1107	132	132	133	152	130
1108	132	132	133	152	130
1109	132	132	133	152	130
1110	132	132	133	152	130
1111	132	132	132	152	130
1112	132	132	132	151	129
1113	132	131	132	151	129
1114	132	131	132	151	129
1115	132	131	132	151	129
1116	132	131	132	150	129
1117	132	131	131	150	129
1118	131	131	131	150	128
1119	131	131	131	150	128

22

1120	131	130	131	150	128
1121	131	130	131	150	128
1122	131	130	131	150	128
1123	131	130	131	150	128
1124	131	130	130	150	128
1125	131	130	130	150	128
1126	131	129	130	149	128
1127	131	129	130	149	128
1128	131	129	130	149	127
1129	131	129	130	149	127
1130	130	129	129	149	127
1131	130	129	129	149	127
1132	130	128	129	149	127
1133	130	128	129	149	127
1134	130	128	129	148	126
1135	130	128	129	148	126
1136	129	128	128	148	126
1137	129	128	128	148	125
1138	129	128	128	148	125
1139	129	128	128	148	125
1140	129	128	128	147	125
1141	129	127	128	147	125
1142	129	127	128	147	125
1143	129	127	128	147	125
1144	128	127	128	147	125
1145	128	127	127	147	125
1146	128	127	127	147	125
1147	128	126	127	147	125
1148	127	126	127	147	124
1149	127	126	127	147	124
1150	127	126	127	147	124
1151	127	126	126	146	124
1152	127	126	126	146	124
1153	127	126	126	145	124
1154	127	125	126	145	124
1155	127	125	126	145	124
1156	127	125	126	145	124
1157	127	125	126	145	123
1158	126	125	125	145	123
1159	126	125	125	145	123
1160	126	125	125	144	123
1161	126	125	125	144	123
1162	126	125	125	144	122
1163	126	125	125	144	122
1164	126	125	125	144	122
1165	125	125	125	144	122
1166	125	125	125	144	122
1167	125	124	125	144	122
1168	125	124	125	144	121
1169	125	124	125	144	121
1170	125	124	125	143	121

23

1171	125	124	124	143	121
1172	125	124	124	143	121
1173	125	124	124	143	121
1174	125	124	124	143	121
1175	124	123	124	143	121
1176	124	123	124	143	121
1177	124	123	124	143	121
1178	124	123	124	142	120
1179	124	123	123	142	120
1180	124	122	123	142	120
1181	124	122	123	142	120
1182	124	122	123	142	120
1183	124	122	123	141	120
1184	124	121	122	141	120
1185	123	121	122	141	120
1186	123	121	122	141	120
1187	123	121	122	141	119
1188	123	121	121	141	119
1189	123	121	121	141	119
1190	123	121	121	140	119
1191	122	121	121	140	119
1192	122	121	121	140	119
1193	122	121	121	140	118
1194	122	120	121	140	118
1195	122	120	121	140	118
1196	122	120	121	140	118
1197	122	120	121	140	118
1198	122	120	120	140	118
1199	122	120	120	140	118
1200	121	120	120	140	118
1201	121	120	120	140	118
1202	121	120	120	140	117
1203	121	120	120	140	117
1204	121	120	120	139	117
1205	121	120	120	139	117
1206	121	119	120	139	117
1207	121	119	120	139	117
1208	121	119	120	139	117
1209	121	119	120	139	117
1210	121	119	119	139	117
1211	120	119	119	139	116
1212	120	119	119	139	116
1213	120	119	119	139	116
1214	120	119	119	139	116
1215	120	118	119	138	116
1216	120	118	119	138	116
1217	120	118	119	138	116
1218	120	118	119	138	116
1219	120	118	118	138	116
1220	120	118	118	138	116
1221	120	117	118	137	116

24

1222	119	117	118	137	116
1223	119	116	118	137	116
1224	119	116	118	137	115
1225	119	116	117	137	115
1226	119	116	117	137	115
1227	119	116	116	137	115
1228	119	116	116	136	115
1229	119	116	116	136	115
1230	118	116	116	136	115
1231	118	116	116	136	114
1232	118	116	116	136	114
1233	118	116	116	136	114
1234	118	115	116	136	114
1235	118	115	116	136	114
1236	118	115	116	136	114
1237	118	115	116	135	114
1238	117	115	115	135	114
1239	117	115	115	135	113
1240	117	115	115	135	113
1241	117	115	115	135	113
1242	117	115	115	135	113
1243	117	114	115	134	113
1244	117	114	115	134	113
1245	117	114	115	134	112
1246	117	114	115	134	112
1247	117	114	114	134	112
1248	117	113	114	134	112
1249	117	113	114	133	112
1250	117	113	114	133	112
1251	117	113	114	133	112
1252	117	113	113	133	112
1253	116	113	113	133	112
1254	116	113	113	133	111
1255	116	113	113	133	111
1256	116	113	113	132	111
1257	116	113	113	132	111
1258	115	113	113	132	111
1259	115	113	113	132	111
1260	115	113	113	132	111
1261	115	113	113	132	111
1262	115	112	113	132	110
1263	115	112	113	132	110
1264	115	112	113	131	110
1265	114	112	113	131	110
1266	114	112	112	131	110
1267	114	112	112	131	110
1268	114	112	112	131	110
1269	114	112	112	131	110
1270	114	111	112	131	110
1271	113	111	112	131	110
1272	113	111	112	131	110

25

1273	113	111	112	130	110
1274	113	111	111	130	110
1275	113	111	111	130	110
1276	113	111	111	130	110
1277	113	111	111	130	109
1278	113	110	111	130	109
1279	113	110	111	130	109
1280	113	110	111	130	109
1281	113	110	111	130	109
1282	113	110	110	130	109
1283	112	110	110	130	109
1284	112	110	110	129	109
1285	112	110	110	129	109
1286	112	110	110	129	109
1287	112	109	110	129	109
1288	112	109	110	129	109
1289	112	109	110	129	109
1290	112	109	110	129	109
1291	112	109	109	129	109
1292	112	109	109	128	108
1293	112	109	109	128	108
1294	111	109	109	128	108
1295	111	109	109	128	107
1296	111	109	109	128	107
1297	111	109	109	128	107
1298	111	108	109	128	107
1299	111	108	109	128	107
1300	111	108	109	128	107
1301	111	108	109	128	107
1302	111	108	108	128	107
1303	111	108	108	127	107
1304	111	108	108	127	107
1305	110	108	108	127	106
1306	110	108	108	127	106
1307	110	108	108	127	106
1308	110	108	108	127	106
1309	110	108	108	127	106
1310	110	108	108	127	106
1311	110	108	108	127	106
1312	110	108	108	127	106
1313	110	107	108	127	106
1314	110	107	108	126	105
1315	110	107	108	126	105
1316	109	107	108	126	105
1317	109	107	107	126	105
1318	109	107	107	126	105
1319	109	107	107	126	105
1320	109	107	107	126	105
1321	109	107	107	126	105
1322	109	106	107	126	105
1323	108	106	107	126	105

26

1324	108	106	107	126	105
1325	108	106	107	126	104
1326	108	106	106	125	104
1327	108	106	106	125	104
1328	108	106	106	125	104
1329	108	106	106	125	104
1330	108	106	106	125	104
1331	108	106	106	125	104
1332	108	106	106	125	104
1333	108	106	106	125	103
1334	108	105	106	125	103
1335	108	105	106	124	103
1336	108	105	106	124	103
1337	107	105	106	124	103
1338	107	105	105	124	103
1339	107	105	105	124	103
1340	107	105	105	124	103
1341	107	105	105	124	102
1342	107	105	105	124	102
1343	107	105	105	124	102
1344	107	104	105	123	102
1345	107	104	105	123	102
1346	107	104	105	123	102
1347	107	104	105	123	102
1348	107	104	104	123	102
1349	107	104	104	123	101
1350	106	104	104	123	101
1351	106	104	104	123	101
1352	106	104	104	123	101
1353	106	104	104	123	101
1354	106	103	104	123	101
1355	106	103	104	122	101
1356	106	103	104	122	101
1357	105	103	104	122	101
1358	105	103	103	122	101
1359	105	103	103	122	101
1360	105	103	103	122	101
1361	105	103	103	122	100
1362	105	103	103	122	100
1363	105	103	103	122	100
1364	105	103	103	122	100
1365	105	103	103	122	100
1366	105	103	103	121	100
1367	105	103	103	121	100
1368	105	102	103	121	100
1369	105	102	103	121	100
1370	105	102	103	121	100
1371	105	102	103	121	100
1372	105	102	102	121	100
1373	104	102	102	121	99
1374	104	101	102	121	99

27

1375	104	101	102	121	99
1376	104	101	102	120	99
1377	104	101	102	120	99
1378	104	101	101	120	99
1379	104	101	101	120	99
1380	104	101	101	120	99
1381	104	101	101	120	99
1382	104	101	101	120	99
1383	104	101	101	120	99
1384	104	100	101	120	98
1385	104	100	101	119	98
1386	104	100	101	119	98
1387	103	100	101	119	98
1388	103	100	100	119	98
1389	103	100	100	119	98
1390	103	100	100	119	98
1391	103	100	100	119	98
1392	103	100	100	119	98
1393	103	100	100	119	97
1394	103	99	100	119	97
1395	103	99	100	119	97
1396	103	99	100	119	97
1397	103	99	100	118	97
1398	103	99	99	118	97
1399	102	99	99	118	97
1400	102	99	99	118	97
1401	102	99	99	118	96
1402	102	99	99	118	96
1403	102	98	99	118	96
1404	102	98	99	118	96
1405	102	98	99	118	96
1406	102	98	99	118	96
1407	102	97	98	118	96
1408	102	97	98	118	96
1409	101	97	98	117	96
1410	101	97	98	117	96
1411	101	97	97	117	95
1412	101	97	97	117	95
1413	101	97	97	117	95
1414	101	97	97	117	95
1415	101	96	97	117	95
1416	101	96	97	117	95
1417	101	96	97	117	95
1418	101	96	97	117	95
1419	101	96	96	117	95
1420	101	96	96	117	95
1421	101	96	96	116	95
1422	101	96	96	116	95
1423	101	96	96	116	95
1424	100	95	96	116	95
1425	100	95	96	116	95

28

1426	100	95	96	116	95
1427	100	95	96	116	95
1428	100	95	95	116	95
1429	100	95	95	116	95
1430	100	95	95	116	95
1431	100	95	95	115	95
1432	100	95	95	115	95
1433	100	95	95	115	94
1434	100	95	95	115	94
1435	100	94	95	115	94
1436	100	94	95	115	94
1437	99	94	95	115	94
1438	99	94	95	115	94
1439	99	94	94	115	94
1440	99	94	94	115	94
1441	99	94	94	114	94
1442	99	94	94	114	94
1443	99	94	94	114	94
1444	99	94	94	114	94
1445	99	94	94	114	94
1446	99	94	94	114	94
1447	99	93	94	114	94
1448	99	93	94	114	94
1449	99	93	94	114	94
1450	99	93	94	114	94
1451	99	93	93	113	93
1452	99	93	93	113	93
1453	99	93	93	113	93
1454	99	93	93	113	93
1455	99	93	93	113	93
1456	98	93	93	113	93
1457	98	93	93	113	93
1458	98	93	93	113	93
1459	98	93	93	113	93
1460	98	93	93	112	93
1461	98	93	93	112	93
1462	98	93	93	112	93
1463	98	93	93	112	93
1464	98	93	93	112	93
1465	98	92	93	112	93
1466	98	92	93	112	93
1467	97	92	93	112	92
1468	97	92	93	112	92
1469	97	92	92	111	92
1470	97	92	92	111	92
1471	97	92	92	111	92
1472	97	92	92	111	92
1473	97	92	92	111	92
1474	97	92	92	111	92
1475	97	92	92	111	92
1476	96	92	92	111	92

29

1477	96	92	92	111	92
1478	96	92	92	111	91
1479	96	91	92	111	91
1480	96	91	92	111	91
1481	96	91	92	111	91
1482	96	91	92	110	91
1483	96	91	91	110	91
1484	96	91	91	110	91
1485	96	91	91	110	91
1486	96	91	91	110	91
1487	96	91	91	110	90
1488	96	91	91	110	90
1489	96	91	91	110	90
1490	96	91	91	110	90
1491	96	91	91	110	90
1492	96	91	91	109	90
1493	95	91	91	109	90
1494	95	91	91	109	90
1495	95	91	91	109	90
1496	95	91	91	109	90
1497	95	90	91	109	89
1498	95	90	91	109	89
1499	95	90	91	109	89
1500	95	90	91	109	89
1501	95	90	90	109	89
1502	95	89	90	109	89
1503	95	89	90	108	89
1504	95	89	90	108	89
1505	94	89	90	108	89
1506	94	89	89	108	89
1507	94	89	89	108	88
1508	94	89	89	108	88
1509	94	89	89	108	88
1510	94	89	89	108	88
1511	94	89	89	108	88
1512	94	89	89	108	88
1513	94	89	89	107	88
1514	94	89	89	107	88
1515	94	88	89	107	88
1516	94	88	89	107	88
1517	94	88	89	107	88
1518	94	88	89	107	87
1519	94	88	88	107	87
1520	94	88	88	107	87
1521	94	88	88	106	87
1522	94	88	88	106	87
1523	94	88	88	106	87
1524	94	88	88	106	87
1525	94	88	88	106	87
1526	93	88	88	106	86
1527	93	88	88	106	86

1528	93	88	88	106	86
1529	93	88	88	106	86
1530	93	87	88	106	86
1531	93	87	88	106	86
1532	93	87	88	106	86
1533	93	87	88	106	86
1534	93	87	87	106	86
1535	93	87	87	106	86
1536	93	87	87	106	86
1537	93	87	87	105	86
1538	93	87	87	105	86
1539	93	87	87	105	86
1540	93	87	87	105	85
1541	93	87	87	105	85
1542	93	87	87	105	85
1543	93	87	87	105	85
1544	93	87	87	105	85
1545	92	87	87	105	85
1546	92	86	87	105	85
1547	92	86	87	105	85
1548	92	86	87	105	85
1549	92	86	87	105	85
1550	92	86	86	105	85
1551	92	86	86	105	85
1552	92	86	86	105	85
1553	92	86	86	105	85
1554	92	86	86	104	85
1555	92	86	86	104	85
1556	92	86	86	104	85
1557	92	86	86	104	85
1558	92	86	86	104	85
1559	92	86	86	104	85