Heart of Mathematics Final: Chapters 1-7

Name:

Directions:

- All problems are equally weighted (10 points each).

- You must skip one problem. Write "skip" clearly on it.

- Show your work! Answers without justification will likely result in few points. Your written work also allows me the option of giving you partial credit in the event of an incorrect final answer (but good reasoning).

- **Good luck!**
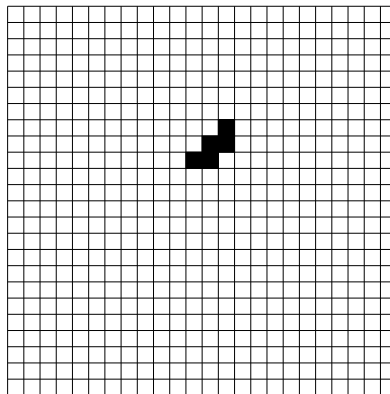
Problem 1.

- Describe the Fibonacci numbers.

- Describe the golden rectangle.

- How are the two related?

Problem 2. To gather information on sexually transmitted diseases (STDs), a researcher uses the two-coin method: if a student flips two heads, s/he answers the opposite of the truth; for any other flips, the student answers truthfully. Of 100 students surveyed, 73 said that they had a sexually transmitted disease.

Use this information to estimate the total percentage of students who have an STD. To receive credit, you must clearly show all work leading to your conclusion.

Problem 3. Given the following initial populations in the game of life, determine the next three generations:
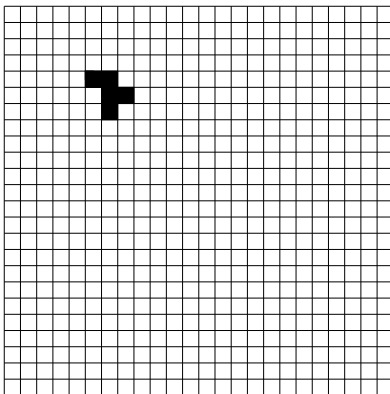
Problem 4. Here is the first step in a collage process. What is the next step? Roughly what would the final fractal look like?
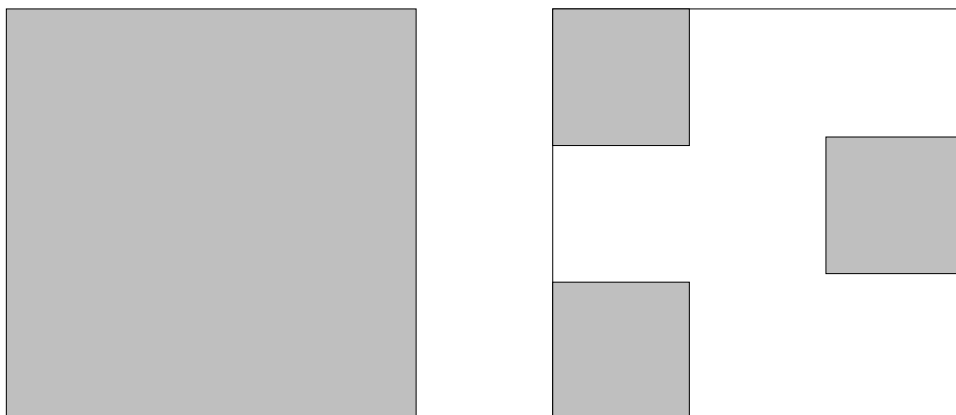
Problem 5. True or False?

1. ( )   A coin is flipped 100 times, and comes up heads 50 times and tails 50 times: the coin must be fair.

2. ( )   A moebius band has a single edge.

3. ( )   There are more real numbers than irrational numbers.

4. ( )   It is always possible to win as player 2 in Fibonacci Nim.

5. ( )   The pidgeonhole principle guarantees that at least two people in a room of 183 people will share a birthday.

Problem 6. Draw a stereographic projection of either the dodecahedron or the icosohedron (and describe the properties of whichever you are drawing!).

Problem 7. Demonstrate that the square root of 5 is irrational.

Problem 8. Fifty people in your company always drive to work between 7:30 and 7:45, and arrive 30 minutes later. Why must two people always arrive at work at the same time, within a minute?

Problem 9. Calculate the following probabilities using a standard deck of 52 playing cards (Remember that a standard deck of cards has four suits (spades, hearts, diamonds, clubs) with 13 cards in each suit; two suits are red, two are black.)

1. The probability of choosing a heart in one draw.

2. The probability of choosing a black card in one draw.

3. The probability of choosing a face card (jack, queen, or king) or an ace in one draw.

4. The probability of choosing 51 cards and **not** getting the queen of hearts.

Problem 10. In a short essay, discuss the concept of infinity as explored in our text and this course.