Study Guide MTH 113 Exam 2

General comments. The exam will take place on MS Teams. You will take a picture of your finished work and upload it to Bb. I will be happy to answer technical questions during the exam.
As you study for the exam, work with the book and your notes from the class. Materials assigned after Spring break (especially links to videos) are in the Blackboard announcements and in MS Teams Posts.

Section 1: Graph Theory

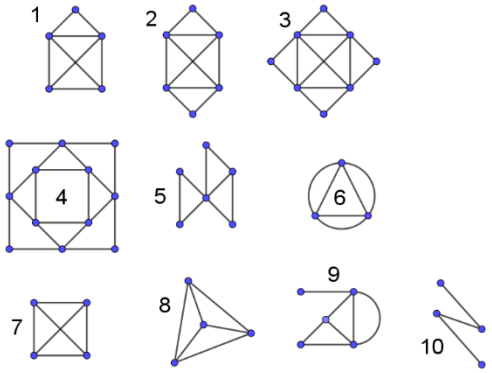
Graph theory is the Chapter 5 (Graphs and Euler circuits/paths) and Chapter 6 (Traveling Salesman and Hamilton circuits/paths). Look at the following sections and solve the related problems.

Section 5.2 Introduction to Graphs

1. Al, Bob, Cam, Dan, and Euclid are all members of the social networking website *Facebook*. The site allows members to be "friends" with each other. It turns out that Al and Cam are friends, as are Bob and Dan. Euclid is friends with everyone. Represent this situation with a graph.
2. If 5 people each shake hands with each other, how many handshakes took place? Draw a graph that will help you explain your solution.
3. What is the Königsberg bridge problem? (Example 5.4 on page 140). Draw a graph representing it. (Example 5.12)
4. Explain your reasoning in solving the "connections problems". Hint: The sum of the degrees of all the vertices should give you an idea.
    a. Among a group of 5 people, is it possible for everyone to be friends with exactly 2 of the people in the group?
    b. What about 3 of the people in the same group of 5 people?
    c. How about 6 people with 3 connections each?
5. Solve the following problems from the book. Answers are provided in the back of the book.
    a. Problem 1 on page 162.
    b. Problem 11 on page 163.

Section 5.3 Euler Paths and Circuits

6. Decide if the graphs in the picture have Euler path, circuits, both or neither. The legend on the bottom provides the answers.
7. Solve problem #31 on page 166 (read the introduction to these problems right after 5.3 on page 166 for hints on how to answer the questions).
8. Solve problem #35 on page 167. Both 7 and 8 have answers in the back of the book.



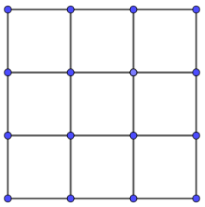
1EP	2EC	3X
4EC	5EP	6EC
7X	8X	9EP

Section 5.4 Eulerizing and semi-eulerizing graphs.

These problems were solved during the last class before the Spring break. The goal is to find the most efficient route for mail delivery or garbage collection if there is no Euler path or circuit in the graph. To "Eulerize" means to add some edges to create an Euler circuit in the graph. To "semi-eulerize" means to add some edges to create an Euler path in it. Of course, we are

trying to find the simplest solution so we want to add as few edges as possible. Examples 5.19 and 5.20 on pages 156-7 explain the idea.

9. Consider the 3x3 grid in the picture (can be streets and avenues).



   a. Is there an Euler path or circuit there? Explain.
   b. Pick a starting point and add as few edges as possible to create an Euler circuit.
   c. Pick a starting point and add as few edges as possible to create an Euler path.
10. Solve #43, 45 and 47 on page 168. Answers are in the back.

Sections 6.2-6.4 Hamilton Paths and Circuits and related algorithms

11. Solve the following problems from the book. Answers are in the back.
   a. #1 and #3 on pages 194-5
   b. #27 on page 197 and #29 on page 198
   c. #33 on page 198 (do both Nearest-Neighbor and Repetitive Nearest Neighbor algorithm here).

Section 2. Mathematics of Chance – Introduction to probability.

Section 16.1 Sample spaces and Events

12. #1 on page 501, #3 on page 502, and #5 on page 502.
13. You should be familiar with "standard" probability experiments, be able to list or identify their sample spaces and evaluate related probabilities:
   a. Flipping a Coin
      i. List the sample space for flipping 1 coin. What is the probability of getting a head? Etc…
      ii. List the sample space for flipping 2 coins. What is the probability of getting 1 head and 1 tail? What is the probability of getting 2 tails? Etc….
      iii. List the sample space for flipping 3 coins and find the probability of getting 1 head. Etc…
14. Rolling a die
   a. List the sample space for rolling 1 die.
   b. What is the probability of getting 6?
   c. What is the probability of getting an odd number?
   d. What is the probability of getting an odd number OR a multiple of 3?
   e. What is the probability of getting a multiple of 3 AND an odd number?
15. Rolling two dice
   a. List the sample space for rolling 2 dice.
   b. What is the probability of rolling two 1's?
   c. What is the probability of rolling 5 and 6?
   d. What is the probability of rolling the sum of 12?
   e. What is the probability of rolling the sum of 10?

16. Spinner. A spinner with 8 equal sectors is spun. List the sample space. What is the probability of obtaining the following:
    a. 6 or 2
    b. 11
    c. Odd number
    d. Multiple of 3
17. What is the Pascal's Triangle? Generate a few rows and use it to answer the following questions. Use complementary events to simplify your solution when appropriate.
    a. What is the probability of getting all heads when flipping 7 coins? Getting exactly 3 tails? Getting at least 5 heads? Getting at least 1 tail?
    b. What is the probability of getting at least 80% on a true/false test with 10 questions if you select answers randomly? What is the probability of getting 100% on a test with 15 questions? You may use the Pascal's triangle (you may print one from my website).
    c. What is the probability that in a family with 5 children all will be girls? 3 girls and 2 boys? Assume that the probability of having a boy is the same as having a girl.