Practice Final Exam

MAT 118

May 15, 2009

Name: (please print)	**ID #**:
Your recitation: Rec 1, W 5:20-6:15	Rec 2, Tu 11:20-12:15 Rec 3, Th 12:50-1:45
(circle your recitation)	

Directions: There are 7 problems on 8 pages (including the cover page) in this exam. Do all of your work in this exam booklet, and cross out any work that should be ignored. **Show your reasoning and computations — not just the answer.**

You may use a calculator and up to two "cheat sheets" of paper, with formulas. No other notes or books are allowed.

This practice is similar in difficulty and length to the actual final. However, there is no guarantee that the actual final will contain exactly same type of problems: **the actual final can contain questions on any of the topics discussed in class, including topics not covered in the practice final.**

1. Consider the election with 4 candidates A, B, C, and D, with the following preference table:

Number of voters	7	4	2
1^{st} choice	A	B	D
2^{nd} choice	B	D	A
3^{rd} choice	C	C	C
4^{th} choice	D	A	B

(a) Which candidate would win a plurality election?

(b) Which candidate, if any, is the Condorcet winner?

(c) Which candidate would win the Borda count?

(d) Suppose C decides to drop out of the race. Which candidate would win the Borda count then?

2.

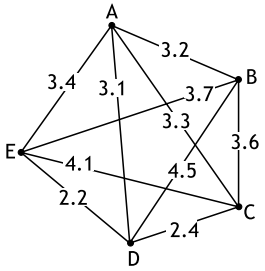
In a city school board, there are 3 members, each having 1 vote, and the chairman, who has 2 votes. All decisions are made by simple majority of the votes.

(a) Write the weighted voting system describing this council, in the form $[q : w_1, w_2, \dots]$.

(b) Find the Banzhaf power index of each player.

(c) Find the Shapley-Shubik power index of each player.

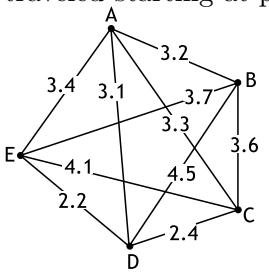
3. Consider the weighted graph shown to the right



(a) Use the nearest neighbor algorithm to find an approximate solution to the traveling salesman problem, making a circuit starting at B. What is the length of this circuit? (Write your answers in the spaces below.)

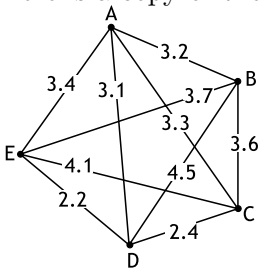
B, __, __, __, __, B. Length: _____

(b) Use the nearest neighbor algorithm **starting at vertex A** to find an approximate solution to the traveling salesman problem, then rewrite the circuit as it would be traveled starting at point B. For your convenience, here is a copy of the graph:



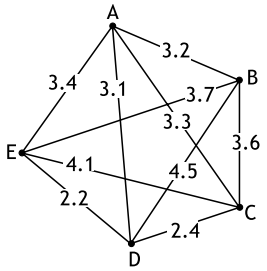
A, __, __, __, __, A.
B, __, __, __, __, B. Length: _____

(c) Use the cheapest link algorithm to find an approximate solution to the traveling salesman problem. Write the edges you select in order, then write the circuit as it would be traveled starting at vertex B. What is the length of this circuit? For your convenience, here is a copy of the graph:



Edges selected (e.g., AB): ____, ____,____,____,____
The circuit: B, __, __, __, __, B. Length: _____

4. Consider the weighted graph below (yes, it is the same graph as in the previous problem). Find the minimal spanning tree for this graph, using Kruskal algorithm. Write the edges you selected at each step of the algorithm below.



Edges selected (e.g., AB):

5. The population of a certain city is growing by 4% a year; in year 2000, the population was approxiamtely 50,000.

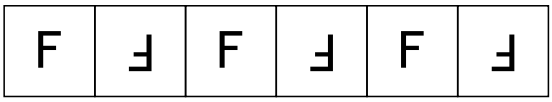
(a) Write a general formula for the population in year $2000 + n$.

(b) By how many percents had the population grown over the period 2000 – 2010?

(c) In what year will the population reach 80,000?

6. For each of the border patterns shown below, describe all their symmetries. Mark on the picture rotation centers and lines of reflection symmetries (if any). Determine the symmetry type (e.g., `11`). In each case, each of the squares has side 1 cm and the pattern is continuing indefinitely in both directions — only part of it is actually shown in the figure.

(a)



Translations (specify direction and distance):

Rotations (yes/no; if yes, specify angle and mark rotocenters on the figure):

Reflections (yes/no; if yes, mark reflection line on the figure):

Glide reflections (yes/no; if yes, mark reflection line on the figure and write the translation directon and length here):

Symmetry type:

(b)

Translations (specify direction and distance):

Rotations (yes/no; if yes, specify angle and mark rotocenters on the figure):

Reflections (yes/no; if yes, mark reflection line on the figure):

Glide reflections (yes/no; if yes, mark reflection line on the figure and write the translation directon and length here):

Symmetry type:

7. In a certain lottery, three balls are randomly drawn from a bag containing 50 balls, numbered 1 through 50.

(a) To win the lottery, you need to guess all three balls correctly (order does not matter). What is the probability of winning this lottery?

(b) What is the probability that all three drawn numbers will be even?