Final exam PS 30 December 2006

Name:

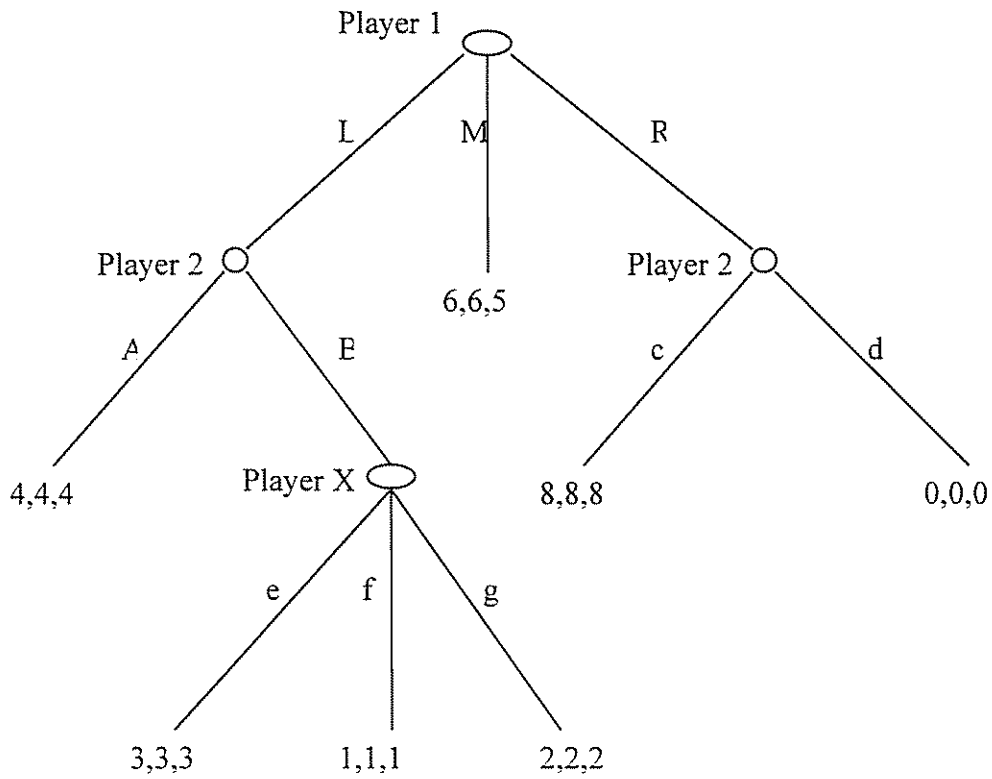
TA:

Section number:

This is a closed book exam. The only thing you can take into this exam is yourself and writing instruments. Everything you write should be your own work. Cases of academic dishonesty will be referred to the Dean of Students office, which has the power to suspend and expel students. Partial credit will be given: math mistakes will not jeopardize your grade. There are eight parts in this exam. Each part is weighted equally (12 points for each part). Please show all steps of your work and explain what you are doing at each step. Correct answers alone are worth nothing without a clear and correct explanation of where the answers come from. Clarity and legibility are factors in the grade.

If you have a question, raise your hand and hold up the number of fingers which corresponds to the part you have questions about (if you have a question on Part 2, hold up two fingers). When the end of the exam is announced, please stop working immediately. People who continue working after the end of the exam is announced will have their grades penalized by 25 percent. If you need to leave the room to use the bathroom during the exam, please write your name down on the bathroom log before you leave. A person cannot leave the room more than once during the exam (a person who leaves for a second time will be considered to have completed his or her exam). Please turn in your exam to one of the TAs. When you hand in your exam, please write your name down on the log. Please write all answers on this exam—if you write on the reverse side of pages, please indicate this clearly. Please turn off all cell phones and other electronic gadgets. Good luck!

Part 1.



a. Say Player X is Player 3. List all strategies for each player (P1, P2, and P3). (3 points)

b. Represent the above game as a strategic form game. (4 points)

c. Now say that Player X is Player 1. List all strategies for each player (P1 and P2). (2 points)

d. Represent the above game as a strategic form game. (3 points)

Part 2.

a. (4 points) Find all pure and mixed strategy Nash equilibria of the following game.

		P2	
		L	**R**
P1	**T**	3, 5	-2, 3
	D	-1, -2	4, 2

b. (4 points) Now consider this modified version of the game where the payoffs for D, R are x, y. For what values of x and y will there be a mixed strategy Nash equilibrium in which Player 1 plays D with probability 2/3 and Player 2 plays R with probability 2/3?

		P2	
		L	**R**
P1	**T**	3, 5	-2, 3
	D	-1, -2	x, y

c. (4 points) In the game from part b above, is there a value of x and y such that there is no mixed strategy Nash equilibrium? If yes, indicate all possible values of x and y such that there is no mixed strategy Nash equilibrium. If not, explain why not.

Part 3.
Consider the following 3-player strategic form game.

P3 X

P1 \ P2	a	b	c	d
A	2,5,2	3,2,5	2,1,2	2,0,1
B	3,2,1	2,5,3	2,1,1	2,0,2
C	1,2,2	1,2,1	1,1,2	2,0,1
D	0,2,1	0,2,2	0,1,1	2,0,2

P3 Y

P1 \ P2	a	b	c	d
A	2,5,2	3,2,4	2,1,2	2,0,1
B	3,2,1	2,5,2	2,1,1	2,0,2
C	4,2,2	1,2,1	1,1,2	2,0,1
D	0,2,1	0,2,2	0,1,1	2,0,2

a. Find all pure strategy Nash equilibria. Write strategy profile like (P1's, P2's, P3's). (3 points).

b. Find all mixed strategy Nash equilibria of this game. (9 points)

Part 4.

Consider 100 residents attending a town meeting in Westwood. They must choose among three proposals for dealing with town garbage. Proposal 1 asks the town to provide garbage collection; Proposal 2 calls for the town to hire a private garbage collector; Proposal 3 calls for residents to be responsible for their own garbage. There are 3 groups of residents as below. For example, residents in Group 1 like Proposal 1 best and Proposal 3 worst.

Group 1 (40 residents)	Group 2 (26 residents)	Group 3 (35 residents)
Proposal 1	Proposal 2	Proposal 3
Proposal 2	Proposal 3	Proposal 2
Proposal 3	Proposal 1	Proposal 1

a. Is there a Condorcet winner? If so, which proposal is the Condorcet winner? (3 points)

b. Suppose there are three possible voting procedures: Plurality rule, Borda count and a Runoff system. What are the results from each of these procedures? In order for Group 3 to get its way, which voting method(s) are most advantageous for Group 3? (9 points)

Part 5.

A town is deciding on whether to allocate more or less money to highways and to buses in the coming year. The town has four groups of voters. Aristocrats make up 30% of the population and prefer to reduce spending on buses by $2 million and reduce spending on highways by $6 million. Burghers make up 40% and prefer to increase spending on buses by $6 million and leave funding for highways unchanged. Cosmopolitans make up 20% and want to spend $6 million less on buses and $6 million more on highways. Urbanites are 10% of the population and want no change in bus spending but $1 million more for highways. New spending proposals are made by candidates in increments of $1 million (for example, a candidate can propose to spend $2 million more on buses but cannot propose $2.5 million more). Voters will vote for the candidate whose proposal is closest to their preferences. In the event that there is more than one proposal that is equally close to a voting group's preference, the group's vote will be split equally amongst the proposals. Whichever candidate receives the most votes wins.

a. (4 points) Say that there are two candidates. Candidate 1 proposes to cut spending on buses by $3 million and increase spending on highways by $1 million. Candidate 2 proposes to increase spending on buses by $3 million and cut spending on highways by $3 million. Which candidate wins? Show your work by specifying what percentage of the vote is received by each candidate.

b. (4 points) Consider the losing candidate from part a. above. She decides that she will change her policy proposal in order to attract more votes than her opponent and win. However, she wants to keep her new proposal as close to her original proposal (from part a.) as possible. Assume that the other candidate's proposal does not change. What policy proposal will the losing candidate now make?

c. (4 points) Consider now a different situation where there are three candidates. Again, whichever candidate receives the most votes wins. As in part a., Candidate 1 proposes to cut spending on buses by $3 million and increase spending on highways by $1 million. Candidate 2 proposes to increase spending on buses by $3 million and cut spending on highways by $3 million. Candidate 3 does not want spending to change on highways but is willing to propose anything for bus spending to ensure victory. List all possible bus spending proposals that Candidate 3 can make to ensure victory.

Part 6.

Here "n" = non-participation and "p" = participation.

Each player has a lower threshold, which is the minimum number of players other than him or herself who must be participating in order for him or her to start participating. Each player also has an upper threshold, which is the maximum number of other players he or she can tolerate participating at the same time as him or herself.

Consider the following situation:

Player	Lower Threshold	Upper Threshold	Initial Condition	t = 1	t = 2	t = 3	t = 4	t = 5
A	0	6						
B	1	6						
C	2	6						
D	x	x						
E	x	x						
F	5	6						

Feel free to use the blank columns as scratch for answering these questions. There is also a sheet of tables to use as scratch paper at the end of this question.

a) With an initial condition of all non-participation (n,n,n,n,n,n), find all the value(s) of **x** that will lead to player F participating at some point, even if F is no longer participating when an equilibrium is reached. Demonstrate the participation of player F for each of your values of x in the tables provided below. (8 points)

A								
B								
C								
D								
E								
F								

A								
B								
C								
D								
E								
F								

A								
B								
C								
D								
E								
F								

b) With an initial condition of all participation (p,p,p,p,p,p), find all value(s) of x that will allow player F to continue participating indefinitely. Demonstrate how this occurs for each of your x value answers in the tables provided below: <4 points>

A								
B								
C								
D								
E								
F								

A								
B								
C								
D								
E								
F								

A								
B								
C								
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A								
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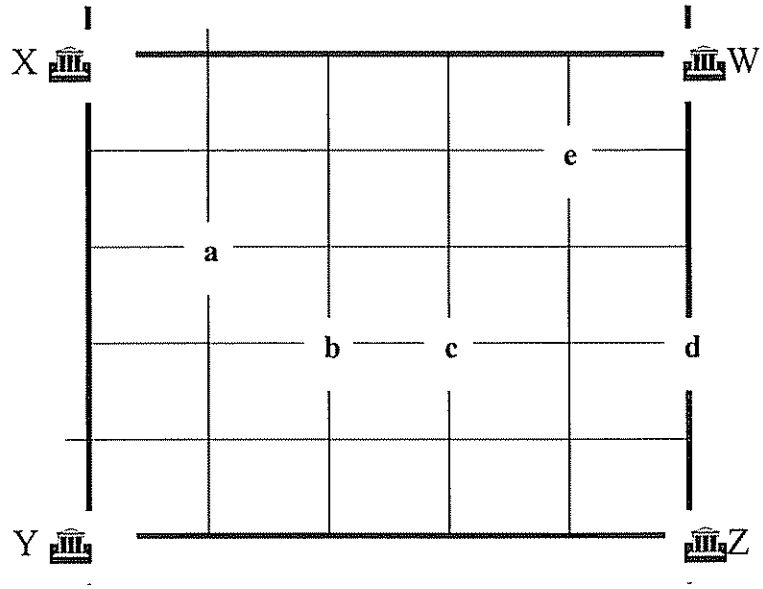
F								

Part 7.

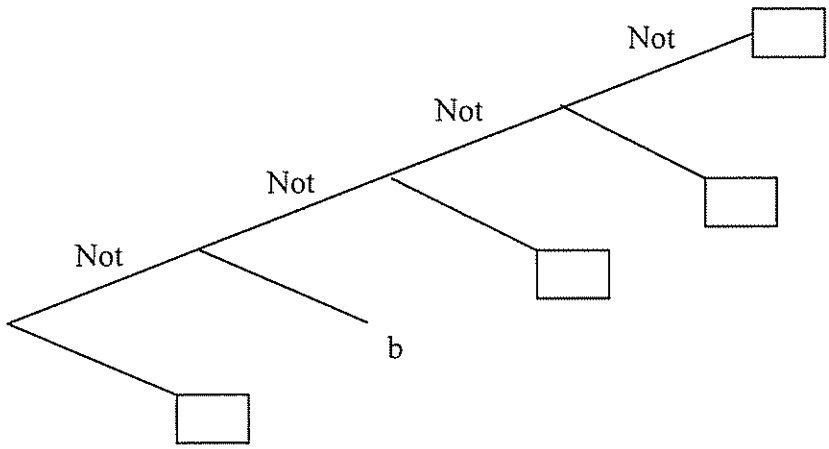
Say there is a small county called Kyrandia, which consists of four towns, W, X, Y, and Z. The population in these towns is distributed such that 30 people reside in Town W, 35 people reside in Town X, 14 people reside in Town Y, and 22 people reside in Town Z.

The County Commissioner is from the largest town and holds agenda control power. Wal Mart wants to open a new branch in Kyrandia and five locations (a, b, c, d, e) are available. A map of these five possible locations is provided below. Each person wants Wal Mart to be as close to her own town as possible.

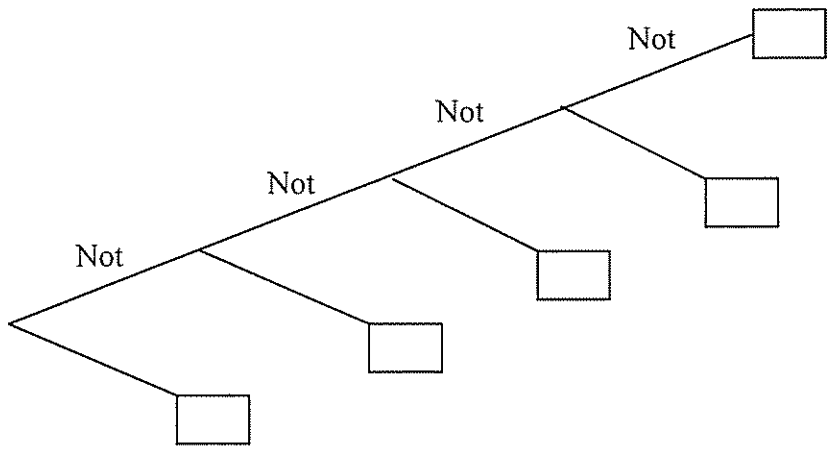


a. The county commisioner sets an agenda in which people vote by majority rule sequentially. For example, people vote on "a" or not. If "a" wins by majority rule, then Wal Mart is located at a. If "a" loses by majority rule, then they vote on "b" or not, and so on. If you are the County Commissioner, which location is the best outcome you can bring to your hometown people? Explain why. (6 points)

b. Draw the agenda tree in which you arrive at the answer for part a. Assume that b is voted on in the second round. (3 points)



c. Now say that the population in Kyrandia shifts. The population is now distributed such that 16 people live in Town W, 40 people live in Town X, 25 people live in Town Y and 20 people live in Town Z. Also, now the County Commissioner comes from the smallest town. Assume that you are the County Commissioner. Can you manipulate the voting agenda to move Wal Mart to a location that your townspeople prefer? If you can, draw an agenda tree showing your voting agenda. If you cannot, explain why not. (3 points)



Part 8.

You are a professional match maker. The most desperate customers are four 40-year-old single men, Alex, Brian, Chuck, and David and four 40-year-old single women, Evie, Frida, Geanette, and Heidi. You organized a group blind date, and found Alex prefers Heidi best, Geanette next, Frida next, and Evie least. Brian prefers Frida best, Geanette next, Heidi next, and Evie least. Chuck's preference ordering (from best to worst) is Frida, Geanette, Heidi, Evie. David's ordering is Geanette, Frida, Heidi, Evie. Evie's ordering is Alex, Chuck, Brian, David. Frida's ordering is Alex, David, Chuck, Brian. Geanette's ordering is Alex, David, Brian, Chuck. Heidi's ordering is Chuck, Brian, David, Alex.

a. How many possible matchings are there? (2 points)

b. Among the set of stable matchings, which matching is most preferred by the men? (4 points)

c. Among the set of stable matchings, which matching is most preferred by the women? (4 points)

d. In your opinion as a professional match maker, would you recommend the men-preferred matching or the women-preferred matching? Why? (2 points)