

**Math 104**  
**Final Exam**

Name: \_\_\_\_\_

To receive full credit, you must show all of your work. The use of graphing calculators is not permitted.

Problem	Points	
1	40	
2	20	
3	30	
4	20	
5	30	
6	20	
7	20	
8	20	
Total	200	

1. (20 points each) Solve the zero-sum games (Payoffs to A).

a)

		Player B			
		I	II	III	IV
Player A	I	-1	0	1	2
	II	5	2	-2	1
	III	4	3	3	8
	IV	0	-1	5	1

Player A's strategy:

Player B's strategy:

Value of the game:

b)

		Player B			
		I	II	III	IV
Player A	I	2	-4	1	5
	II	-1	0	-1	9
	III	4	-2	5	4
	IV	6	-1	8	0

Player A's strategy:

Player B's strategy:

Value of the game:

2. (20 points) Solve the following game: Two players simultaneously show one, two, or three fingers. If they picked different numbers, Player B must pay Player A an amount equal to the number of fingers A is showing. If they picked the same number, Player A must pay Player B *double* the amount that B is showing.

Player A's strategy:

Player B's strategy:

Value of the game:

3. (10 points each) The stock market at any given time will either be rising (a bull market) or falling (a bear market). Assume that the probabilities of each of these outcomes are equal. Two competing companies, A and B, are deciding on investing strategies; Company A has a choice of three plans (X, Y, or Z), whereas Company B (being smaller), can only choose between X and Y. Suppose that Company A makes its move first and that neither company can predict what the market will be.

a) Write down a game tree for this game (leave the payoffs blank). Be sure to label all branches and indicate any information sets using dotted lines.

b) List all possible strategies for Company A and Company B.

c) If each company can wait until it knows the state of the market to implement its plan (and Company A still moves first), how many possible strategies does each have?

4. Consider the following game:

		Player B		
		I	II	III
Player A	I	(5,5)	(4,3)	(0,4)
	II	(1,0)	(5,2)	(6,-1)

a) (5 points) Determine whether this game is SSS. Justify your answer.

b) (15 points) Find each player's prudential and counter-prudential strategies and security level.

5. (15 points each)

a) Consider the following game:

		Player B	
		I	II
Player A	I	(0,7)	(5,2)
	II	(3,5)	(2,1)
	III	(4,-1)	(1,0)

If you are Player A, would you prefer to move first or second? Justify your answer.

b) Consider the following game:

		Player B	
		I	II
Player A	I	(8,6)	(1,4)
	II	(-3,10)	(2,9)
	III	(5,-1)	(1,2)

If Player A is to move first, can Player B improve his expected payoff by means of threats and/or promises? If so, determine how payoffs could be lowered to make these threats/promises credible.

6. (20 points) Find the Nash arbitration scheme solution for the following game (use the security level status quo):

		Player B		
		I	II	III
Player A	I	(4,4)	(0,1)	(5,3)
	II	(0,-2)	(4,0)	(6,1)

Player A's payoff:

Player B's payoff:

7. (10 points each) Companies A, B, and C are interested in marketing a new product. Each company advertises that its product is the best one and must decide whether to run the ads in the morning or in prime time. If all three companies run their ads in the same time period, consumers will be skeptical of their competing claims and their sales will not change. If a company runs its ads unopposed in the morning it will gain 10 units in sales; if it alone advertises in prime time it will gain 20 units in sales. If two companies advertise in the same time slot, they will each gain half of the corresponding sales.

a) Write down the matrices for this game and find all of the equilibria.

b) Suppose you are the head of Company A and the head of Company B offers you the chance to form an alliance against Company C, *with all profits to be divided equally*. If you do not take this deal, Company C will. Should you take him up on his offer? (Assume that everyone plays prudentially.) Explain your answer.

8. Two players start out with a large number of nickels and dimes. On his turn, each player can throw either a nickel or a dime into a pile; whoever makes the total amount of money in the pile at least 30 cents takes all of the coins in it.

a) (15 points) Solve this game using a game tree.

b) (5 points) Suppose you are going to play this game and are given the option of going first or second. Which would you choose? Explain.