
Exam #3

Name:

Date: Friday, November 11, 2016

Directions: You have a total of 50 minutes for this examination.

- Make sure to put your name on your exam!
 - There are a total of 10 questions (worth 10 points each).
 - Please write clearly and justify your answers.
 - No calculators.
 - No materials other than a pen, pencil, and eraser.
 - Do not begin until designated.
 - Stop working and close exam when time is called.
 - Please note that questions are not necessarily in order of difficulty.
-

Question 1 (10 points):**(1 point each) Match the following words to their definitions.**

----- Divide and Choose

----- Lone Divider

----- Cake Division

----- Last Diminisher

----- Proportional Procedure

----- Maximin-Minimax

----- Partial Conflict Game

----- Total Conflict Game

----- Monty Hall Problem

----- Newcomb's Paradox

- 1.) A game proposed by a super-intelligent alien popularized by philosophers.
- 2.) The premise of a game show involving two goats and a car that had even professional mathematicians confused.
- 3.) A procedure players can use to allocate a cake among themselves so each player has a strategy to guarantee themselves a piece they are "satisfied" with.
- 4.) A type of game where both players can benefit by cooperating.
- 5.) A cake division procedure for two players.
- 6.) A type of game where if one person wins then the other loses.
- 7.) A strategy for evaluating total conflict games.
- 8.) A cake division procedure for three players.
- 9.) A cake division procedure for four or more players.
- 10.) The name for the type of cake division procedure where each player's strategy guarantees that each player gets a fair share.

Question 2 (10 points): Alice and Bob find buried treasure.

Use the adjusted winner procedure to divide their loot.

Object	Alice's Points	Bob's Points
\$1000 cash	10	20
Diamonds	36	48
Rubies	24	12
Doubleloon	26	18
Baseball card	4	2

(4 points) Who is the “initial winner” and who is the “initial loser”?

(6 points) What is the final division of their loot using the adjusted winner procedure?

Question 3 (10 points):

Use the Knaster inheritance procedure to determine a fair allocation.

Item	Alice	Bob
Cabin	\$ 40,000	\$ 80,000

(2 points) What do Alice and Bob think their “fair share” is?

(3 points) What is the final allocation using the Knaster inheritance procedure?

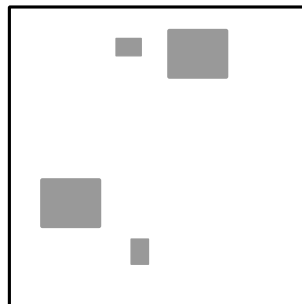
Item	Alice	Bob
Boat	\$ 24,000	\$ 20,000

(2 points) What do Alice and Bob think their “fair share” is?

(3 points) What is the final allocation using the Knaster inheritance procedure?

Question 4 (10 points):**(3 points)****What is the Divide and Choose procedure for dividing cake between two people?****(1 point) Does this generalize to three people?****(1 point) Does this generalize to four or more people?****(5 point) Suppose that the US and Canada are dividing a segment of seafloor. As the US, split the segment below into two parts, the first step of Divide and Choose.**

Deposits containing gold, tin, titanium, and diamonds are designated as gray.



Question 5 (10 points): We need to divide the following cakes.

Alice and Bob are splitting a cake.

(3 points) Pretend to be Alice; how would you initially cut the cake?



(2 points) Explain what Alice considered in this decision.

Alice, Bob, and Carol are splitting a cake.

(3 points) Pretend to be Alice; how would you initially cut the cake?



(2 points) Explain what Alice considered in this decision.

Question 6 (10 points): Cake Division with Three Players.

Alice, Bob, and Carol are trying to divide two cakes, Cake 1 and Cake 2. Suppose that Alice divides the cake as follows for the Lone Divider Procedure.

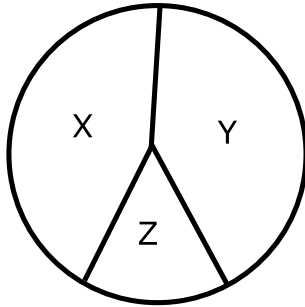


Figure 1: Cake 1

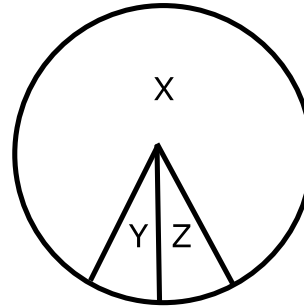


Figure 2: Cake 2

(5 points) For Cake 1, if Bob and Carol both only approve of slices X and Y , then what is a final allocation of the cake using the Lone Divider Procedure?

(5 points) For Cake 2, if Bob and Carol both only approve of slice X , then what is a final allocation of the cake using the Lone Divider Procedure?

Question 7 (10 points):

Consider the following total conflict game. Players X and Y are each have a pile of pennies. On each turn they will reveal either a heads (H) or tails (T).

If the pennies match then Player X wins, and if they do not match then Player Y wins. Player X wins \$2 if they are both heads and \$6 if they are both tails. Player Y wins \$5 if Player Y plays heads and Player X plays tails and \$3 if Player X plays heads and Player Y plays tails.

(6 points) Fill in the values in the matrix below for this game.

		Player Y		min
		H	T	
Player X	H			
	T			
		max		—

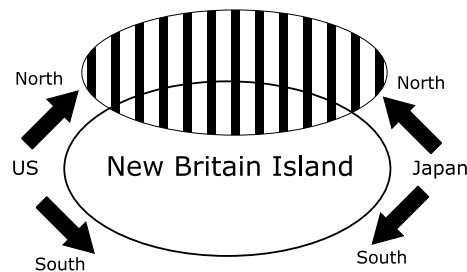
Let us suppose that they are only going to play one round and each player is afraid of risk (and will therefore use the Maximin/Minimax Strategy).

(2 points) What will Player X do?

(2 points) What will Player Y do?

Question 8 (10 points): The Battle of the Bismark Sea (March 1943).

The Japanese want to send reinforcements West to their army in New Guinea. They must decide to sail North or South around the island of New Britain. The US has aircraft on the west side must decide whether to fly North or South. When the US planes see the Japanese ships, the Japanese will be attacked by US bombers. The north side of the island is under heavy cloud cover, while the sky over the south side is clear.



The US wants to maximize (and Japan wants to minimize) the amount of time the Japanese fleet is exposed to attack. The values in the payoff matrix are the number of days the US bombs Japanese ships in various scenarios.

		Japan		
		North	South	
United States	North	2	3	
	South	1	4	
	Max			—

In this situation both countries are avoiding risk and use the Maximin/Minimax Strategy.

(4 points) Fill in the rest of the table.

(3 points) Can we conclude what Japan will do using this strategy?

(3 points) Can we conclude what the United States will do using this strategy?

Question 9 (10 points): The Battle of the Bismark Sea (March 1943).

Alternate history lesson.

What if in the Battle of the Bismark Sea (see Question 8) the cloud cover on the North side of the island of New Britain cleared?

If the two armies initially make the same decision (both go North or both go South), then the Japanese fleet is attacked for 4 days. If the two armies initially make different decisions (one goes North and the other goes South), then the Japanese fleet is attacked for 2 days.

(6 points) Fill in the values in the payoff matrix.

		Japan		
		North	South	Min
United States	North			
	South			
	Max			—

(4 points) What does the Maximin/Minimax Strategy tell us?

Question 10 (10 points):

Consider the following matrix.

		USSR	
		Arm	Disarm
US	Arm	(10, 10)	(30, 0)
	Disarm	(0, 30)	(5, 5)

(8 points) What are the preference rankings for the US? For the USSR?

(2 points) Does the US have a dominant strategy?

This page was intentionally left blank for use as scratch paper!
For credit, please clearly indicate the problem number.