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The Open University of Sri Lanka
Faculty of Natural Sciences
B.Sc/ B. Ed Degree Programme

Department	**: Mathematics**
Level	**: 05**
Name of the Examination	: Final Examination
Course Title and - Code	**: Operational Research – ADU 5304/APU3146**
Academic Year	**: 2020/2021**
Date	**: 28.03.2022**
Time	**: 09.30 am – 11.30 am**
Duration	**: 02 hrs**

General Instructions

1. Read all instructions carefully before answering the questions.

2. This question paper consists of 6 questions in 5 pages.

3. Answer any 4 questions only. All questions carry equal marks.

4. Answer for each question should commence from a new page.

5. Involvement in any activity that is considered as an exam offense will lead to punishment

6. Use blue or black ink to answer the questions.

7. Clearly state your index number in your answer script.

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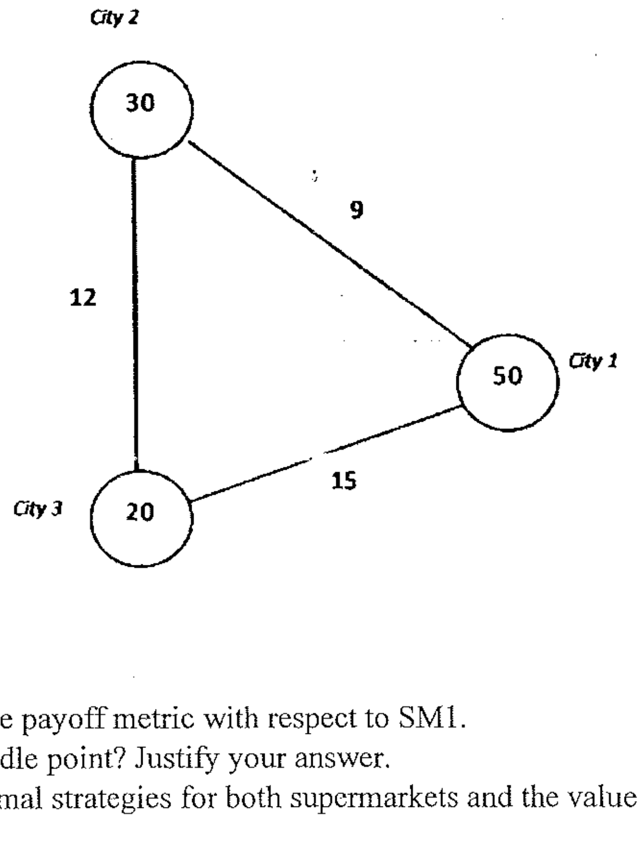
Question No. 01

(a) Explain the assumptions underlying game theory.

(b) Discuss pure and mixed strategies.

(c) Explain two-person zero-sum game.

(d) Two Super Markets, SM1 and SM2 are planning to locate in one of three cities. We shall assume that if both super markets locate in the same city they split all business equally. But if they locate in different cities then all the business in the city that doesn't have a super market will go to the closer of the two super markets. The percentages of customers in each city are marked in the circles and the distances (kilometers) between the cities are marked on the lines connecting them as given in the following figure:



(i) Determine the payoff metric with respect to SM1.
(ii) Is there a saddle point? Justify your answer.
(iii) Find the optimal strategies for both supermarkets and the value of the game.

Question No. 2

(a) Consider the following payoff matrix for 2×2 two-person zero-sum game which does not have any saddle point:

Player A		B_1	B_2	Player B
	A_1	a_{11}	a_{12}	
	A_2	a_{21}	a_{22}	

Write down the formulas for optimum mixed strategies of Player A and Player B and the value of the game.

(b) Mr. Supun works for Mr. Gihan and frequently must advise him on the acceptability of certain projects. Whenever Mr. Supun can make a clear judgment about a given project, he does so honestly. But, when he has no reason to either accept or reject a given project, he tries to agree with Mr, Gihan. If he manages to agree with him he gives himself 10 points; if he is unfavorable when his boss is favorable, he credits himself with 0 points; but when he is favorable and his boss is unfavorable (the worst case), he losses 50 points. The matric of the game is given below:

		Mr. Gihan Opinions	
		Favorable	Unfavorable
Mr. Supun's Opinions	Favorable	10	-50
	Unfavorable	0	10

(i) Is the above game fair and strictly determinable? Justify your answer.

(ii) Find the optimal strategies for each player.

(iii)Find the expected gain for each player.

Question No. 03

Consider the following game whose payoff matrix is:

		Player B	
		B1	B2
Player A	A1	-2	0
	A2	3	-1
	A3	-3	2
	A4	5	-4

(a) Reduce the dimension of the above payoff matrix using the dominance property, if possible.
(b) Write A's expected payoffs for B's pure moves with the usual notations.
(c) Solve the game using graphical method and write down the value of the game and optimal strategies of both players.

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Question No. 04

(a) Consider the game problem with $mx\ n$ payoff matrix having neither a saddle point nor any dominant raw or column. Let the $m \times n$ rectangular payoff matrix $\left(a_{ij}\right)_{m,n}$ for Player A, where neither m nor n is 2.

Write the Linear programming models for Payer A and Player B in usual notation.

(b) Consider the following Game:

	Player B	
Player A	3	6
	5	2

Formulate linear programming models for both players and hence, find the value of the game and also the optimal strategies of each player.

Question No. 05

(a) Briefly Explain the following terms used in Queuing Theory.

(i) Queue Discipline

(ii) Service Mechanism

(iii) Service Channels

(b) A mechanic finds that the time spent on repairing TV sets has an exponential distribution with mean 30 minutes, if he repairs TV sets in order in which they come in. The distribution of arrivals of TV sets is known to be approximately Poisson with an average rate of 10 per eight-hour day.

(i) What is the mechanic's expected idle time each day?

(ii) How many jobs are ahead of the average set just brought in?

Question No. 06

Arrivals at a telephone booth are considered to be Poisson with an average time of 10 minutes between one arrival and the next. The length of a phone call is assumed to be distributed exponentially with mean 3 minutes.

(a) What is the probability that a person arriving at the booth will have to wait?

(b) What is the average length of the queue that forms from time to time?

(c) the telephone department will install a second booth when convinced that an arrival would have to wait at least three minutes to make a call from the telephone. By how much time must the flow of arrivals be increased in order to justify a second booth?