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KIRIRI WOMEN'S UNIVERSITY OF SCIENCE AND TECHNOLOGY UNIVERSITY EXAMINATION, 2024/2025 ACADEMIC YEAR THIRD YEAR, FIRST SEMESTER EXAMINATION FOR THE BACHELOR OF BUSINESS AND INFORMATION TECHNOLOGY KMA 2304 MATHEMATICAL METHODS FOR MANAGERIAL DECISIONS

Date: 8TH AUGUST 2024 Time: 11:30AM – 1:30PM

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS QUESTION ONE (30 MARKS)

- a) In every managerial decision making, there are three environments under which a decision is made. Explain these three environments. (5 Marks)
- b) A farm manager deciding on the type of crop to plant in the next planting season. According to meteorological department, the expected rainfall amounts can be High, Medium or Low. The expected payoffs (in hundred thousand shillings) are as shown below.

Cron	State of Rainfall				
Crop	High	Medium	low		
Maize	90	70	-10		
Barley	50	80	30		
Potatoes	-20	75	40		

Determine the optimal decision based on the following criteria

- i) Pessimism criterion.
- ii) Minimax Savage criterion.
- iii) Laplace criterion.
- c) Consider the following pay-off table.

Actions	State of Nature				
Actions	S1	S2	S3	S4	
Α	100	130	130	160	
В	210	40	80	110	
С	85	75	75	95	
Prob	0.35	0.3	0.25	0.1	

Use the following criterion for decision making under risk environment to determine the optimal decision.

- i) Expected Monitory Value.
- ii) Expected Value of Perfect Information.
- iii) Expected Opportunity Loss.
- iv) Return-To-Risk-Ratio.
- d) Consider a for played by companies A and B. Company A has 4 strategies while B has 5 strategies at hand. The payoff table for company A is as shown below

(2 Marks) (3 Marks) (3 Marks)

(3 Marks)

(3 Marks)

(3 Marks)

(3 Marks)

Reduce the game by domination property and solve it.	

QUESTION TWO (20 MARKS)

Finicky's Jewelers sells watches for KSh. 6500 each. During the next month, they estimate that they will sell 15, 25 or 35 watches with respective probabilities of 0.45, 0.35 and 0.20. They can only buy watches in lots of ten from their dealer. 10, 20, 30 and 40 watches cost KSh. 5200, 5100, 4800 and 4700 per watch respectively. Every month, Finicky's has a clearance sale and will get rid of any unsold watches for KSh 3100 (watches are only in style for a month and so they have to buy the latest model each month). Any customer that comes in during the month to buy a watch, but is unable to, costs Finicky's KSh 1000 in lost goodwill.

a) (Construct the pay-off table.	(6 Marks)
b) F	For each action, determine the;	
i	i) Expected Monetary Value (EMV).	(4 Marks)
i	ii) Expected Value of Perfect Information (EVPI).	(3 Marks)
i	iii) Variance.	(4 Marks)
i	iv) Return-to-Risk Ratio (RTRR).	(3 Marks)

QUESTION THREE (20 MARKS)

A real estate company is considering to build 2000 (Mega) units, 1000 (Medium) units or 500 (Small) units for the next sales period, though it has an option of not constructing the units at all. However, the company is not sure whether there will be a strong, fair or weak demand for the units. If the company decides on constructing the units, it may or may not conduct market research to aid in decision making. The cost of market research is KES 5M. The market research results can be favorable with probability 0.8 or unfavorable with probability 0.2. No matter the results of the market research, the company can still go ahead with construction. If the market research is favorable, then the chances of strong, fair and weak demand is 0.6, 0.3 and 0.1 respectively. For unfavorable market research results, then the chances of strong, fair and weak demand are 0.2, 0.3 and 0.5 respectively. If the market research is not conducted, then the chances of strong, fair and weak demands are respectively 0.4, 0.20 and 0.4. The payoff for mega units under strong, fair and weak demands market conditions are 30M, 10M and -12M respectively. For medium units, the payoffs are 14M, 6M and 2M for strong fair and weak demands. While the payoffs for small are respectively 8M, 3Mand 1M for strong fair and weak demands.

a)	Construct a decision tree.	(8 Marks)
1.)		$(0 \mathbf{M}_{-}, \mathbf{l}_{-})$

- b) Use the decision tree to determine the optimal decision. (9 Marks
- c) Explain the advantage of a decision tree over a payoff table.

QUESTION FOUR (20 MARKS)

Consider the following table of a certain company. The payoffs are in millions of shillings.

Action	State of Nature			
Action	S_1	<i>S</i> ₂	S_3	
A	60	110	120	
В	110	60	110	
С	80	90	100	
D	80	100	110	
Probability	0.25	0.45	0.30	

Company	Company B				
Company A	1	2	3	4	5
Ι	1	3	2	7	4
II	3	4	1	5	6
III	6	5	7	6	5
IV	2	0	6	3	1

(5 Marks)

(8 Marks) (9 Marks) (3 Marks)

- a) Compute the Expected values of each Action and determine the best solution.
- b) In order to make the appropriate decision, the company decides to conduct a market survey at a cost of Ksh. 10, 000. The market survey results can turn positive (P) or negative (N). The firm's ability to assess the market is:

$P(P S_1) = 0.3$	$P(N S_1) = 0.7$
$P(P S_2) = 0.6$	$P(N S_2) = 0.4$
$P(P S_3) = 0.8$	$P(N S_3) = 0.2$

- i) Compute the posterior probabilities for the states of nature S_1 , S_2 and S_3 .
- ii) Based on the posterior probabilities, compute the expected values for the states of nature if the market survey result is positive. (4 Marks)
- iii) Compute the Expected Value of the Sample Information.
- iv) How efficient is the sample?

QUESTION FIVE (20 MARKS)

A game is to be played by company A and company B has a payoff table shown in the table below

		Company B		
		B 1	B2	B3
Company A	A1	3	-2	4
	A2	-1	4	2
	A3	2	2	6

Let V = value of the game p1, p2 & p3 = probabilities of selecting strategies A1, A2 & A3 respectively and q1, q2 & q3 = probabilities of selecting strategies B1, B2 & B3 respectively.

- a) Construct a standard form LP representing the game in the table above. (6 Marks)
- b) Solve the LP in (a) using simplex methods.

c) Determine from the solution in (b), the best strategies for A and B and the value of the game.

(4 Marks)

(10 Marks)

(4 Marks)

(6 Marks)

(4 Marks)

(2 Marks)