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KIRIRI WOMENS' UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2022/2023 ACADEMIC YEAR
THIRD YEAR, FIRST SEMESTER EXAMINATION
FOR THE DEGREE OF BACHELOR OF
BUSINESS INFORMATION TECHNOLOGY

Date: 15th December, 2022
Time: 8.30am – 10.30am

KMA 2304 -MATHEMATICAL METHODS FOR MANAGERIAL DECISIONS

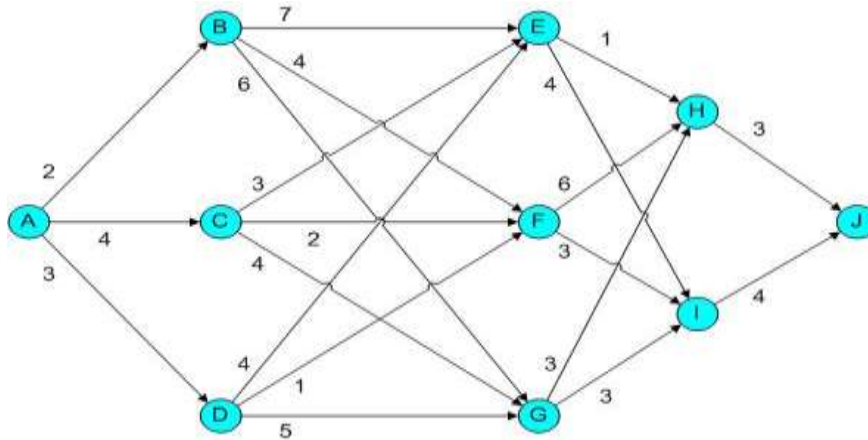
INSTRUCTIONS TO CANDIDATES

ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

- a) Explain the meaning of the following terms as used in Game Theory
- i) Saddle point (1 Mark)
 - ii) dominance (1 Mark)
 - iii) Pure Strategy (1 Mark)
 - iv) Two-person zero-sum game (1 Mark)
- b) In a departmental store one cashier is there to serve the customers. And the customers pick up their needs by themselves. The arrival rate is 9 customers for every 5 minutes and the cashier can serve 10 customers in 5 minutes. Assuming Poisson arrival rate and exponential distribution for service rate, find;
- i) Average number of customers in the system. (2 Marks)
 - ii) Average number of customers in the queue or average queue length. (2 Marks)
 - iii) Average time a customer spends in the system. (2 Marks)
 - iv) Average time a customer waits before being served. (2 Marks)
- c) Discuss the characteristics of queuing system. (3 Marks)
- d) A manager of a fast food restaurant observes that, an average of 9 customers is served by a waiter in a one-hour time period. Assuming that the service time has an exponential distribution, what is the probability that a customer shall be free within 12 minutes? (2 Marks)

- e) At the end of a given day, the price of stock is recorded. If the stock has gone up, the probability that it will go up tomorrow is 0.7. If the stock has gone down, the probability that it will go up tomorrow is only 0.5.
- Formulate the transition matrix. (2 Marks)
 - If on Monday the stock was up what is the probability that the stock will be down on Wednesday. (2 Marks)
 - Find the steady state matrix. (2 Marks)
- f) Find the shortest route from node A to J.



(3 Marks)

- g) Determine the saddle point solution, the associated pure strategy and the value of the game for each of the following games.

The payoffs are for player

	Player B			
Player A	3	− 1	4	2
	− 1	− 3	− 7	0
	4	− 7	3	− 9

(4 Marks)

QUESTION TWO (20 MARKS)

- Under what circumstances is CPM a better technique of project management than PERT? (6 Marks)
- Preface Retailers is a high-technology retailer and mail order business. In order to improve its process the company decides to install a new microcomputer system to manage its entire operation (i.e. payroll, accounts, and inventory). Terminals for each of its many stores will be networked for fast, dependable service. The specific activities that Preface will need to accomplish before the system is up and running are listed below. The table also includes the necessary increased staffing to undertake the project.

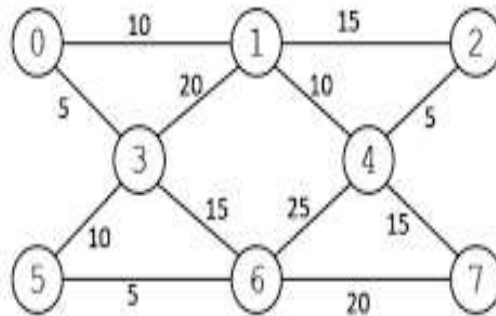
Activity	Preceding Activities	Duration (Days)
A. Build insulated enclosure	-	4
B. Decide on computer system	-	1
C. Electrical wiring of room	A	3
D. Order and collect computer	B	2
E. Install air conditioning	A	4
F. Install computer	D, E	2
G. Staff testing	B	5
H. Install software	C, F	2
I. Staff training	G, H	3

Required:

- Draw a network diagram for the project (5 Marks)
- Calculate the earliest starting time and the latest finish time (5 Marks)
- Determine the critical. (4 Marks)

QUESTION THREE (20 MARKS)

- Discuss the characteristics of two players zero sum game. (5 Marks)
- Find the minimum spanning tree for the following network.



(5 Marks)

- Assume that a man's profession can be classified as professional, skilled labourer, or unskilled labourer. Assume that, of the sons of professional men, 80 percent are professional, 10 percent are skilled labourers, and 10 percent are unskilled labourers. In the case of sons of skilled labourers, 60 percent are skilled labourers, 20 percent are professional, and 20 percent are unskilled. Finally, in the case of unskilled labourers, 50 percent of the sons are unskilled labourers, and 25 percent each are in the other two categories. Assume that every man has at least one son, and form a Markov chain by following the profession of a randomly chosen son of a given family through several generations.
 - Set up the transition probabilities matrix. (2 Marks)
 - Find the probability that a randomly chosen grandson of an unskilled labourer is a professional man. (3 Marks)
 - Find the steady state distribution for the Markov chain. (5 Marks)

QUESTION FOUR (20 MARKS)

- a) Outline areas in management where mathematical models useful decisions making tools.
(4 Marks)
- b) General Motors (GM) is planning their production strategy for their next model. Three alternatives are being considered for their model Malibu: 30,000, 20,000, and 12,000. GM decides to categorize the demand for Malibu for the next year as either High (H) or Low (L). The payoffs measured in millions of dollars and probabilities of states of nature are presented in the table below.

	States of nature	
Decision Alternatives	High (H)	Low (L)
Produce 30K	29	-12
Produce 20K	18	8
Produce 12K	3	11
Probabilities	0.62	0.38

GM can hire a marketing research firm to help estimate the demand more accurately. Consider the reliabilities of the marketing research firm given below;

	High	Low
Encouraging	0.80	0.3
Discouraging	0.2	0.70

- i) Solve the decision tree and find the best production strategy.
(10 Marks)
- ii) Compute EVPI and EVSI.
(6 Marks)

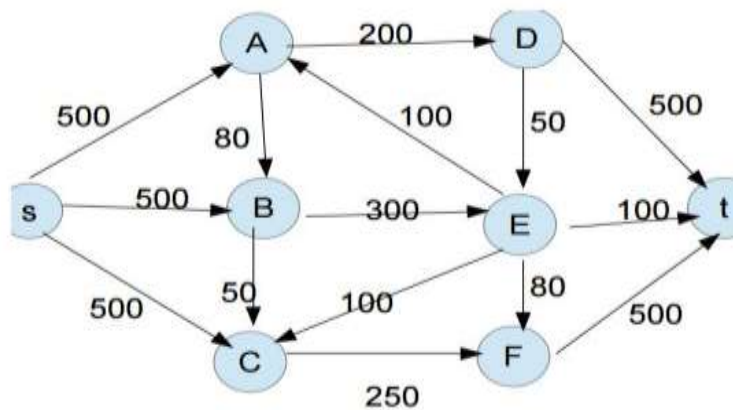
QUESTION FIVE (20 MARKS)

- a) Braneast Airlines uses 500 tail lights per year. Each time an order for tail lights is placed, an ordering cost of \$5 is incurred. Each light cost 40 cents, and the holding cost is 8 cents/light/year. Assume that demand occurs at a constant rate and shortages are not allowed.
- i) What is the EOQ?
(2 Marks)
- ii) How many orders will be placed each year?
(2 Marks)
- iii) How much time will elapse between the placement of orders?
(2 Marks)

- b) The following table contains the three time estimates for a PERT network. (Duration in days).

Activity	A	M	b
1, 2	2	3	4
1, 3	4	6	8
1, 4	4	5.5	10
2, 3	1	3	5
2, 5	3	7.5	9
3, 4	6	7.5	12
3, 6	3.5	5	6.5
4, 6	2	2.5	6
5, 6	0.5	2	3.5

- i) Identify the critical path and expected completion time of the project. (6 Marks)
- ii) The contract schedule allows 18 days in which to complete the entire project. What are the chances that the Project WILL NOT be finished on time? (4 Marks)
- c) Find the maximum flow from source s to sink t in the network below.



(4 Marks)