



# **MURANG'A UNIVERSITY OF TECHNOLOGY**

## **SCHOOL OF PURE AND APPLIED SCIENCES**

### **DEPARTMENT OF APPLIED SCIENCES**

UNIVERSITY ORDINARY EXAMINATION

2017/2018 ACADEMIC YEAR

**THIRD YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF  
BACHELOR OF COMMERCE**

**AMS 333 – QUANTITATIVE METHODS**

**DURATION: 2 HOURS**

**DATE: 6<sup>TH</sup> DECEMBER, 2017**

**TIME: 9.00 – 11.00 A.M.**

#### **Instructions to Candidates:**

1. Answer **Question 1** and **Any Other Two** questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

## SECTION ONE - COMPULSORY

### QUESTION ONE

- (a) Define the following terms
- i) Saddle point
  - ii) Zero-sum game
  - iii) Critical path
  - iv) Queuing discipline
  - v) Queuing system (5 marks)
- (b) In a large metropolitan area, the probability of a family owning a colour TV, a computer or both is 0.88, 0.35 and 0.29 respectively
- i) What is the probability that a family chosen at random during a survey will own a colour TV and/or a computer? (2 marks)
  - ii) Given that the family chosen at random during a survey owns a colour TV, what is the probability that it will own a computer (2 marks)
- (c) A production unit user KSh.10,000 worth of an item during this year. The production units estimated the ordering cost as Ksh.25 per order and holding cost as 12.5% of the average inventory value. Determine
- i) Optimal order size (2 marks)
  - ii) Number of orders per year (2 marks)
  - iii) Time period per order (1 mark)
  - iv) Total cost (2 marks)
- (d) Briefly explain the term simulation and hence state two uses of simulation (3 marks)
- (e) State and explain two criteria used in decisions under risk (3 marks)
- (f) The table below defines the activities within a small project. Draw the project network diagram (5 marks)

| Activity | Immediate Predecessor Activity | Time estimate (weeks) |
|----------|--------------------------------|-----------------------|
| A        | -                              | 2                     |
| B        | -                              | 3                     |
| C        | A                              | 4                     |
| D        | B,A                            | 3                     |
| E        | D,C                            | 8                     |

|   |     |   |
|---|-----|---|
| F | C   | 3 |
| G | E   | 2 |
| H | F,G | 3 |

- (g) Briefly explain any three limitations of queuing theory (3 marks)

## SECTION TWO – ANSWER ANY TWO

### QUESTION TWO

- (a) Consider a game with the following payoff matrix

|                            |   |                            |    |     |    |    |
|----------------------------|---|----------------------------|----|-----|----|----|
|                            |   | <b>Player B Strategies</b> |    |     |    |    |
|                            |   | I                          | II | III | IV | V  |
| <b>Player A Strategies</b> | 1 | -2                         | 5  | -3  | 6  | 7  |
|                            | 2 | 4                          | 6  | 8   | -1 | 6  |
|                            | 3 | 8                          | 2  | 3   | 5  | 4  |
|                            | 4 | 15                         | 14 | 18  | 12 | 20 |

- i) Does this game have a saddle point (3 marks)
- ii) Determine A's optimal strategy and the corresponding value of the game (2 marks)
- (b) Define a dummy activity as used in a project planning (1 mark)
- (c) The estimates of time in days of the activities of a project are as follows

| Activity | Predecessor Activity | Optimistic time estimate (to) | Most likely time estimate (tm) | Pessimistic time estimate (tp) |
|----------|----------------------|-------------------------------|--------------------------------|--------------------------------|
| A        | -                    | 2                             | 4                              | 6                              |
| B        | A                    | 3                             | 6                              | 9                              |
| C        | A                    | 8                             | 10                             | 12                             |
| D        | B                    | 9                             | 12                             | 15                             |
| E        | C                    | 8                             | 9                              | 10                             |
| F        | D,E                  | 16                            | 21                             | 26                             |
| G        | D,E                  | 19                            | 22                             | 25                             |
| H        | F                    | 2                             | 5                              | 8                              |
| I        | G                    | 1                             | 3                              | 5                              |

Calculate the time estimate (te) and draw the project network. Clearly show the different project paths and hence identify the critical path, critical activities and the project completion time

(14 marks)

### QUESTION THREE

(a) The usage of an inventory item each costing \$1 is 10,000 units/year and the ordering cost is \$10, carrying charge is 20% based on the average inventory per year, stock out cost is \$5 per unit of shortage incurred. Determine:

- i) EOQ
- ii) Inventory level
- iii) Shortage level
- iv) Cycle period
- v) Number of order per year
- vi) Total cost

(10 marks)

(b) The following pay-off matrix shows the potential profits in millions of shillings which are expected to arise from launching four new products P<sub>1</sub>, P<sub>2</sub>, P<sub>3</sub>, P<sub>4</sub> in five markets Nairobi, Kisumu, Mombasa, Eldoret and Nakuru. Assuming that the products are mutually exclusive, evaluate the best decision using

- i) Laplace criterion
- ii) Hurwicz criterion. Assume  $\alpha = 1/2$

|        |         | Products       |                |                |                |
|--------|---------|----------------|----------------|----------------|----------------|
|        |         | P <sub>1</sub> | P <sub>2</sub> | P <sub>3</sub> | P <sub>4</sub> |
| Market | Nairobi | 15             | 3              | 1              | 7              |
|        | Kisumu  | 10             | 14             | 5              | 19             |
|        | Mombasa | 0              | 8              | 14             | 10             |
|        | Eldoret | 6              | 9              | 20             | 2              |
|        | Nakuru  | 17             | 2              | 11             | 5              |

(10 marks)

### QUESTION FOUR

(a) The computer lab at a state university has a help desk to assist students working on computer spreadsheet assignments. The students patiently form a single line in front of the desk to wait for help students are served based on first come first served priority rule. On average, 15 students per

hour arrive at the help desk. Student arrivals are best described using a poisson distribution. The help desk server can help an average of 20 students per hour with the service rate being described by exponential distribution. Find

- i) The average number of students in the system
- ii) The average number of students waiting in line
- iii) The average time a student spends in the system
- iv) The average time a student spends waiting in line
- v) The probability of having four students in the system (10 marks)

(b) A soft drinks company has two products that is cocacola and pepsi with profit \$40 and \$30 per unit respectively. The following table illustrates the labour, equipment and materials to produce per unit of each product. Determine suitable product mix which maximizes the profit using simplex method

|           | Pepsi | Coca Cola | Total Resources |
|-----------|-------|-----------|-----------------|
| Labour    | 1     | 1         | 60              |
| Equipment | 3     | 2         | 80              |
| Material  | 2     | 3         | 90              |

(10 marks)

### QUESTION FIVE

(a) Draw the project network hence find the critical path, critical activities and the project completion time of the following project.

| Activity | Predecessor Activity | Time estimate (weeks) |
|----------|----------------------|-----------------------|
| A        | -                    | 4                     |
| B        | -                    | 7                     |
| C        | -                    | 3                     |
| D        | A                    | 6                     |
| E        | B                    | 4                     |
| F        | B                    | 7                     |
| G        | C                    | 6                     |
| H        | E                    | 10                    |
| I        | D                    | 3                     |

|   |     |   |
|---|-----|---|
| J | F,G | 4 |
| K | H,I | 2 |

(10 marks)

(b) The golden muffler shop has decided to open a second garage bay and hire a second mechanic to handle installations. Customers arrive at the rate of two per hour according to poisson distribution. Each mechanic installs mufflers at the rate of three per hour according to exponential distribution. Find

- i) The probability that there are no customers in the system
- ii) The average number of customers waiting in line
- iii) The average number of customers in the system
- iv) The average time a customer spends waiting in line
- v) The average time a customer spends in the system

(10 marks)