

**KABARAK**



**UNIVERSITY**

**UNIVERSITY EXAMINATIONS**

**2009/2010 ACADEMIC YEAR**

**FOR THE DEGREE OF BACHELOR SCIENCE IN**

**ECONOMICS AND MATHEMATICS**

**COURSE CODE: ECON 415**

**COURSE TITLE: OPERATIONS RESEARCH II**

**STREAM: Y4S1**

**DAY: TUESDAY**

**TIME: 2:00 – 4:00 P.M.**

**DATE: 08/12/2009**

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**Instructions**

- i) Answer question ONE and any other TWO questions.
- ii) Begin each question on a separate page.
- iii) Show your workings clearly and neatly.

**QUESTION ONE (30 MARKS)**

- a) What do you understand by the following terms:
  - i) Economic Order Quantity (2mks)
  - ii) Backorder (2mks)
  - iii) Critical Activities (2mks)
  - iv) Earliest Start Time (2mks)
  - v) Earliest Finish Time (2mks)
- b) Explain briefly examples of real Queuing Systems (6mks)
- c) Briefly explain the use of Markov Analysis in Account Receivable Analysis (6mks)
- d) What do you understand by simulation and why is simulation used. (5mks)
- e) Describe how supermarkets use the laser scanner that reads a universal product code (UPC) or bar code printed on the item tag or on packaging to enhance the efficiency of inventory management. (3mks)

**QUESTION TWO (20 MARKS)**

A filling station is being planned and it is required to know how many attendants will be needed to maximize earnings. From traffic studies it has been forecast that customers will arrive in accordance with the following table.

Probability of 0 customers arriving in any minute is 0.72

„	1	„	„	0.24
„	2	„	„	0.03
„	3	„	„	0.01

From past experience it has been estimated that service times vary according to the following table.

Service time	1	2	3	4	5	6	7	8	9	10	11
in minutes											

Probability 0.16 0.13 0.12 0.10 0.09 0.08 0.07 0.06 0.05 0.05 0.05 0.04

If there are more than two customers waiting, in addition to those being serviced, new arrivals drive on and the sale is lost. A petrol pump attendant is paid ksh. 40 per 8 hour day, and average contribution per customer is estimated to be ksh. 4. How many attendants are needed? (20 marks)

**QUESTION THREE (20 MARKS)**

a) Suppose that the R & B Beverage Company has a soft drink product that has a constant annual demand rate of 3,600 cases. A case of the soft drink costs R and B \$3. Ordering costs are \$20 per order and holding costs are 25% of the value of the inventory. R & B has 250 working days per year, and the lead time is 5 days. Identify the following aspects of the inventory policy.

- i) Economic Order Quantity (3mks)
- ii) Reorder point (3mks)
- iii) Cycle Time (3mks)
- iv) Total annual cost (3mks)

b) The computer centre at a certain institution has been experiencing computer downtime. Let us assume that the trials of an associate Markov process are defined as one-hour periods and that the probability of the system being in a running state or a down state is based on the state of the system in the previous period. Historical data show the following transition probabilities.

- i) If the system is initially running, what is the probability of the system being down in the next hour of operation. (3mks)
- ii) What are the steady-state probabilities of the system being in the running state and in the down state. (5mks)

	TO	
FROM	RUNNING	DOWN
RUNNING	0.90	0.10
DOWN	0.30	0.70

**QUESTION FOUR (20 MARKS)**

The reference desk of a university library receives request for assistance. Assume that a poisson arrival probability distribution with a mean rate of 10 requests per hour can be used to describe the arrival pattern and that the service times follow an exponential probability distribution with a mean service rate of 12% requests per hour.

- a) What is the probability that no requests for assistance are in the system. (4mks)
- b) What is the average number of requests that will be waiting for service (4mks)
- c) What will be the average waiting time in minutes before service begins. (4mks)
- d) What is the average time at the reference desk in minutes (waiting time plus service time)
- e) What is the probability that an arrival has to wait for service. (4mks)

**QUESTION FIVE (20 MARKS)**

A small project consisting of eight activities has the following characteristics

Activity	Preceding activity	Time estimates in weeks		
		Most optimist	Most likely	Most Pessimistic
A	None	2	4	12
B	None	10	12	26
C	A	8	9	10
D	A	10	15	20
E	A	7	7.5	11
F	B, C	9	9	9
G	D	3	3.5	7
H	E, F, G	5	5	5

- i) Draw a PERT network for the project (3mks)
- ii) Determine the critical path (4mks)
- iii) Prepare the activity schedule for the project (10mks)
- iv) If a 30 days deadline is imposed, what is the probability that the project will be finished within the time limit. (3mks)