SOUTH EASTERN KENYA UNIVERSITY

UNIVERSITY EXAMINATION 2016/2017

FIRST SEMESTER EXAMINATIONFOR THE DEGREE OF BACHELOR OF SCIENCE IN STATISTICS

STA 421: OPERATIONAL RESEARCH III

DATE: 14TH DECEMBER, 2014   **TIME: 8.00-10.00AM**

1. This question paper has **FIVE** questions

2. Answer question **ONE** and any other **TWO** question

QUESTION ONE

a) Distinguish between the following terms as used in operational research   [3 Marks]

    i). Course of action and state of nature

    ii). Decision making under risk and decision making under uncertainty

b) The pay-off matrix of two player A and B is given as follows

		Player B	
		y	**1-y**
Player A	**x**	1	7
	1-x	5	2

Player A selects his strategies with probabilities x and 1-x respectively and player B chooses his strategies with probabilities y and 1-y respectively. Find the solution to the game.   [5 Marks]

c) The demand rate for a particular item is 12000 units/year. The ordering cost is Ksh.100 per order and the holding cost is Ksh.0.80 per item per month. If no shortages are allowed and the replacement is instantaneous, determine:

    i).   The number of orders per year.   [2 Marks]

    ii).   The optimum annual cost if the cost of item is Ksh. 2 per item.   [3 Marks]

d) In a gas station there is one gas pump. Cars arrive at the gas station according to a poison process. The arrival rate is 20 cars per hour. An arriving car finding n cars at the station immediately leaves with probability $q_n = {}^n/_4$, and joins the queue with probability $1 - q_n$, n=0,1,2,3,4. Cars are served in order of arrival. The service time (i.e the time needed for pumping and paying) is exponential. The mean service time is 3 minutes

    i). Determine the stationary distribution of the number of cars at the gas station   [3 Marks]

    ii). Determine the mean number of cars at the gas station   [2 Marks]

e) Consider the following 2×4 game.

	1	2	3	4
1	2	2	3	-1
2	4	3	2	6

   Determine if this game has a saddle point and explain your answer   [4 Marks]

f) Discuss **Two** primary Strategies used in statistical game by players to make decision   [3 Marks]

g) Customers arrive at George's Hardware according to a Poisson distribution Between 8:00 and 9:00 A.M.an average of 6 customers arrives at the store. What is the probability that k customers Will arrive between 8:00 and 8:30 in the morning (k = 0, 1, 2,…)?   [5 Marks]

QUESTION TWO

a) State **Four** disadvantages of using simulation technique in operation research   [4 Marks]

b) A bakery keeps stock of a popular brand of cake. Daily demand based on past experience is given below:-

Daily Demand	0	15	25	35	45	50
Probability	0.01	0.15	0.20	0.50	0.12	0.02

Consider the following sequence of random numbers:- **R.NO** 48, 78 ,09, 51, 56, 77, 15, 14, 68, 09

using the sequence, simulate the demand for the next 10 days   [16 Marks]

QUESTION THREE

a) State and Discuss **Two** forecasting methods applied for inventory control in operation research

[4 Marks]

b) On a network router, measurements show the packets arrive at a mean rate of 125 packets per second (pps) the router takes about 2 milli secs to forward a packet assuming an M/M/1 model.

    i). What is the probability of buffer overflow if the router had only 13 buffers [6 Marks]

    ii). How many buffers are needed to keep packet loss below one packet per million? [10 Marks]

QUESTION FOUR

Jobs arrive at two parallel machines, each with its own buffer, according to a Poisson stream with a rate of 10 jobs per hour. The processing times are exponential with a mean of 4 minutes on machine 1 and 8 minutes on machine 2. On arrival jobs are assigned with equal probability to the buffer of machine 1 or 2.

a) Determine the mean flow time (waiting time plus processing time) of a job sent to machine 1, sent to machine 2, and also of an arbitrary job. [3 Marks]

b) Determine the fraction of jobs with a flow time longer than 30 minutes. [7 Marks]

c) Suppose that arriving jobs are sent with probability p to machine 1 and with probability $1 - p$ to machine for which p is the mean flow time of an arbitrary job minimal? [10 Marks]

QUESTION FIVE

Two firms, Safaricom and Airtel are competitors in the market of mobile communication. In order to increase its market share, each of the firm can opt any of the following three strategies: high advertising, moderate advertising or low advertising. Corresponding to different possible conditions, the pay-offs in terms of percentage market share are given below. Use dominance strategy to determine the optimal strategies [20 Marks]

		Airtel		
		High	**Moderate**	**Low**
	High	2	3	5
Safaricom	**Moderate**	2	0	6
	Low	0	2	-1