

**UNIVERSITY OF KABIANGA**

**UNIVERSITY EXAMINATIONS**

**2016/2017 ACADEMIC YEAR**

**THIRD YEAR SECOND SEMESTER EXAMINATION**

**FOR THE DEGREE OF BACHELOR OF EDUCATION**

**COURSE CODE: ECO 315**

**COURSE TITLE: QUANTITATIVE METHODS II**

**DATE: 29TH JUNE, 2017**

**TIME: 9.00 A.M-12.00 P.M**

**INSTRUCTIONS TO CANDIDATES:**

Answer question **one** and any other **three** questions

**QUESTION ONE**

1. Which probability distribution might you expect the following random variables to have and why?
2. The time between telephone calls to a call center. (2 marks)
3. The number of mortgages issued by the local branch of a bank in a week if they issue an average of 30 a year (ignore seasonal fluctuations) (2 marks)
4. The actual number not average of the mortgages in (ii) above issued in a year. (2 marks)
5. The number of customers who return a purchase for a refund to a shop out of 8 customers assuming that an average 10% of customers return the goods. (2 marks)
6. Consider the following project details and construct a network for the project, determine the earliest start time and latest start time for each activity. Identify the critical path and duration of the project using normal duration for each activity and cost of the project. (17 marks)

|  |  |  |  |
| --- | --- | --- | --- |
| Activity | Proceeded by | Duration (weeks) | Cost |
| A | - | 2 | 50,000 |
| B | - | 3 | 60,000 |
| C | A, B | 5 | 40,000 |
| D | B | 2 | 20,000 |
| E | B | 7 | 40,000 |
| F | A, B | 4 | 45,000 |
| G | F, D | 6 | 50,000 |
| H | F, D | 10 | 30,000 |
| I | C, G | 3 | 10,000 |

**QUESTION TWO**

1. Customers arrive at a bar at an average rate of 0.2 per minute. Peter, the bar-person, takes an average of 2.5 minutes to serve each customer. Stating any assumptions you make, answer the following:
2. For what proportion of time is Peter busy serving customers? (2 marks)
3. On average, how long will it take a customer to wait and be served? (2 marks)
4. On average, how many customers will be waiting to be served at any time? (2 marks)
5. A company has three factories; F1, F2 and F3 whose production capacities are 250, 300 and 400 units respectively. The factories supply goods to four zones; North, South, Eastern and Western whose monthly demands are 200, 225, 275 and 250 thousands respectively. The per unit transport cost in US Dollars from one factory to a given zone are given in the table below.

|  |
| --- |
|  Zones  |
| Depot  | North  | South  | Eastern  | Western  |
| F1  | 11 | 13 | 17 | 14 |
| F2 | 16 | 18 | 14 | 10 |
| F3 | 21 | 24 | 13 | 10 |

1. Find the initial feasible solution for the transportation problem using North West Corner Rule and the associated transportation cost. (5 marks)
2. Using the initial feasible solution obtained above, find the optimum transportation schedule and the minimum total cost of the transportation. (4 marks)

**QUESTION THREE**

1. Consider a hospital that buys a certain antibiotic from a large supplier, the drug can be bought at the following prices;

Quantity Price per unit

1-4999 2.75

5000-9999 2.6

10,000 & above 2.5

The demand for the drug in the hospital is 50,000 units per year. There is an order cost of $50 per order and a holding cost of 20% of the cost of the item per unit per year. Determine the optimal purchasing policy for the hospital. (5 marks)

1. A video manufacturer produces 8000 video recorders on a continuous production line every month. Each video requires a tape head unit and these are produced very quickly in batches. It costs kshs.12000 to set up the machinery to produce a batch and kshs.30 a month to store and insure a tape head unit once made.
2. How large should the batch size be to minimize total costs and how often will they have to set up a production run? (5 marks)
3. Now suppose the video manufacturer can arrange alternative storage for tape head units at only kshs.20 per unit per month. How will this affect the economic order quantity (EOQ) and the frequency of production runs? (5 marks)

**QUESTION FOUR**

1. Tourists arrive randomly at an information center at an average rate of 24 per hour. There is only one receptionist and each enquiry takes two minutes on average.

Determine;

1. The probability of queuing. (2 marks)
2. The probability of having not to queue. (2 marks)
3. The average number of customers in the system. (2 marks)
4. The average number of customers in the queue. (2 marks)
5. The average time spent in the queue. (2 marks)
6. A company has decided to begin manufacturing a spare part that has previously been purchasing from an outside vendor. The demand is 1000 unit per month. The setup cost per run is $20 and the holding cost is $5 per unit per year. Once a machine is running it can produce the spare parts at a rate of 2500 per month. The company operates approximately 300 working days in a year. The management would like to know the production lot size to run, how many after production runs should be made and the total cost associated with the recommended run size. (5 marks)

**QUESTION FIVE**

Given the following project details in the table:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Activity  | Preceding activities | Duration  | Crash cost (kshs.) | Crash duration | Cost (Kshs.) |
| A | - | 5 | 200 | 4 | 300 |
| B | A | 7 | 500 | 3 | 1000 |
| C | A | 6 | 800 | 4 | 1400 |
| D | - | 6 | 500 | 5 | 700 |
| E | D | 6 | 700 | 3 | 850 |
| F | D | 8 | 900 | 5 | 1050 |
| G | D | 9 | 1000 | 5 | 1240 |
| H | - | 8 | 1000 | 4 | 1320 |
| I | H | 7 | 600 | 4 | 900 |
| J | H | 7 | 800 | 6 | 1000 |
| K | - | 5 | 1000 | 4 | 1200 |
| L | K | 9 | 600 | 5 | 700 |
| M | K | 10 | 800 | 8 | 1240 |
| N | B | 8 | 1000 | 4 | 760 |
| O | N, Q, S | 14 | 500 | 10 | 1780 |
| P | R, U | 15 | 1200 | 10 | 2500 |
| Q | C, E, Y | 10 | 600 | 8 | 2400 |
| R | C, E, Y | 15 | 1500 | 7 | 1900 |
| S | F, I | 20 | 2000 | 15 | 3750 |
| T | V, W | 10 | 2000 | 7 | 3200 |
| U | G, J, L | 14 | 1800 | 9 | 2250 |
| V | G, J, L | 22 | 5000 | 13 | 7700 |
| W | M | 18 | 4000 | 10 | 5280 |
| X | O, P, T | 11 | 3000 | 9 | 4000 |
| Y | H | 3 | 300 | 2 | 350 |

Required:

1. Construct a network for the project outlined above and calculate the free float time and slope for each activity. (9 marks)
2. Determine the earliest start time and latest start time for each activity, identify the critical path and find the duration of the project using normal duration for each activity. (3 marks)
3. If there is a penalty of kshs.500 per day over the contract time of 59 days and a bonus of kshs.200 per day for each less than the contract time, what will be the duration and cost of the project? (3 marks)