

THE OPEN UNIVERSITY OF SRI LANKA  
 FACULTY OF MANAGEMENT STUDIES  
 BACHELOR OF MANAGEMENT STUDIES (HONOURS) DEGREE  
 PROGRAMME - LEVEL 6  
 ACADEMIC YEAR: 2022/23  
 OSU6502 – OPERATIONS RESEARCH  
 ASSIGNMENT TEST  
 DURATION: TWO HOURS



DATE: 29.01.2023

TIME: 1.30PM – 3.30PM

Answer 4 questions only.

All questions carry equal marks.

Non-programmable calculators are allowed.

This question paper carries 5 questions in 4 pages.

**Question 1**

Activity	Immediate predecessors	Duration (days)
A	-	3
B	-	2
C	A	5
D	A, B	7
E	C, D	3
F	D	4
G	E	8
H	E, F	13
I	G	6
J	H	1
K	I, J	10

- Develop a network diagram for a project having the above precedence relationships (7 marks)
  - Find the critical path. (4 marks)
  - The project must be completed in 30 days. Do you anticipate any difficulty in meeting the deadline? Explain. (6 marks)
  - Can activity H be delayed without delaying the project? (4 marks)
  - Can activity E be delayed without delaying the project? (4 marks)
- (Total marks 25)

### Question 2

- a) The belt snapping for conveyors in an open cast mine occurs at the rate of 2 per shift. There is only one hot plate available for processing, and it can process an average of 5 belts snap per shift.
- I. What is the probability that when a belt snaps, the hot plate is readily available? (5 marks)
  - II. What is the average number of belts in the system? (5 marks)
  - III. What is the waiting time for arrival? (5 marks)
  - IV. What is the average waiting time plus processing time? (5 marks)
- b) At a certain petrol pump, customers arrive according to a Poisson process with an average time of 5 minutes between arrivals. The service time is exponentially distributed with a mean of 2 minutes. On the basis of this information finds out what would be the average length. (5 marks)

(Total marks 25)

### Question 3

- a) What are the assumptions used in the EOQ model? (3 marks)
- b) What are the costs associated with inventories? (3 marks)
- c) The demand for an item each costing is 10000 units per year. The ordering cost is Rs.10. Inventory carrying charge is 20% based on the average inventory per year. Lead time is  $\frac{1}{2}$  month. Calculate,
- I. EOQ (5 marks)
  - II. Cycle period (3 marks)
  - III. Number of orders (3 marks)
  - IV. Total cost (5 marks)
  - V. Reorder Level (3 marks)

(Total marks 25)

### Question 4

- Describe each of the following terms (5 marks each)
- a) Economic order quantity
  - b) Reorder level and Lead time
  - c) Activity and Event in a network diagram
  - d) Critical path
  - e) Single-server Queue and Multi-server Queue

(Total marks 25)

### Question 5

A company manufactures 30 items per day. The demand of these items during the past 20 days are listed below.

34	28	24	29	27	21	30	35	35	29	23	31	20	26	17	25	36	40	31	28
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- a) Randomly identify 10 values out of them to carry out a simulation. (For the purpose of this examination, use the random number table given below and carry out the generation of random numbers starting from its top left-hand corner value in vertical direction) (10 marks)
- b) Estimate the profit/ loss of the company for the next 10 days, if the profit per unit of sold products is Rs. 110/- and the loss per unit from unsold products at the end of the day is Rs. 40/-. (15 marks)

(Total marks 25)

36518 36777 89116 05542 29705 83775 21564 81639 27973  
46132 81380 75635 19428 88048 08747 20092 12615 35046  
31841 77367 40791 97402 27569 90184 02338 39318 54936  
84180 93793 64953 51472 65358 23701 75230 47200 78176  
78435 37586 07015 98729 76703 16224 97661 79907 06611  
41859 94198 37182 61345 88857 53204 86721 59613 67494  
13019 07274 51068 93129 40386 51731 44254 66685 72835  
82448 72430 29041 59208 95266 33978 70958 60017 39723  
25432 96593 83112 96997 55340 80312 78839 09815 16887  
69226 38655 03811 08342 47863 02743 11547 38250 58140  
25837 68821 66426 20496 84843 18360 91252 99134 48931  
38914 82707 24769 72026 56813 49336 71767 04474 32909  
04070 60681 64290 26905 65617 76039 91657 71362 32246  
01674 14751 28637 86980 11951 10479 41454 48527 53868  
70294 35450 39982 79503 34382 43186 69890 63222 30110  
73903 98066 52136 89925 50000 96334 30773 80571 31178  
87789 56408 77107 88452 80975 03406 36114 64549 79244  
92320 95929 58545 70699 07679 23296 03002 63885 54677  
46391 60276 92061 43591 42118 73094 53608 58949 42927

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**Formulae**

$\lambda$  –Rate of arrival of units

$\mu$  –Rate of service completion

$\theta = \lambda/\mu$

H = Number of working hours per day

$P_{(n)}$  = Probability of “n” units in the queuing system

$L_s$  = Average number of units in queuing system

$L_q$  = Average number of units in queue

$W_s$  = Average time spent by unit in queuing system

$W_q$  = Average time spent by unit in queue

$P(n) = \theta P(n-1)$  \_\_\_\_\_ (1)

$P(n) = \theta^n P(0)$  \_\_\_\_\_ (2)

$P(n) = \theta^n (1-\theta)$  \_\_\_\_\_ (3)

[Probability that queuing system empty] =  $(1-\theta)$  \_\_\_\_\_ (4)

[Probability that the server is idle] =  $(1-\theta)$  \_\_\_\_\_ (5)

[Number of hours server idle per day] =  $H(1-\theta)$  \_\_\_\_\_ (6)

$L_s = \theta/(1-\theta)$  \_\_\_\_\_ (7)

$L_q = \theta^2/(1-\theta)$  \_\_\_\_\_ (8)

$L_s = \lambda W_s$  \_\_\_\_\_ (9)

$L_q = \lambda W_q$  \_\_\_\_\_ (10)

$$EOQ = \sqrt{\frac{2DA}{C}}$$

$$K = \frac{DA}{Q} + \frac{QC}{2} - \frac{DRm}{100}$$

$$EOQ = \sqrt{\frac{2DA}{C(1-\frac{D}{R})}}$$

$$EOQ = \sqrt{\frac{2DA(C+S)}{CS}}$$