Department of Statistics and Operations Research
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OR 122

Final Examination, First Semester, 1437/38 H

Q.1 Answer the following with true **(T)** or false **(F)**:

(1). In network analysis CPM stands for Critical Programming Method.
(2). Dummy activity uses resources but does not use time.
(3). An activity is the beginning or completion of a task.
(4).The solution of an LPP is called unbounded if there is no common feasible region in the graph.
(5). Decision making under uncertainty is one of the decision making stages.

Q.2 A call center has the following minimum daily requirement for operators:

Period	Clock time	Minimum operators required
1	8 am - 12 noon	7
2	12 noon - 4 pm	10
3	4 pm – 8 pm	12
4	8 pm – 12 am	8
5	12 am – 4 am	23
6	4 am – 8 am	5

Operators report to the centre at the beginning of each period and work for 16 consecutive hours. The centre wishes to determine the minimum number of operators to be employed so that there will be sufficient number of them available for each period. **Formulate** this problem as an LPP.

Q.3 **Solve** the following LPP by using **graphical method**.

$$
\begin{aligned}
Max\ Z &= 300x_1 + 400x_2 \\
s.t.\quad & 5x_1 + 4x_2 \le 200 \\
& 3x_1 + 5x_2 \le 150 \\
& 5x_1 + 4x_2 \ge 100 \\
& 8x_1 + 4x_2 \ge 80 \\
& x_1, x_2 \ge 0
\end{aligned}
$$

Also find **the range of optimality** for c_1 & c_2.

Q.4 Consider the following transportation problem with **unit costs** given in the **right hand** side of each column:

	D1	D2	D3	D4	Supply
F1	**8**	**12**	**44**	**28**	18
F2	**4**	**0**	**24**	**4**	3
F3	**20**	**32**	**60**	**36**	30
Demand	21	15	9	6	

Find the **initial basic feasible solution** by Vogel's approximation method (**VAM**).

Q.5 **Construct** the **network diagram** for the following dependency table of a particular project: (**Diagram should be neat, clear and prominent**)

Activity	Predecessor Activity
A	-
B	-
C	A
D	A
E	A
F	C
G	C
H	C
I	B, D
J	F, I
K	E, H, G, J
L	E, H
M	K, L

Q.6 Payoffs of three acts X, Y, Z and the states of nature P, Q and R are given below:

	Acts		
State of nature	**X**	**Y**	**Z**
P	-1200	-800	1000
Q	2000	4000	-3000
R	2600	-2600	6000

The probabilities of the states of nature P and Q are 0.30 and 0.50. Tabulate the **EMV** for the above data and advice which can be chosen as the **best act**.

Q.7 A child care shop has one cashier who handles all customers' payments. The cashier takes on an average 15 customers per hour. On an average 12 customers arrive per hour to the cashier area. The management received a large number of customer's complaints and decided to investigate the following questions:

(i). The probability that the cashier expected to be idle?
(ii).What is the average length of time that a customer would be expected to wait to pay?
(iii).What is the average length of queue?
(iv). What is the expected number of customers in the shop?

USE:

1. $P_0 = 1 - \frac{\lambda}{\mu}$.

2. $P_n = P_0(\frac{\lambda}{\mu})^n$

3. $L_s = \frac{\lambda}{\mu - \lambda}$.

4. $L_q = \frac{\lambda^2}{\mu(\mu - \lambda)}$

5. $W_s = \frac{1}{\mu - \lambda}$.

6. $W_q = \frac{\lambda}{\mu(\mu - \lambda)}$

7. $P(W_s \geq t) = e^{-(\mu - \lambda)t}$.

8. $P(W_q \geq t) = \frac{\lambda}{\mu} e^{-(\mu - \lambda)t}$.