E 1989 (Pages : 3) Reg. No.....

Name.....

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, OCTOBER 2011

Third Semester

Complementary Course—Operations Research

QUEUEING THEORY

(For B.Sc. Mathematics Model II)

Time : Three Hours Maximum Weight : 25

Part A (Objective Type Questions)

Answer **all** *questions.*
A bunch of four questions has weight one.

Bunch I

1. What is the condition for the matrix (a_{ij}) to have a saddle point at (r, s) ?
2. If $A = \begin{bmatrix} 2 & -3 & 7 \\ -7 & 4 & -5 \\ 5 & -6 & 6 \end{bmatrix}$, find $\min_j \max_i a_{ij}$.
3. Is there an optimal strategy for the game with payoff matrix $\begin{bmatrix} 1 & 3 \\ -2 & 10 \end{bmatrix}$?
4. For what values λ, the game with pay-off matrix $\begin{bmatrix} 2 & 6 \\ -2 & \lambda \end{bmatrix}$ has a value ?

Bunch II

5. Name the network-analysis which is used for project involving activities of non-repetitive nature.
6. In which phase of the project management, we specify the inter-relationship between various activities ?
7. What is the name defined to an event which represents the joint completion of more than one activity in a network diagram ?
8. How we represent a dummy activity in a network diagram ?

Bunch III

9. In an AOA network, what are represented by nodes ?
10. Name two methods of calculating various times of events and activities in critical path analysis.
11. What is represented by the length of critical path in a network diagram ?
12. If the total float value of an activity is negative, what can we say about the resources given to that activity ?

Turn over

Bunch IV

13. Give an example of an infinite population in a queuing model.
14. Write the probability density function of an exponential distribution.
15. First-come, first-served service discipline comes under which queue discipline ?
16. Name the term to denote the total number of customers in the queuing system who are waiting in the line and not being served.

$(4 \times 1 = 4)$

Part B (Short Answer Questions)

Answer any **five** *questions.*
Each question has weight one.

17. Define a two-person zero-sum game.
18. What is meant by an optimal strategy in theory of games ?
19. What are the three phases of project management ?
20. Define burnt event in a network diagram.
21. Draw a network diagram containing a loop.
22. Write two advantages of using AOA network.
23. What are the essential features of a queuing system ?
24. What is meant by pre-emptive priority in a queuing system ?

$(5 \times 1 = 5)$

Part C (Short Essay Questions)

Answer any **four** *questions.*
Each question had weight 2.

25. Use the notion of dominance to simplify the following pay-off matrix and then solve the game

$$\begin{bmatrix} 0 & 5 & -4 \\ 3 & 9 & -6 \\ 3 & -1 & 2 \end{bmatrix}.$$

26. Let $f(X, Y)$ be such that both $\max_X \min_Y f(X, Y)$ and $\min_Y \max_X f(X, Y)$ exists. Prove that

$$\max_X \min_Y f(X, Y) \leq \min_Y \max_X f(X, Y)$$

27. Explain the significance of PERT | CPM.
28. What is a float ? What are the different types of floats ?
29. What are the rules of AOA Network construction ?

30. In a railway marshalling yard, goods trains arrive at a rate of 30 trains per day. Assuming that the inter-arrival time follows an exponential distribution and the service time distribution is also exponential with an average of 36 minutes. Calculate :

    (a) Expected queue size in length.

    (b) Probability that the queue size exceeds 10.

$(4 \times 2 = 8)$

Part D (Essay Questions)

Answer any **two** *questions.*
Each question had weight 4.

31. Solve graphically the game whose pay-off matrix is $\begin{bmatrix} 2 & 7 \\ 3 & 5 \\ 11 & 2 \end{bmatrix}$.

32. Draw a network diagram for the following list of activities :

Activity	Predecessor Activity
A	–
B	–
C	–
D	A
E	B
F	B, C
G	D, E, F
H	E, F

33. Customers arrive at a box office window being manned by a single individual according to a Poisson input process with a mean rate of 30 per hour. The time required to serve a customer has an exponential distribution with a mean of 90 seconds. Find the average waiting time of a customer. Also determine the average number of customers in the system and average queue length.

$(2 \times 4 = 8)$