B.Com(A&F) DEGREE EXAMINATION,APRIL 2020
I Year II Semester
Operations Research

Time : 3 Hours **Max.marks :75**

Section A $(10 \times 2 = 20)$ Marks

Answer any **TEN** questions

1. What is Operations Research?
2. What is a Slack variable?
3. What is meant by transportation problem?
4. What is degeneracy in transportation solution?
5. Find the initial feasible solution to the transportation problem given below, by north west corner rule:

Destination					
Origins		D1	D2	D3	Supply
	O1	2	7	4	5
	O2	3	3	1	8
	O3	5	4	7	7
	O4	1	6	2	14
	Demand	7	9	18	

6. What is Assignment problem?
7. Find the optimum solution to the following assignment problem showing the cost (Rs.) for assigning workers to jobs:

Job				
Workers		X	Y	Z
	A	18	17	16
	B	15	13	14
	C	19	20	21

8. Explain the term Float.
9. What is CPM?
10. Draw the network diagram to the following activities:

Activity (I,J)	Time Duration
1-2	2
1-3	4
1-4	3

2-5	1
3-5	6
4-6	5
5-6	7

11. What is queue Jockeying?
12. The arrival rate of customers at a banking counter follows Poisson distribution with a mean of 45 per hour. The service rate of the counter clerk also follows Poisson distribution with a mean of 60 per hour?
    a. What is the probability of having 0 customer in the system (P_0)?
    b. What is the probability of having 5 customers in the system (P_5)?

Section B $(5 \times 5 = 25)$ Marks

Answer any **FIVE** questions

13. What are the types of Models in OR?
14. Use graphical method to solve the following LP problem.

    Maximise $Z = 60X_1 + 40X_2$

    Subject to the constraints

    $2X_1 + X_2 \leq 60$
    $X_1 \leq 25$
    $X_2 \leq 35$
    Where $X_1, X_2 \geq 0$
15. Determine the optimal transportation plan from the following table giving the plant to market shipping costs and quantities required at each market and available at each plant by using VAM:

Market						
Plant		W1	W2	W3	W4	Availability
	F1	11	20	7	8	50
	F2	21	16	10	12	40
	F3	8	12	18	9	70
	Requirement	30	25	35	40	

16. Given below is a matrix showing the profit for different jobs done through different machines. Find an assignment programme which will maximise the total profit.

Machines					
Jobs		M1	M2	M3	M4
	J1	51	53	54	50
	J2	47	50	48	50
	J3	49	50	60	61
	J4	63	64	60	61

17. Construct the Network diagram

    I) A is the first operation
    II) B and C can be performed in parallel and are immediate successor to A
    III) D,E and F follow B
    IV) G follows E
    V) H follows D, but it cannot start until E is complete
    VI) I and J succeed G
    VII) F and J precede K
    VIII) H and I precede L
    IX) M succeeds L and K
    X) The last operation N succeeds M and C

18. PERT calculations yield a project length of 50 weeks with a variance of 16. Within how many weeks would you expect the project to be completed with probability of (a) 95% (b) 40%?

19. A harbour has single dock to unload the containers from the incoming ships. The arrival rate of ships at the harbour follows Poisson distribution and the unloading time for the ships follows exponential (negative) distribution and hence, the service rate also follows Poisson distribution. The arrival rate and the service rate are 8 ships per week and 14 ships per week respectively. Find the following.

    a) Utilization of the dock
    b) Average number of waiting ships in the queue
    c) Average number of waiting ships in the system
    d) Average waiting time per ship in the queue
    e) Average waiting time per ship in the system

Section C $(2 \times 15 = 30)$ Marks

Answer any **TWO** questions

20. Solve the LPP by Simplex method

    Maximise $Z = 5X_1 + 3X_2$

    Subject to the constraints

    $X_1 + X_2 \leq 2$
    $5X_1 + 2X_2 \leq 10$

$3X_1 + 8X_2 \leq 12$
Where $X_1, X_2 \geq 0$

21. Solve the following Transportation problem by using VAM and check the optimality.

		To					
		W1	W2	W3	W4	W5	Available
From	F1	3	4	6	8	9	20
	F2	2	10	1	5	8	30
	F3	7	11	20	40	3	15
	F4	2	1	9	14	16	13
	Required	40	6	8	18	6	

22. Five workers are available for work with the machines and the respective costs (in Rs.) associated with each worker-machine assignment is given below. A sixth machine is available to replace one of the existing machines and the associated costs are also given below. Determine whether the new machine can be accepted. Find out the optimal assignment also.

	M1	M2	M3	M4	M5	M6
W1	12	3	6		5	8
W2	4	11		5		3
W3	8	2	10	9	7	5
W4		7	8	6	12	10
W5	5	8	9	4	6	

23. A project schedule has the following characteristics

Activity	Time	Activity	Time
1-2	4	5-6	4
1-3	1	5-7	8
2-4	1	6-8	1
3-4	1	7-8	2
3-5	6	8-10	5
4-9	5	9-10	7

a) Construct network diagram
b) Compute TE and TL for each event
c) Find EST, LST, EFT and LFT values of all activities
d) Find critical path and project duration