

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)
BCom DEGREE EXAMINATION DECEMBER 2023
(Fourth Semester)
Branch – E – COMMERCE
OPERATIONS RESEARCH

Time: Three Hours

Maximum: 50 Marks

SECTION-A (5 Marks)

Answer ALL questions

ALL questions carry EQUAL marks (5 x 1 = 5)

- Given a system of m simultaneous linear equations in n unknowns ($m < n$) the number of basic variables will be ____
i) m ii) n , iii) $n-m$, iv) $n+m$
- The dummy source or destination in a transportation problem is introduced to ____.
i) prevent solution to become degenerate
ii) to satisfy rim conditions.
iii) ensue that total cost does not exceed a limit
iv) solve the balanced transportation problem
- The problem of replacement is not concerned about the ____.
i) items that deteriorate graphically.
ii) items that fails suddenly.
iii) determination of optimum replacement interval.
iv) maintenance of an item to work out profitability.
- Multiple severs may be ____.
i) in parallel ii) in series
ii) in combination of parallel and series iv) all the above
- Network problems have advantage in terms of project ____.
i) scheduling ii) planning
iii) controlling iv) all the above

SECTION - B (15 Marks)

Answer ALL Questions

ALL Questions Carry EQUAL Marks (5 x 3 = 15)

- a. Find all the feasible solution to the system of equations
 $2x_1 - x_2 + 2x_3 = 2$, $x_1 + 4x_2 = 18$.
OR
b. Establish the differences between Feasible solution and Basic feasible solutions.
- a. Three fertilizer factories X, Y and Z located at different places of the country produce 6,4 and 5 lakhs tons of urea respectively. Under the directive of the Central Government they are to be distributed to 3 States A, B,C as 5,3 and 7 lakhs tones respectively. The transportation cost per tones in rupees is given below.

	A	B	C
X ...	11	17	16
Y ...	15	12	14
Z ...	20	12	15

Find out suitable transportation pattern at minimum cost.

Cont...

OR

- b Solve the following transportation problems:

From	To			Available
	A	B	C	
I	50	30	220	1
II	90	45	170	3
III	250	200	50	4
Requirement	4	2	2	

8. a Let
- $v=0.9$
- and initial price is Rs5000. Running cost varies as follows:

Year: 1 2 3 4 5 6 7

Running cost in Rs: 400 500 700 1000 1300 1700 2100

What would be the optimum replacement interval?

OR

- b The cost of a new machine is Rs.5000. The maintenance cost of nth year is given
- $C_n=500(n-1)$
- ;
- $n=1,2,\dots$
- . Suppose that the discount rate per year is 0.5. After how many years it will be economical to replace the machine by new one.

9. a A T.V repairman finds that the time spent on his jobs has an exponential distribution with mean 30 minutes. If he repairs sets in the order in which they came in and if the arrival of sets is approximately Poisson with an average rate of 10 per 8-hour days what is repairman's expected idle time each day? How many jobs are ahead of the average set just brought in?

OR

- b If for a period of 2 hours in the day (8 to 10 am) trains arrive at the yard every 20 minutes but the service time continues to remain 36 minutes then calculate for this period: (a) the probability that the yard is empty (b) average number of trains in the system on the assumption that the line capacity of the yard is limited to 4 trains only.

10. a Consider the data of the project find its critical path and project duration;

Activity: A B C D E F G H I
 Predecessor: — — A B C, D B E E F, G
 Duration in days: 4 7 2 9 6 5 2 10 4

OR

- b Distinguish between PERT and CPM with suitable illustrations.

SECTION -C (30 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks (5 x 6 = 30)

11. a Use simplex method to maximize
- $z=x_1 + 2x_2 + 3x_3$
- subject to the constraints:
-
- $x_1 + 2x_2 + 3x_3 \leq 10$
- ,
- $x_1 + x_2 \leq 5$
- ,
- $x_1, x_2, x_3 \geq 0$

OR

- b Use two-phase simplex method to (a) maximize
- $z=10x_1 + 20x_2$
- subject to the constraints:
- $2x_1 + x_2 = 1$
- ,
- $x_1 + 2x_2 = 5$
- ,
- $x_1 \geq 0$
- ,
- $x_2 \geq 0$

12. a Solve the following transportation problems:

Source	Destination				Available
	1	2	3	4	
1	21	16	25	13	11
2	17	18	14	23	13
3	32	27	18	41	19
Requirement	6	10	12	50	43

OR

Cont...

- b Find the optimal solution to the following transportation problem

Source	Destination				Available
	D ₁	D ₂	D ₃	D ₄	
O ₁	23	27	16	18	30
O ₂	12	17	20	51	40
O ₃	22	28	12	32	53
Required	22	35	25	41	123

13. a The yearly cost of 2 machines A and B when the money value is neglected is as follows:

Year :	1	2	3	4	5
Machine A :	1800	1200	1400	1600	1000
Machine B :	2800	200	1400	1100	600

Find their cost patterns if money value is 10% per year and hence find which machine is most economical?

OR

- b The initial cost of an item is Rs.15000 and maintenance or running costs for different year are given below:

Year :	1	2	3	4	5	6	7
Running cost in Rs :	2500	3000	4000	5000	6500	8000	10,000

What is the replacement policy to be adopted if the capital is worth 10% and there is no salvage value?

14. a Assume that the goods trains are coming in a yard at the rate of 30 trains per day and suppose that the inter-arrival times follow an exponential distribution. The service time for train is assumed to be exponential with an average of 36 minutes. If the yard can admit 9 trains at a time (three being 10 lines, one of which is reserved for shunting purposes). Calculate the probability that the yard is empty and find the average queue length?

OR

- b State and explain the condition for the existence of steady state in case of $M/M/C$ queueing system.

15. a Give the following information:

Activity	0-1	1-2	1-3	2-4	2-5	3-4	3-6	4-7	5-7	6-7
Duration in days	2	8	10	6	3	3	7	5	2	8

- Draw the arrow diagram.
- Identify critical path and find the total project duration
- Determine total, free and independent floats.

OR

- b Explain in detail about cost analysis with example.

Z-Z-Z

END