PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2018
(Fifth Semester)

Branch – **MATHEMATICS**

OPERATIONS RESEARCH

Time : Three Hours Maximum : 75 Marks

SECTION-A (20 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks (10 x 2 = 20)

1 Define degenerate solution and basic feasible solution.

2 Write the dual of the following linear programming model
Maximize $z = c_1x_1 + c_2x_2 + \ldots + c_nx_n$
Subject to the constraints :
$ai_1x_1 + ai_2x_2 + \ldots + ai_nx_n = bi.\ i = 1, 2. \ldots, m$
$xj \geq 0, j = 1, 2, \ldots, n.$

3 Mention two methods of finding an initial basic feasible solution to a transportation problem.

4 Give the mathematical formulation of the assignment problem.

5 Define strategy.

6 Determine the saddle point for the game.

$$\begin{array}{c} \\ A \end{array}\begin{array}{c} \begin{array}{cc} B & \end{array} \\ \begin{bmatrix} 0 & 2 \\ -1 & 4 \end{bmatrix} \end{array}.$$

7 Define activity and critical activity.

8 Name the two ways of calculations used in the critical bath calculations.

9 In (M/M/1) : (∞/ FIFO) model, what is the average waiting time of a customer in queue?

10 In an (M/M/1) : (∞ : FIFO) model $\lambda = 10$ and $\mu = 16$. Then what is the value of p_o?.

SECTION - B (25 Marks)
Answer **ALL** Questions
ALL Questions Carry **EQUAL** Marks (5 x 5 = 25)

11 a Obtain all the basic solutions to the following systems of linear equations:
$x_1 + 2x_2 + x_3 = 4$
$2x_1 + x_2 + 5x_3 = 5.$

OR

b Write the dual of the L.P.P:
Minimize $Z = 4x_1 + 6x_2 + 18x_3$
Subject to the constraints :
$x_1 + 3x_2 \geq 3,\ x_2 + 2x_3 \geq 5;$ and $xj \geq 0\ (j = 1, 2, 3).$

12 a Determine an initial basic feasible solution for the following transportation problem using the Vogel's approximation method:

	Destination				
Source	I	II	III	IV	Availability
1	20	22	17	4	120
2	24	37	9	7	70
3	32	37	20	15	50
Requirement	60	40	30	110	

OR

12 b Solve the following assignment problem

		Workers			
		W	X	Y	Z
Jobs	A	8	7	9	10
	B	7	9	9	8
	C	10	8	7	11
	D	10	6	8	7

13 a Determine the range of value of p and q that will make the payoff element a_{22} a saddle point for the game whose payoff matrix (aij) is given below:

	Player B		
Player A	2	4	7
	10	7	q
	4	p	8

OR

b Using the principle of dominance solve the following game:

		Player B		
		B_1	B_2	B_3
Player A	A_1	10	5	−2
	A_2	13	12	15
	A_3	16	14	10

14 a Construct the network diagram comprising activities B. C. .... Q and N such that the following constraints are satisfied:
B < E, F ; C < G, L; E, G < H; L, H < I ; L < M; H < N: H < J: I. J < P: P < Q.
The notation x < y means that the activity X must be finished before Y can begin.

OR

b Distinguish between PERT and CPM.

15 a A T.V repairmen 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 day, what is repairman's expected idle time each day? How many jobs are ahead of the average set just brought in?

OR

b Patients arrive at a clinic according to a Poisson distribution at a rate of 30 patients per hour. The waiting room does not accommodate more than 14 patients. Examination time per patient is exponential with mean rate 20 per hour.
i) Find the effective arrival rate
ii) What is the probability that an arriving patient will not wait?
iii) What is the expected waiting time until a patient is discharged from the clinic ?

SECTION - C (30 Marks)

Answer any **THREE** Questions
ALL Questions Carry **EQUAL** Marks (3 x 10 = 30)

16 Solve the following L.P.P using simplex method:
Maximize $z = 4x_1 + 10x_2$
Subject to the constraints :
$2x_1 + x_2 \leq 50$
$2x_1 + 5x_2 \leq 100$
$2x_1 + 3x_2 \leq 90$

17 Solve the following assignment problem:

	A	B	C	D
I	1	4	6	3
II	9	7	10	9
III	4	5	11	7
IV	8	7	8	5

18 Solve the following game graphically:

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

19 Given the following information :

Activity :	1-2	1-3	2-3	2-4	3-4	4-5
Duration :	20	25	10	12	6	10

a) Draw the activity network of the project
b) Find the total float and free float for each activity
c) Determine the critical path and the project duration.

20 A foreign bank is considering opening a drive-in window for customer service. The customers will arrive for service at the rate of 12 per hour. The teller whom it considering to staff the window can serve customers at the rate of one every three minutes. Assuming Poisson arrivals and exponential service, find:

i) Utilisation of teller
ii) Average number in the system
iii) Average waiting time in the line
iv) Average waiting time in the system.

Z-Z-Z END