18MAP04

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc DEGREE EXAMINATION DECEMBER 2018
(First Semester)

Branch –**MATHEMATICS**

MATHEMATICAL PROGRAMMING

Time: Three Hours Maximum: 75 Marks

SECTION-A (10 Marks)

Answer **ALL** questions
ALL questions carry **EQUAL** marks (10 x 1 = 10)

1 Identify the network based on deterministic activity duration.
(i) Maximal flow (ii) PERT
(iii) CPM (iv) Minimal spanning tree

2 The algorithm to find the shortest routes between the nodes from which the starting node is fixed.
(i) Floyd's (ii) Dijkstra's
(iii) Maximal flow (iv) Spanning tree

3 Name the recursion in which the computations proceed from stage 1 to stage 3.
(i) Forward recursion (ii) Backward recursion
(iii) Logical recursion (iv) Shortest route problem

4 Name the model in which they must decide on the most valuable items to carry in a backpack situation and the limited funds assigned to the projects.
(i) Fly-Away (ii) Knapsack
(iii) Cargo-loading (iv) Recursion

5 Identify the distribution used in sampling from probability distribution in convolution method.
(i) Uniform distribution (ii) Poisson distribution
(iii) Normal distribution (iv) both (ii) and (iii)

6 State the formula to generate the pseudo-random numbers.
(i) $u_n = (bu_{n-1} + c) \bmod (m)$ (ii) $u_n = (bu_{n-1} + c) \bmod (b)$
(iii) $u_n = (bu_n + c) \bmod (m)$ (iv) $u_n = u_{n-1} \bmod (m)$

7 State the condition for weak maximum of the stationary point.
(i) $f(X_0 + h) < f(X_0)$ (ii) $f(X_0 + h) \leq f(X_0)$
(iii) $f(X_0 + h) \geq f(X_0)$ (iv) $f(X_0 + h) > f(X_0)$

8 Mention the procedure for solving simultaneous nonlinear equations by Newton-Raphson method.
(i) Direct procedure (ii) Iterative procedure
(iii) Logical procedure (iv) Analytical procedure

9 Find the value of x_1 and x_2 of uncertainty using Golden Section method.

(i) $x_1 = x_R - \frac{\sqrt{5}-1}{2}(x_R - x_L)$ and $x_2 = x_L + \frac{\sqrt{5}-1}{2}(x_R - x_L)$

(ii) $x_1 = x_R + \frac{\sqrt{5}-1}{2}(x_R - x_L)$ and $x_2 = x_L + \frac{\sqrt{5}-1}{2}(x_R - x_L)$

(iii) $x_1 = x_R - \frac{\sqrt{5}-1}{2}(x_R - x_L)$ and $x_2 = x_L - \frac{\sqrt{5}-1}{2}(x_R - x_L)$

(iv) $x_1 = x_R + \frac{\sqrt{5}-1}{2}(x_R - x_L)$ and $x_2 = x_L - \frac{\sqrt{5}-1}{2}(x_R - x_L)$

10 Identify the nature of function type in Quadratic Programming.
(i) convex (ii) strictly convex
(iii) concave (iv) strictly concave

SECTION - B (25 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 x 5 = 25)

11 a Discuss about the Dijkstra's algorithm.

OR

b Explain about the various time estimates in PERT.

12 a Categories the knapsack and Cargo Loading model with suitable notation.

OR

b Explain about equipment replacement model in deterministic programming.

13 a Determine the generation of random number suing multiplicative congruential method.

OR

b Analyze about (i) Arrival event (ii) Departure event in single server model.

14 a Evaluate the stationary point of the function :

$$f(x_1, x_2, x_3) = x_1 = 2xx_2x_3 - x_1^2 - x_2^2 - x_3^2$$

OR

b Analyze the sensitivity analysis in Jacobian method.

15 a Explain about Direct Search method.

OR

b Solve the chance-constrained problem :

Maximize $z = 5x_1 + 6x_2 + 3x_3$; subject to

$P\{a_{11}x_1 + a_{12}x_2 + a_{13}x_3 \leq 8\} \geq .95$, $P\{5x_1 + x_2 + 6x_3 \leq b_2\} \geq .10$, $x_1, x_2, x_3 \geq 0$

SECTION -C (40 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 x 8 = 40)

16 a Construct the maximal flow algorithm.

OR

b The following table gives the optimistic time (a), most likely (m) and pessimistic time (p). Draw the network of the project and calculate the slack for each event. Find the critical path and the probability of completing the project in 35 days.

activity :	1-2	1-3	2-5	3-4	4-5	5-8	4-6	4-7	6-9	8-9	7-10	9-10
a :	3	1	6	8	0	5	6	3	1	3	8	2
m :	5	2	8	12	0	7	9	6	2	5	15	5
p :	7	3	12	17	0	9	12	8	3	8	20	6

17 a Analyze about (i) Investment model (ii) Work force size model.

OR

b A construction contractor estimates that the size of the work force needed over the next 5 weeks to be 5, 7, ,8 4 and 6 workers, respectively. Excess labour kept on the force will cost $ 300 per worker per week and new hiring in any weeks will incut a fixed cost of $ 400 plus $ 200 per worker per week. Determine the optimum solution and the total cost.

18 a Evaluate the Erlang and Poisson distribution using convolution method.

OR

b Determine the area of the circle defined as $(x-1)^2 + (y-2)^2 = 25$ using Monte-Carlo Sampling.

19 a Develop the Karush – Kuhn – Tucker necessary and sufficient condition for inequality constraints.

OR

b Solve the stationary point use of constrained derivatives of the problem :

Minimize $f(X) = x_1^2 + x_2^2 + x_3^2$ subject to

$g_1(X) = x_1 + x_2 + 3x_3 - 2 = 0$, $g_2(X) = 5x_1 + 2x_2 + \ldots$