K21U 1131

Reg. No. : ....

Name : ....

IV Semester B.Sc. Degree CBCSS (OBE) Regular Examination, April 2021
(2019 Admission Only)
COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS
4C04MAT – BCA : Mathematics for BCA – IV

Time : 3 Hours

Max. Marks : 40

PART – A
(Short Answer)

Answer **any 4** questions. **1** mark **each** :

1. What is the probability of getting a sum of 7 when two dice are thrown ?

2. Define a surplus variable in a linear programming problem.

3. Number of edges in a tree with n vertices.

4. Define a spanning tree.

5. Give the Simpson's $\frac{1}{3}^{rd}$ rule for numerical integration.

(4×1=4)

PART – B
(Short Essay)

Answer **any 7** questions. **2** marks **each** :

6. Two dice are thrown simultaneously. What is the probability of getting two numbers whose product is even ?

7. A bag contains 20 balls, 3 are coloured red, 6 are coloured green, 4 are coloured blue, 2 are coloured white and 5 are coloured yellow. One ball is selected at random. Find the probability that the ball selected is either red or white or blue.

8. Given an LP Problem

   Maximise $z = 3x_1 + 5x_2$

   subject to the constraints $x_1 \leq 5$

   $$x_2 \leq 7$$
   $$3x_1 + 2x_2 \leq 25$$
   $$x_1, x_2 \geq 0$$

   Convert it to the canonical form.

9. Define optimum basic feasible solution of a Linear Programming Problem.

10. Vitamin C and K are found in two different foods A_1 and A_2. One unit of food A_1 contains 4 units of vitamin C and 10 units of vitamin K. One unit of food A_2, contains 8 units of vitamin C and 4 units of vitamin K. One unit of food A_1 and A_2 cost Rs 60 and Rs. 50 respectively. The minimum daily requirements (for an individual) of vitamin C and K is 80 and 100 units respectively. Assuming that anything in excess of daily minimum requirements of Vitamin C and K is not harmful. Find out the optimal mixture of food A_1 and A_2 at the minimum cost which meets the daily minimum requirements of vitamin C and K. Formulate this as a linear programming problem.

11. Find the dual of the following LPP

    Minimise $z = x_1 - x_2 - x_3$

    Subject to the constraints $-3x_1 - x_2 + x_3 \leq 3$

    $$2x_1 - 3x_2 - 2x_3 \geq 4$$
    $$x_1 - x_3 = 2$$
    $$x_1, x_2 \geq 0$$

12. Draw the network diagram for the project whose activities and their precedence relationship are given below.

Activity	A	B	C	D	E	F	G	H	I
Predecessors	–	A	A	–	D	B, C, E	F	E	G, H

13. Find the maximum flow from source to sink from the data given below where node s is the source, node t is the sink and (i, j) represents the capacity of the directed arc from i to j

Directed arc	Capacity
(s, 1)	4
(s, 4)	2
(1, 2)	4
(1, 3)	2
(2, t)	3
(3, 2)	1
(3, t)	1
(4, 3)	1
(4, t)	3

14. Use Euler's method to compute y(0.02) in the equation $\dfrac{dy}{dx} = x^3 + y$, y(0) = 1, h = 0.01.

15. $y' = x - y^2$, y(0) = 1. Find y(0.1) correct to four decimal places using Taylor's series method.   (7×2=14)

PART – C
(Short Essay)

Answer **any 4** questions. **3** marks **each** :

16. A survey was taken in 30 classes of a school to find the total number of left-handed students in each class. The table below shows the results:

No. of left-handed students	0	1	2	3	4	5
Frequency (no. of classes)	1	2	5	12	8	2

A class was selected at random.

a) Find the probability that the class has 2 left-handed students.

b) What is the probability that the class has at least 3 left-handed students ?

c) Given that the total number of students in the 30 classes is 960, find the probability that a student randomly chosen from these 30 classes is left-handed.

17. In a single throw of two dice, what is the probability that neither a double nor a sum of 9 will appear ?

18. Use Simplex method to maximise $z = 5x_1 + 3x_2$
    Subject to the constraints
    $$x_1 + x_2 \le 2$$
    $$5x_1 + 2x_2 \le 10$$
    $$3x_1 + 8x_2 \le 12$$
    $$x_1, x_2 \ge 0$$

19. Solve the following problem graphically
    Maximise $z = 60x_1 + 40x_2$
    Subject to the constraints $2x_1 + x_2 \le 60$
    $$x_1 \le 25$$
    $$x_2 \le 35$$
    $$x_1, x_2 \ge 0$$

20. Find the minimum spanning tree in the following undirected graph where arc(A, B) is denoted as the arc connecting A and B

ARC	WEIGHT
(A, B)	5
(A, C)	6
(C, E)	5
(A, D)	4
(B, C)	1
(B, D)	2
(C, D)	2
(D, F)	4
(C, F)	3
(E, F)	4

21. Use Simpson's rule with n = 6 to estimate the integral $\int_0^1 \sqrt{1+x^3}\, dx$ correct to four decimal places.

22. Determine y(0.1) from the differential equation $y'' - xy' - y = 0$, $y(0) = 1$, $\dot{y}'(0) = 0$ by Taylor's method. (4×3=12)

PART – D
(Long Essay)

Answer **any 2** questions. **5 marks each** :

23. In a class, there are 15 boys and 10 girls. Three students are selected at random. Find the probability that 1 girl and 2 boys are selected.

24. Solve using graphical method

    Maximise z = 8000 x_1 + 7000 x_2

    Subject to the constraints $3x_1 + x_2 \leq 66$

    $$x_1 \leq 20$$
    $$x_2 \leq 40$$
    $$x_1 + x_2 \leq 45$$
    $$x_1, x_2 \geq 0$$

25. Find the maximum flow in the directed graph from a to b whose directed arcs and capacities are given below as a table where (i, j) denotes as the directed arc from i to j.

Directed arc	Capacity
(a, 1)	3
(a, 2)	2
(a, 3)	1
(1, 4)	1
(1, 5)	4
(1, 6)	2
(2, 4)	2
(2, 6)	1
(3, 5)	1
(3, 6)	1
(4, b)	0
(4, 3)	2
(5, b)	5
(6, b)	2
(5, 2)	1

26. $\frac{dy}{dx} = 1 + y^2$, y(0) = 0. Find y(0.2) and y(0.4) by fourth order Runge-Kutta method.

(2×5=10)