K22U 1567

Reg. No. : .....

Name : .....

IV Semester B.Sc. Degree CBCSS (OBE) Regular/Supplementary/ Improvement Examination, April 2022
(2019 Admission Onwards)
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. Find the probability of getting two heads when five coins are tossed.
2. Define a slack variable in a linear programming problem.
3. True or false : Any connected, undirected graph G = (V, E) with |E| = |V| – 1 is a tree.
4. Give an example of a spanning tree in a network.
5. Give the Euler's formula to solve $\frac{dy}{dx} = f(x, y)$. **(4×1=4)**

PART – B
Short Essay

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

6. From a pack of 52 cards, two cards are drawn together at random. What is the probability of both the cards being kings ?
7. In a cricket tournament a cricketer hits eight times '6' out of thirty-two balls. Calculate the probability that he would not hit a 6.

P.T.O.

8. Reduce to the standard problem form

   Maximise $z = 2x_1 - x_2 + x_3$

   Subject to the constraints $x_1 + 3x_2 - x_3 \leq 20$,

   $$2x_1 - x_2 + x_3 \leq 12$$

   $$x_1 - 4x_2 - 4x_3 \geq 2$$

   $$x_1, x_2, x_3 \geq 0.$$

9. Define a basic feasible solution of an LP problem.

10. A business organization is engaged in producing two products M and N. Each unit of product M requires 4 kg of raw material and 8 labour hours for processing, whereas each unit of product N requires 6 kg of raw material and 6 hours of labour of the same type. Every week, the firm has an availability of 120 kg of raw material and 192 labour hours. One unit of product M sold yields Rs. 80 and one unit of product N sold gives Rs. 70 as profit. Formulate this problem as a linear programming problem to determine as to how many units of each of the product should be produced per week so that the firm can earn the maximum profit.

11. Find the dual of the following LPP

    Minimise $z = 3x_1 + 5x_2 - x_3$

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

    $$2x_1 - 3x_2 \leq 4$$

    $$x_1, x_2 \geq 0.$$

12. Problem : Develop a network from the following data.

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

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, a)	4
(s, b)	2
(a, c)	2
(c, t)	2
(c, b)	1
(b, c)	2
(b, d)	3
(d, t)	4

14. Find the value of y at $x = 0.1$ given that $y' = x^2 + y$, $y(0) = 1$, $h = 0.05$ by modified Euler's method.

15. $\frac{dy}{dx} = y - x$, $y(0) = 2$. Find $y(0.1)$ correct to four decimal places using second order Runge-Kutta method. **(7×2=14)**

PART – C

Short Essay

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

16. Two dice are thrown together. What is the probability that the number obtained on one of the dice is multiple of number obtained on the other dice ?

17. What is the probability of getting a sum of 22 or more when four dice are thrown ?

18. Find a feasible solution by graphical method

Maximise $z = 3x_1 + 5x_2$

Subject to the constraints $x_1 + 2x_2 \leq 2000$

$x_1 + x_2 \leq 1500$

$x_2 \leq 600$

$x_1, x_2 \geq 0$.

19. Use simplex method to maximise $z = 6x_1 + 4x_2$

Subject to the constraints $-2x_1 + x_2 \leq 2$

$x_1 - x_2 \leq 2$

$3x_1 + 2x_2 \leq 9$

$x_1, x_2 \geq 0.$

20. Find the minimum spanning tree in the following undirected graph where (i, j) denotes the arc connecting i and j.

Arc	Length
(a, b)	4
(a, c)	8
(b, e)	10
(b, d)	8
(b, c)	9
(c, d)	2
(c, f)	1
(d, e)	7
(d, f)	9
(e, f)	5
(e, g)	6
(f, g)	2

21. Use Trapezoidal rule with n = 4 to estimate $\int_0^1 \frac{1}{1+x}\,dx$.

22. Solve by modified Euler's method, the differential equation $\frac{dy}{dx} = x^2 + y$, $y = 1$ when $x = 0$ for $x = 0.02$. **(4×3=12)**

PART – D
Long Essay

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

23. A box contains six 10Ω resistors and ten 30Ω resistors. The resistors are all unmarked and are of the same physical size. Two resistors are selected from the box. Find the probability that :

i) Both are 10Ω resistors.

ii) The first is a 10Ω resistor and the second is a 30Ω resistor.

iii) Both are 30Ω resistors.

24. Use simplex method to solve the following LP problem :

Minimise $z = x_1 - 2x_2$

Subject to the constraints $2x_1 + 3x_3 = 1$

$$3x_1 + 2x_2 - x_3 = 5$$

$$x_1, x_2, x_3 \geq 0.$$

25. Let the villages in a region are to be connected by roads. The direct distance in km between each pair of villages along a possible road and its cost of construction per km in (10^4Rs) are given in the following table. Distances are given in the upper triangle and cost in the lower triangle. Find the minimum cost at which all the villages can be connected by roads.

		DISTANCE				
		1	2	3	4	5
COST	1		18	12	15	10
	2	3		15	8	22
	3	4	3		6	20
	4	5	5	6		7
	5	2	2	5	7	

26. $\frac{dy}{dx} = y - x$, $y(0) = 2$. Find $y(0.1)$ and $y(0.2)$ correct to four decimal places using forth order Runge-Kutta method. **(2×5=10)**