K24U 0736

Reg. No. : ....

Name : ....

IV Semester B.Sc. Degree (C.B.C.S.S. – O.B.E. – Regular/Supplementary/ Improvement) Examination, April 2024
(2019 to 2022 Admissions)
COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS
4C04MAT-BCA : Mathematics for BCA – IV

Time : 3 Hours   Max. Marks : 40

PART – A

Answer **any 4** questions out of 5 questions. **Each** question carries 1 mark. **(4×1=4)**

1. Define mutually exclusive events.
2. Find the chance of throwing 'four' with an ordinary six faced die.
3. Define a tree.
4. Define connected network.
5. Write the general formula of Trapezoidal rule.

PART – B

Answer **any 7** questions out of 10 questions. **Each** question carries 2 marks. **(7×2=14)**

6. Find the number of permutations of all the letters of the word 'COMMITTEE'.
7. What is the chance that a leap year selected at random will contain 53 Sundays ?
8. Find the chance of throwing an even number with an ordinary six faced die.
9. An agriculture has a farm with 125 acres. He produces Radish, Muttar and Potato. Whatever he raises is fully solid in the market. He gets Rs. 5 for Radish per Kg, Rs. 4 for Muttar per Kg and Rs. 5 for Potato per Kg. The average yield is 1500 Kg of Radish per acre, 1800 Kg of Muttar per acre and 1200 Kg of Potato per acre. To produce each 100 Kg of Radish and Muttar and to produce each 80 Kg of Potato, a sum of Rs. 12.50 has to be used for manure. Labour required for each acre to raise the crop is 6 man days for Radish and Potato each and 5 man days for Muttar. A total of 500 man days of labour at a rate of Rs. 40 per man days are available. Formulate this as a linear programming model to maximize the agriculturist's total profit.

P.T.O.

10. A company makes two kinds of leather belts. Belt A is a high quality belt and belt B is of lower quality. The respective profits are Rs. 4.00/- and Rs. 3.00/- per belt. Each belt of type A requires twice as much time as a belt of type B and if all belt were of type B, the company could make 1000 belts per day. The supply of leather is sufficient for only 800 belts per day (both A and B combined). Belt A requires a fancy buckle and only 400 buckles per day are available. There are only 700 buckles a day available for belt B. Determine the optimal product mix.

11. Explain graphical method.

12. Explain directed network with an example.

13. Define directed paths and cycles.

14. Explain Simpson's $\frac{1}{3}$ rule.

15. Write Runge-Kutta fourth order formula.

PART – C

Answer **any 4** questions out of 7 questions. **Each** question carries **3** marks. **(4×3=12)**

16. From six engineers and five architects a committee is to be formed having three engineers and two architects. How many different committee can be formed if

    i) there is no restriction ?

    ii) two particular engineers must be included ?

17. Given $P(A) = \frac{1}{4}, P(B) = \frac{1}{3}, P(A \cup B) = \frac{1}{2}$. Evaluate P(A/B) and P(B/A).

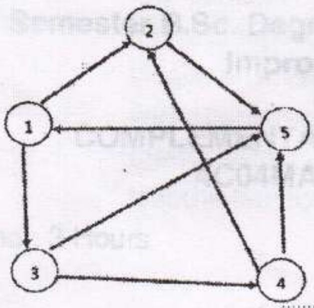
18. Find the maximum value of $z = 107x_1 + x_2 + 2x_3$

    subject to the constraints $14x_1 + x_2 - 6x_3 + 3x_4 = 7$

    $$16x_1 + x_2 - 6x_3 \le 5$$

    $$3x_1 - x_2 - x_3 \le 0,\ x_1 \ge 0;\ x_2 \ge 0;\ x_3 \ge 0,\ x_4 \ge 0.$$

19. Consider the following network



Determine

a) two paths

b) a cycle.

20. Given $\frac{dy}{dx} = y - x$ where $y(0) = 2$ and $h = 0.1$. Find $y(0.1)$ using Runge-kutta fourth order formula.

21. Evaluate $I = \int_0^1 \frac{1}{1+x} dx$ correct to three decimal place with $h = 0.25$ using Simpson's rule.

22. Evaluate $I = \int_0^1 \frac{1}{1+x} dx$ correct to three decimal places using trapezoidal rule with $h = 0.5$.

PART – D

Answer **any 2** questions out of 4 questions. **Each** question carries **5** marks. **(2×5=10)**

23. A five figure number is formed by the digits 0, 1, 2, 3, 4 without repetition. Find the probability that the number formed is divisible by 4.

24. Use simplex method to solve the following LPP

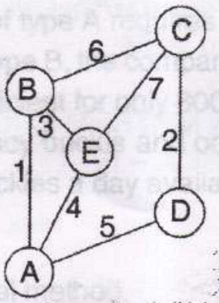
Maximize $z = 4x_1 + 10x_2$

subject to the constraints $2x_1 + x_2 \leq 50$

$2x_1 + 5x_2 \leq 100$

$2x_1 + 3x_2 \leq 90, x_1 \geq 0; x_2 \geq 0.$

25. Use Dijikstra's algorithm to determine a shortest path from A to C for the following network.



26. If $y' = x - y^2$ and $y(0) = 1$, then find $y(0.1)$ correct to four decimal places by Taylor series for $y(x)$.

K23U 1132

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IV Semester B.Sc. Degree (CBCSS – OBE – Regular/Supplementary/ Improvement) Examination, April 2023
(2019 Admission Onwards)
COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS
4C04 MAT-BCA : Mathematics for BCA – IV

Time : 3 Hours Max. Marks : 40

PART – A

Answer **any four** questions. **Each** question carries **1 mark** : **(4×1=4)**

1. What is meant by an exhaustive event ?
2. Find $^5P_3$.
3. What is meant by a linear programming problem ?
4. Define a path in a network.
5. What is meant by an initial value problem ?

PART – B

Answer **any 7** questions. **Each** question carries **2** marks : **(7×2=14)**

6. What is the chance that a leap year selected at random will contain 53 Sundays ?
7. In how many ways can one make a first, second, third and fourth choice among 12 firms leasing construction equipment ?
8. State addition law of probability.
9. What are the three components of an LPP ?

P.T.O.

10. Write the canonical form of

    $\max Z = 2x_1 + 3x_2$

    sub to $2x_1 - 4x_2 \leq 4$

    $x_1 + x_2 \geq 3$

    $x_1 + 7x_2 \leq 7$

    $x_1, x_2 \geq 0.$

11. State fundamental theorem on Linear programming.
12. Explain a directed network. Give an example.
13. What is meant by link capacity in network analysis ?
14. Explain the Trapezoidal rule.
15. Evaluate $\int_0^{\frac{\pi}{2}} \frac{1}{x} dx$ using Simpson's rule.

PART – C

Answer **any 4** questions. **Each** question carries **3** marks : **(4×3=12)**

16. A problem is given to three students A, B and C whose chances of solving it are $\frac{1}{2}, \frac{1}{3}$ and $\frac{1}{4}$ respectively. What is the probability that the problem will be solved ?
17. Explain the characteristics of general LP form.
18. Use graphical method to solve that LPP

    Maximize $z = 4x_1 + 3x_2$

    Sub to $2x_1 + x_2 \leq 1000$

    $x_1 + x_2 \leq 800$

    $0 \leq x_1 \leq 400$ and $0 \leq x_2 \leq 700$.

19. Explain Konigsberg network flow problem.
20. State the characteristics of minimal spanning tree problem.
21. From the Taylor series for y(x), find y(0.1) correct to four decimal places if y(x) satisfies $y' = x - y^2$ and $y(0) = 1$.
22. Determine the value of y when x = 0.1, given that $y(0) = 1$ and $y' = x^2 + y$.

PART – D

Answer **any 2** questions. **Each** question carries **5** marks : **(2×5=10)**

23. A committee consists of 9 students two of which are from 1st year, three from 2nd year and four from 3rd year. Three students are to be removed at random. What is the chance that
    i) the three students belongs to different classes
    ii) two belongs to the same class and third to the different classes,
    iii) the three belong to the same class ?

24. Use simplex method to solve the LPP
    Maximize $z = 4x_1 + 10x_2$
    Sub to $2x_1 + x_2 \le 50$
    $2x_1 + 5x_2 \le 100$
    $2x_1 + 3x_2 \le 90$
    $x_1, x_2 \ge 0.$

25. Use Dijkstra's algorithm to determine the shortest route and hence the shortest distance from city 1 to city 7. (Given the network in figure – 1)

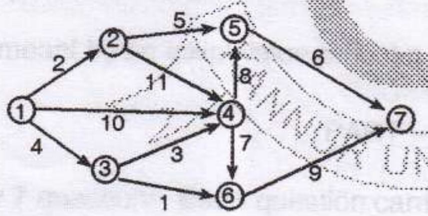

Figure 1

26. Using Runge-Kutta method of both second order and fourth order formula, find y(0.1) and y(0.2) correct to four decimal places, given $\frac{dy}{dx} = y - x$ where $y(0) = 2$, $h = 0.1$.

K22U 1567

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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					
COST		1	2	3	4	5
	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)**

K21U 1131

Reg. No. : ....

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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 $\frac{dy}{dx} = x^3 + y$, 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
    $$x_1 + x_2 \leq 2$$
    $$5x_1 + 2x_2 \leq 10$$
    $$3x_1 + 8x_2 \leq 12$$
    $$x_1, x_2 \geq 0$$

19. Solve the following problem graphically

    Maximise $z = 60x_1 + 40x_2$

    Subject to the constraints $2x_1 + x_2 \leq 60$
    $$x_1 \leq 25$$
    $$x_2 \leq 35$$
    $$x_1, x_2 \geq 0$$

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 $y'' - xy' - y = 0$, $y(0) = 1$, $y'(0) = 0$ 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)

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