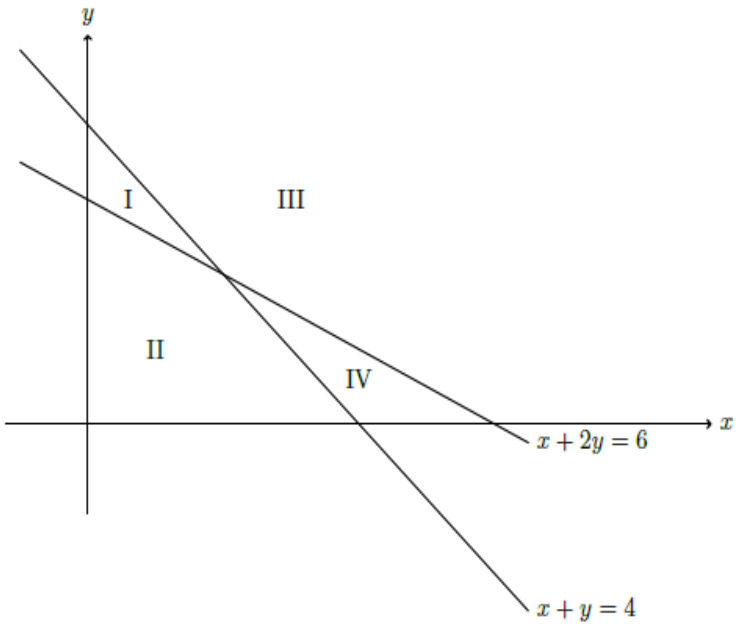
QUIZ 1: NMND 501 -2024 Monsoon **TOTAL – 20 Points** **TIME: 45 MINS**

All questions are 1 mark each

Multiple Choice Questions

Indicate your answer choices by **shading** in your answers on the **cover page**.



1. (5 points) Consider the feasible region given by the following inequalities, whose boundary lines are graphed above.

$$x+2y \geq 6, \quad x+y \geq 4, \quad x \geq 0, \quad y \geq 0$$

Which one of the following labels best indicate the feasible region described above?

A. I

B. III

C. IV

D. II

E. None of these labels adequately or completely indicate the feasible region.

2. (5 points) At which point is the cost function $C = x+3y$ **minimized** with respect to the feasible region described in problem 1 above?

A. $(6,0)$

B. $(0,4)$

C. $(2,2)$

D. $(4,0)$

E. None of these.

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3. (5 points) A linear programming problem has objective function $P = 3x + 2y$ and the following linear inequality constraints.

$$x - y \leq 0, \quad x + y \leq 3, \quad x \geq 0, \quad y \geq 0$$

How many slack variables are needed for the simplex algorithm?

A. 4

B. 2

C. 1

D. 3

E. None of these.

4. (5 points) When applying the simplex method to the simplex tableau

x	y	z	u	v	w	P	RHS
2	−6	2	1	0	0	0	6
6	2	3	0	1	0	0	12
4	4	1	0	0	1	0	20
−8	−12	4	0	0	0	1	0

the column given by variable y should be selected next for pivot operations. Which row should then be selected?

A. R_1

B. R_2

C. R_3

D. R_4

E. None of these.

5. (5 points) The objective function for a linear programming problem is $P = 3x + 2y - z$. What is the correct way to arrange this equation in order to enter it into a Simplex Tableau?

A. $P = 3x + 2y - z$

B. $-3x - 2y + P = z$

C. $-3x - 2y + z + P = 0$

D. $3x + 2y - z - P = 0$

E. None of these.

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Q6. What is the primary goal of Coal India Ltd's initiative to improve First Mile Connectivity by 2025?

A) Achieving complete mechanization of coal loading and transportation

B) Doubling coal production capacity

C) Expanding coal exports to new markets

D) Replacing all traditional mining methods with automated systems

Q7. By enhancing FMC, how does Coal India Ltd aim to reduce its carbon footprint?

A) By switching to electric trucks for coal transportation

B) By minimizing the use of road transport and maximizing rail transport

C) By using coal with a higher carbon content

D) By planting trees around coal mines

Q8. What is the expected impact of the Gati Shakti plan on the logistics sector in India?

A) Increase in transportation costs

B) Reduction in transportation time and cost

C) Decrease in the use of technology

D) Dependence on traditional logistics methods

Q9. Which of the following sectors is NOT directly targeted by the Gati Shakti plan?

A) Transportation

B) Telecommunications

C) Agriculture

D) Healthcare

Q10. Which technology is widely adopted for real-time monitoring and optimization of coal transportation?

A) Blockchain technology

B) Internet of Things (IoT)

C) Virtual Reality (VR)

D) Augmented Reality (AR)

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Q11. How does the use of automated conveyor systems impact coal transportation?

A) It decreases the need for manual labor

B) It increases the efficiency of coal transport

C) It enhances the speed and reduces the cost of transporting coal over short distances

D) It leads to decrease in maintenance costs without benefits

Q12.

$$\begin{aligned} \max\ & 5x_1 - 7x_2 \\ \text{s.t.:}\quad & x_1 + x_2 \leq 1 \\ & 3x_1 + 2x_2 \geq 6 \\ & x_1, x_2 \geq 0 \end{aligned}$$

Check **ALL** true statements

- ☐ The Dual LP is feasible.
- ☐ The Dual LP is unbounded.
- ☐ The Primal LP is unfeasible.
- ☐ The Primal LP is feasible and bounded.

Q13.

A simple tableau shown below generated during the maximization of linear programming problem using simplex method.

Variable	Z	X_1	X_2	X_3	X_4	RHS
Z	1	-1	0	1	0	6
X_2	0	1/3	1	1/3	0	2
X_4	0	7/3	0	−2/3	1	2

After one iteration, the value of the objective function becomes

(A) $\frac{48}{7}$ (B) $\frac{11}{3}$ (C) $\frac{22}{7}$ (D) $\frac{2}{3}$

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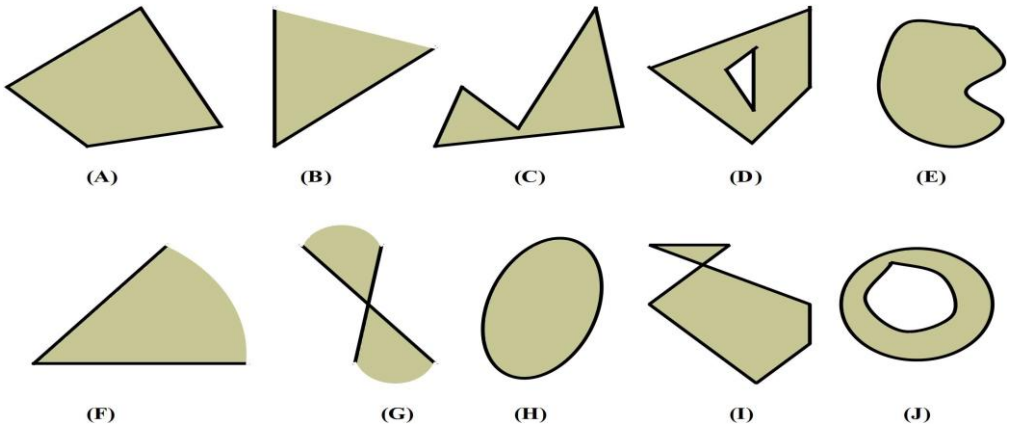
Q14 As shown in the figures below, which of the following sets are convex?



Q15. Consider the following linear Programming problem:

Min $Z = \beta X_1 + 6X_2$
Subject to $2X_1 + 2X_2 \geq 30$
$X_1 \geq 5$
$X_2 \geq 5$
$X_1, X_2 \geq 0$

For which values of β is (5,10) an optimal solution?

a. $0 \leq \beta \leq 6$
b. $6 \leq \beta \leq \infty$
c. $0 \leq \beta \leq 3$
d. $3 \leq \beta \leq \infty$

Q16. Consider the following Linear Programming problem:

Max $4X_1 + 6X_2$
Subject to $5X_1 + 5X_2 \leq 20$
$2X_1 + 4X_2$

What is the upper bound of the sensitivity range of the coefficient on X_1 in the objective function?

A. 4
B. 6
C. 2
D. 3

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Q17. What is the upper bound of the sensitivity range of the coefficient on X_2 in the objective function? **Based on Q16 above**

A. 2
B. 4
C. 8
D. 6

Q18.A pair of feasible solutions of dual canonical linear programming problems exhibit complementary slackness

(a) if and only if they are basic solutions.

(b) if and only if they are basic feasible solutions.

(c) if and only if they are optimal solutions.

(d) cannot be determined

Q19. A linear programming problem having an empty constraint set is said to be

(a) Feasible

(b) Bounded

(c) Unbounded

(d) Infeasible

Q20.

For an LP problem, identify the INCORRECT statement

(A) Optimal point lies in one of the corner points
(B) Objective function is linear
(C) All the constraints are linear
(D) Optimal point lies in any of the interior points of the feasible region