# MAL210, OPTIMIZATION METHODS & APPLICATIONS
## Minor-II

Max Marks: 25

Time: 1 Hr.

NOTE:
- Attempt all questions.
- All Notations have their usual meaning.

1. Let (LP1) denote the associated LPP of a given (AILP). Let the optimal simplex tableau of (LP1) be

| $x_B$ | $y^{(1)}$ | $y^{(2)}$ | $y^{(3)}$ | $y^{(4)}$ |
|---|---|---|---|---|
| $x_2 = \frac{9}{5}$ | 0 | 1 | $\frac{3}{10}$ | $\frac{-1}{10}$ |
| $x_1 = \frac{7}{2}$ | 1 | 0 | $\frac{-1}{4}$ | $\frac{1}{4}$ |
| $z(x_B) = \frac{53}{10}$ | 0 | 0 | $\frac{1}{20}$ | $\frac{3}{20}$ |

(i.) Generate *Gomory's cut constraint* through the variable $x_2$.

(ii.) Construct (LP-2) and obtain its optimal solution. (Do NOT continue any further, even if needed)

2. Consider the problem

$$\min \quad 3x_1 + 4x_2 + 2x_4 + 3x_5 + 4x_6$$

subject to

$$x_1 + x_2 + x_3 = 13$$
$$x_4 + x_5 + x_6 = 5$$
$$x_1 + x_4 = 8$$
$$x_2 + x_5 = 4$$
$$x_3 + x_6 = 6$$
$$x_1,\ x_2,\ x_3,\ x_4,\ x_5,\ x_6 \geq 0,$$

and all variables are integers.

Solve the given optimization problem.

3. Solve AP($C$) where $C$ is given by

$$C = \begin{pmatrix} 14 & 4 & 10 & 16 \\ 21 & 6 & 15 & 24 \\ 35 & 10 & 25 & 40 \\ 56 & 16 & 40 & 64 \end{pmatrix}.$$

Let AD($C$) denote the dual of AP($C$). Obtain an optimal solution of AD($C$).

4. If possible, construct an example of each of the following and justify your answer.

(i) a balanced TP which is not feasible.

(ii) an AILP whose feasible region is a convex set.

(iii) a non-convex function whose every $\alpha-$cut is a convex set.

(iv) a function whose epigraph is a convex set.

(v) a function $f : \mathbb{R} \to \mathbb{R}$ such that $f$ and $\frac{1}{f}$ both are convex functions.