MSMS 206 : Practical 02

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🎯 **Question :** Solve the following linear programming problem.

$$
\begin{aligned}
\textit{Minimize} \quad & z = 2x_1 + x_2 + 4x_3 \\
\textit{subject to} \quad & -2x_1 + 4x_2 \leq 4, \\
& x_1 + 2x_2 + x_3 \geq 5, \\
& 2x_1 + x_3 \leq -2, \\
& x_1, x_2, x_3 \geq 0.
\end{aligned}
$$

```
library(lpSolve)
```

```
coeff <- c(2, 1, 4)

constraint_mat <- matrix(data = c(-2, 4, 0,
                                  1, 2, 1,
                                  2, 0, 1),
                         nrow = 3, ncol = 3, byrow = TRUE)

constraint_direction <- c("<=", ">=", "<=")

constraint_RHS <- c(4, 5, -2)
```

```
sol <- lp(direction = "min",
   objective.in = coeff,
   const.mat = constraint_mat,
   const.dir = constraint_direction,
   const.rhs = constraint_RHS)
```

```
sol
```

```
## Error: no feasible solution found
```

```
sol$status
```

```
## [1] 2
```

✎ Solution status = 2 implies there is no feasible solution.

🎯 **Question :** Solve the following linear programming problem.

$$\begin{aligned} \textit{Maximize} \quad z &= 3x_1 + 5x_2 + 4x_3 \\ \textit{subject to} \quad 2x_1 + 3x_2 &\leq 8, \\ 2x_2 + 5x_3 &\leq 10, \\ 3x_1 + 2x_2 + 4x_3 &\leq 15, \\ x_1, x_2, x_3 &\geq 0. \end{aligned}$$

```
coeff <- c(3, 5, 4)

constraint_mat <- matrix(data = c(2, 3, 0,
                                  0, 2, 5,
                                  3, 2, 4),
                         nrow = 3, ncol = 3, byrow = TRUE)

constraint_direction <- c("<=", "<=", "<=")

constraint_RHS <- c(8, 10, 15)
```

```
sol <- lp(direction = "max",
   objective.in = coeff,
   const.mat = constraint_mat,
   const.dir = constraint_direction,
   const.rhs = constraint_RHS)
```

```
sol

## Success: the objective function is 18.65854
```

```
sol$status

## [1] 0
```

✎ The optimal value of the objective function is

```
sol$objval

## [1] 18.65854
```

✎ The optimal solution of the linear programming problem is

```
sol$solution

## [1] 2.170732 1.219512 1.512195
```