### Course Code : MSCM302

## **Course Name: Operation Research**

**Duality Theory** 

- Every LP problem (called the 'Primal') has associated with another problem called the 'Dual'.
- The 'Dual' problem is an LP defined directly and systematically from the original (or Primal) LP model.
- The optimal solution of one problem yields the optimal solution to the other.
  - Duality ease the calculations for the problems, whose number of variables is large.

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Rules for converting Primal to Dual

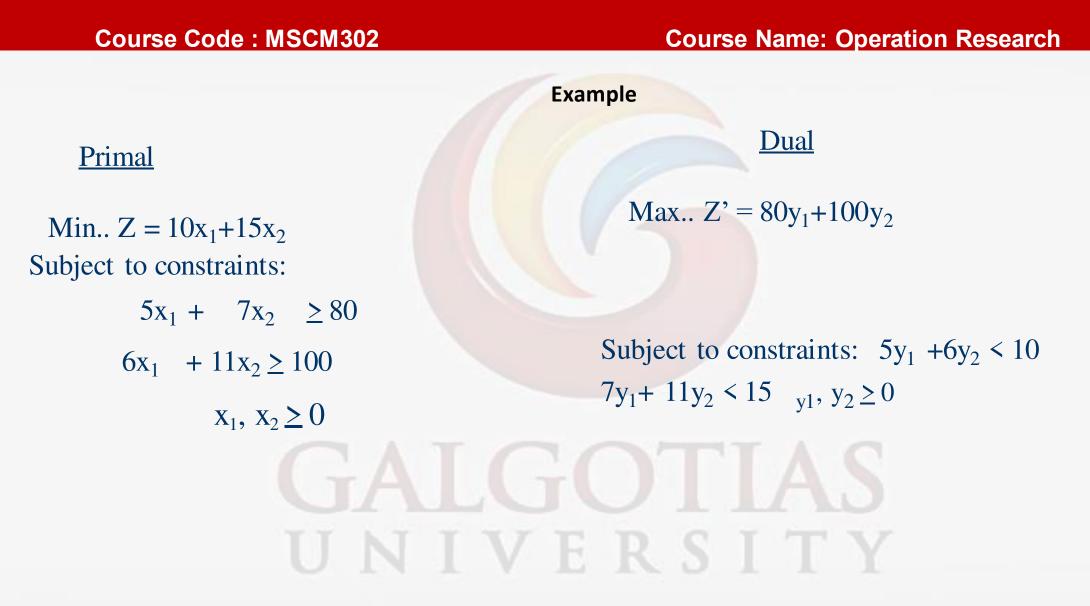
If the Primal is to maximize, the dual is to minimize.
If the Primal is to minimize, the dual is to maximize.
For every constraint in the primal, there is a dual variable.
For every variable in the primal, there is a constraint in the dual.

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## **Course Code : MSCM302 Course Name: Operation Research Dual Problem Primal LP: Associated Dual LP:** Max $z = c_1 x_1 + c_2 x_2 + ... + c_n x_n$ Min. $z = b_1y_1 + b_2y_2 + ... + b_my_m$ subject to: subject to: $a_{11}y_1 + a_{21}y_2 + \dots + a_{m1}y_m \ge c_1$ $a_{11}X_1 + a_{12}X_2 + ... + a_{1n}X_n \leq b_1$ $a_{12}y_1 + a_{22}y_2 + \dots + a_{m2}y_m \ge c_2$ $a_{21}X_1 + a_{22}X_2 + ... + a_{2n}X_n \leq b_2$ $a_{1n}y_1 + a_{2n}y_2 + \dots + a_{mn}y_m \ge c_n$ $a_{m1}x_1 + a_{m2}x_2 + \ldots + a_{mn}x_n \le b_m$ $y_1 \ge 0, y_2 \ge 0, \dots, y_j \ge 0, \dots, y_m \ge 0.$ $x_1 \ge 0, x_2 \ge 0, \dots, x_i \ge 0, \dots, x_i$

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 $\geq 0.$ 



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Youtube/other Video Links

https://youtu.be/M8POtpPtQZc
 https://youtu.be/8IRrgDoV8Eo
 https://youtu.be/YrsbJG8XqU0

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