Q4

	A	B	C	D	Price	min. demand
Ratio for F1	1	1	2	4	\$220/bbl	250 bbl/day
Ratio for F2	2	2	1	3	\$260/bbl	450 bbl/day
Supply max. bbl/day	800	1000	1100	1400		
Cost (\$)/bbl	100	80	90	140		

⇒ LP model development to determine the optimal production mix for F1 and F2:→

→ Based on given ratio, we can say that,

$$8x_{1A} = 8x_{1B} = 4x_{1C} = 2x_{1D} = x_1$$

and, $$4x_{2A} = 4x_{2B} = 8x_{2C} = \frac{8}{3}x_{2D} = x_2$$

$$\therefore x_{1A} = \frac{x_1}{8},\ x_{1B} = \frac{x_1}{8},\ x_{1C} = \frac{x_1}{4},\ x_{1D} = \frac{x_1}{2}$$

$$x_{2A} = \frac{x_2}{4},\ x_{2B} = \frac{x_2}{4},\ x_{2C} = \frac{x_2}{8},\ x_{2D} = \frac{3x_2}{8}$$

$\therefore$ Constraints:

$$\frac{x_1}{8} + \frac{x_2}{4} \le 800 \qquad \frac{x_1}{2} + \frac{3x_2}{8} \le 1400$$

$$x_1/8 + x_2/4 \le 1000 \qquad \text{and, } x_1 \ge 250$$

$$\frac{x_1}{4} + \frac{x_2}{8} \le 1100 \qquad x_2 \ge 450 \text{ (i.e. } x_2 \ge 450)$$

— ①

and, obj. fun, max Z $= \left[220\left(\frac{x_1}{8} + \frac{x_1}{8} + \frac{x_1}{4} + \frac{x_1}{2}\right) + 260\left(\frac{x_2}{4} + \frac{x_2}{4} + \frac{x_2}{8} + \frac{3x_2}{8}\right)\right]$

$- \left[100\left(\frac{x_1}{8} + \frac{x_2}{4}\right) + 80\left(\frac{x_1}{8} + \frac{x_2}{4}\right) + 90\left(\frac{x_1}{4} + \frac{x_2}{8}\right) + 140\left(\frac{x_1}{2} + \frac{3x_2}{8}\right)\right]$

$= 220x_1 + 260x_2 - 115x_1 - 108.75x_2$

$\therefore$ $\boxed{\text{max. } Z = 105x_1 + 151.25x_2}$ — ②

$\therefore$ eqn ② represent optimizn objective fun and eqn ① presents constraints that are subject to objective fun optimizn.