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Linear Programming Part 3/3 The Grand Finale



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Medium	Audience Reached Per Ad	Cost Per Ad(\$)	Maximum Ads Per Week
TV spot (1 minute)	5,000	800	12
Daily newspaper (full-page ad)	8,500	925	5
Radio spot (30 seconds, prime time)	2,400	290	25
Radio spot (1 minute, afternoon)	2,800	380	20



Decision Variables:

- X1: Number of TV Spots per week
- X2: Number of newspaper ads per week
- X3: Number of 30-secs radio ads per week
- X4: Number of 60-secs radio ads per week

Obj. Fn.: **Maximize: $5000X_1 + 8500X_2 + 2400X_3 + 2800X_4$**

Subject to:

- Constraints:
- $X_1 \leq 12$ (max TV spots/week)**
 - $X_2 \leq 5$ (max ads/week)**
 - $X_3 \leq 25$ (max 30-secs radio spots/week)**
 - $X_4 \leq 20$ (max 60-secs radio spots/week)**
 - $800X_1 + 925X_2 + 290X_3 + 380X_4 \leq 8000$ (weekly bdtg)**
 - $X_3 + X_4 \geq 5$ (min radio spots/week)**
 - $290X_3 + 380X_4 \leq 1800$ (max radio expense)**



Flair Furniture Company Data

Hours Required to Produce One Unit

Department	X_1 Tables	X_2 Chairs	Available Hours per Week
Carpentry	1	1	6
Painting/Varnishing	9	5	45
Profit/unit	\$7.5	\$5.5	

- Constraints:
- $X_1 + X_2 \leq 6$ (carpentry)**
 - $9X_1 + 5X_2 \leq 45$ (painting & varnishing)**

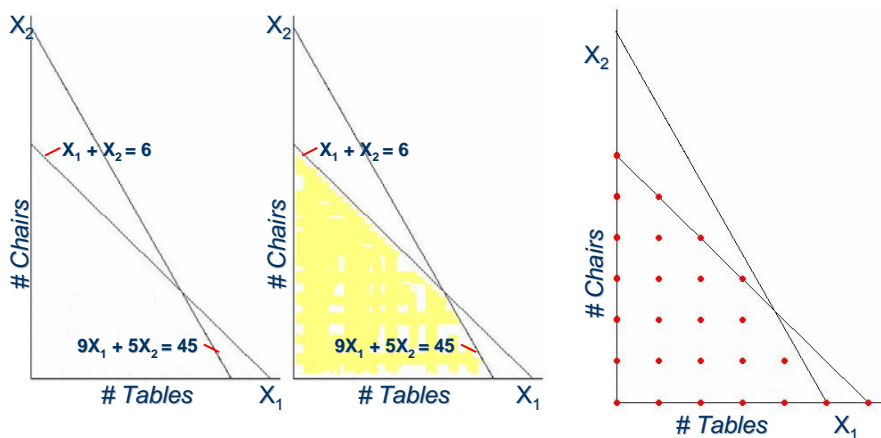
Objective: **Maximize: $7.5X_1 + 5.5X_2$**



Decision Variables: X_1 : Number of tables to be produced
 X_2 : Number of chairs to be produced

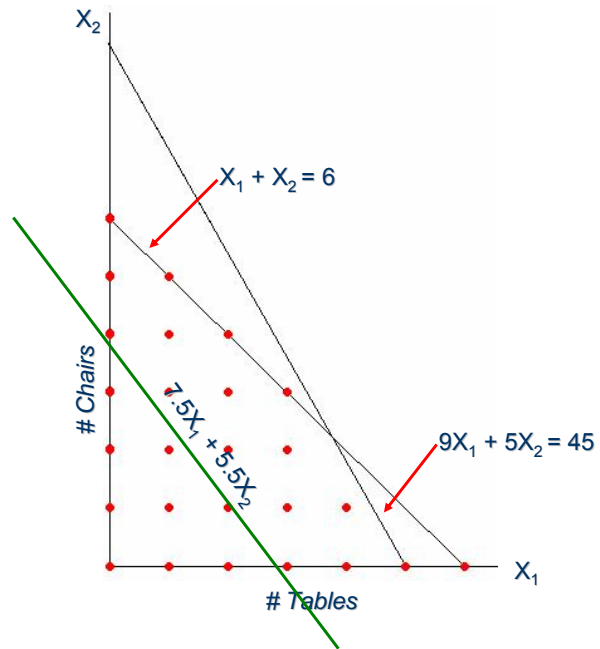
Obj. Fn.: Maximize: $7.5X_1 + 5.5X_2$

Constraints: S.T.
 $X_1 + X_2 \leq 6$ (carpentry)
 $9X_1 + 5X_2 \leq 45$ (painting & varnishing)
 $X_1, X_2 \geq 0$
 X_1, X_2 are integers



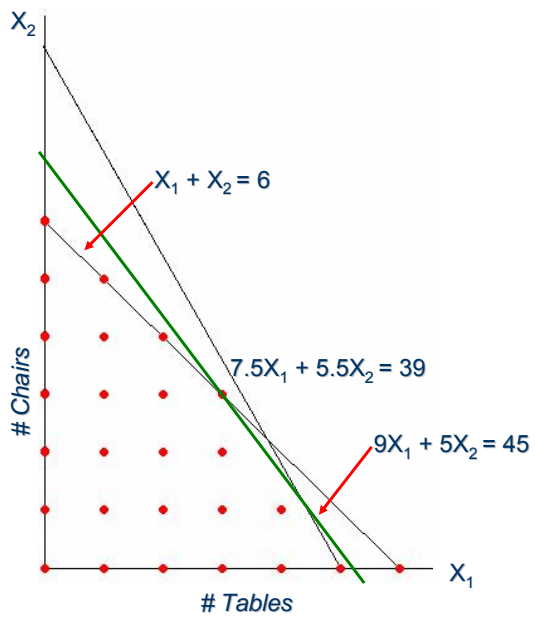
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7
Integer Solution



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8
Integer Solution



Truck Loading - Goodman Shipping

Item	Value (\$)	Weight (lbs)
1	22,500	7,500
2	24,000	7,500
3	8,000	3,000
4	9,500	3,500
5	11,500	4,000
6	9,750	3,500



X_n is a toggle variable for item n (0 for included, 1 otherwise)

Maximum : $22500X_1 + 24000X_2 + 8000X_3 + 9500X_4 + 11500X_5 + 9750X_6$

Subject to :

$7500X_1 + 7500X_2 + 3000X_3 + 3500X_4 + 4000X_5 + 3500X_6 \leq 10000$

$X_1 \leq 1$

$X_2 \leq 1$

$X_3 \leq 1$

$X_4 \leq 1$

$X_5 \leq 1$

$X_6 \leq 1$

All X 's are integer 0/1



Time Period	# Tellers Required
9 A.M. – 10 A.M.	10
10 A.M. – 11 A.M.	12
11 A.M. – Noon	14
Noon – 1 P.M.	16
1 P.M. – 2 P.M.	18
2 P.M. – 3 P.M.	17
3 P.M. – 4 P.M.	15
4 P.M. – 5 P.M.	10

true

- F = full-time teller
- P1 = part-time teller starting 9
- P2 = part-time teller starting 10
- P3 = part-time teller starting 11
- P4 = part-time teller starting noon
- P5 = part-time teller starting 13

true

Minimize: $50F + 16(P1 + P2 + P3 + P4 + P5)$

Subject to:

$$F + P1 \geq 10$$

$$F + P1 + P2 \geq 12$$

$$0.5F + P1 + P2 + P3 \geq 14$$

$$0.5F + P1 + P2 + P3 + P4 \geq 16$$

$$F + P2 + P3 + P4 + P5 \geq 18$$

$$F + P3 + P4 + P5 \geq 17$$

$$F + P4 + P5 \geq 15$$

$$F + P5 \geq 10$$

$$4(P1 + P2 + P3 + P4 + P5) \leq 0.5(10+12+14+16+18+17+15+10)$$

$$F \leq 12$$

$$F, P1, P2, P3, P4, P5 \geq 0$$



The general partners of High-Tech, a venture capital investment company, are considering investing in one or more proposals they have received from various entrepreneurial businesses. The research Department has screened each proposal and four of the entrepreneurs meet High-Tech's requirement of achieving a sufficient high return for the associated risk. These companies are Bio-Tech, Telcom, Laser-Optics and CompuWare. The estimated total return in \$ are given below:

Investment Data for High-Tech (\$)

Projects	Yr1	Yr2	Yr3	Yr4	Return
Bio-Tech	60	10	10	10	250
Telcom	35	35	35	35	375
Laser-Optics	10	50	50	10	275
CompuWare	15	10	10	40	140
Investable Funds	90	80	80	50	

Accounting Dept. has estimated total funds available in each year for the next four years. Which project(s) is(are) to be invested to achieve the highest total return. For diversification purpose, Telcom and Laser-Optics will not be invested together.



X1: Integer 0/1 for BioTech (1 for 'go', 0 for 'no-go')

X2: Integer 0/1 for Telcom

X3: Integer 0/1 for Laser

X4: Integer 0/1 for CompuWare

Max: $250X1 + 375X2 + 275X3 + 140X4$

s.t.

$60X1 + 35X2 + 10X3 + 15X4 \leq 90$

$10X1 + 35X2 + 50X3 + 10X4 \leq 80$

$10X1 + 35X2 + 10X3 + 40X4 \leq 50$

$X2 + X3 \leq 1$

All X's are integer 0/1

true

