

A small firm manufactures toboggans and sleds. It takes five hours and twenty-five dollars in parts to make a toboggan, and four hours and forty dollars in parts to make a sled. The profits are ten dollars per toboggan and twelve dollars per sled. The firm has two thousand dollars in parts and three hundred and twenty labor hours available. How many sleds and toboggans should be built to maximize profit?

Feeling around

$$\begin{aligned} 100 \text{ sleds} \times 12 &= \$1200 \leftarrow \\ 50 \text{ toboggans} \times 10 &= \$1000 \leftarrow \\ \hline &= \$2200 \leftarrow \text{Profit} \end{aligned}$$

$5 \times 100 = 500 \text{ hrs}$
 $> 320 \text{ hrs}$

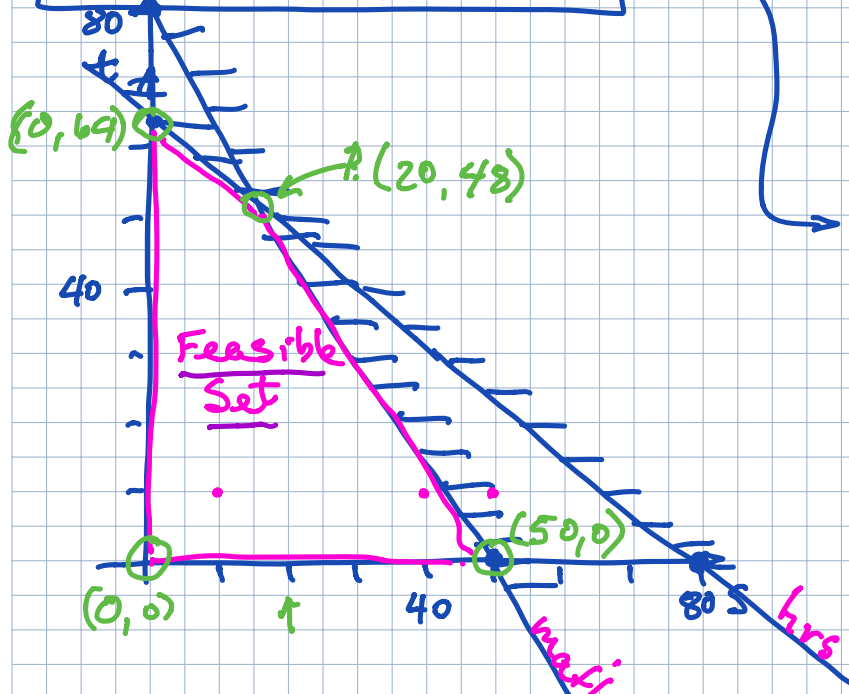
Maximize:

$$\text{Profit} = 12s + 10t$$

subject to:

hours $5t + 4s \leq 320$

materials $25t + 40s \leq 2000$



c	d
1	1
1	1
1	1
1	1

} 10/10

s	t
1	1
1	1
1	1
1	1
1	1
1	1
1	1
1	1
1	1
1	1

exhaustive search

t	s
0	80
64	0
0	50
80	0

hrs

materials

$$\begin{aligned} 5t + 4s &\leq 320 \\ s &\leq 80 \\ 5t + 4s &\leq 320 \\ t &\leq 320/5 \end{aligned}$$

$$= 64$$

Fundamental Thm of LP:

Optimum will occur at a vertex of the feasible set.

$$? \quad 5t + 4s = 320$$

$$25t + 40s = 2000$$

$$25t + 20s = 1600$$

$$0 \quad 20s = 400$$

$$s = 400/20$$

$$= 20$$

$$5t + 4(20) = 320$$

$$5t + 80 = 320$$

$$5t = 240$$

$$t = 48$$

s	t	Profit
0	0	$12 \cdot 0 + 10 \cdot 0 = 0$
50	0	$12 \cdot 50 + 10 \cdot 0 =$ \$600
<u>20</u>	<u>48</u>	$12 \cdot 20 + 10 \cdot 48 =$ <u>\$720</u>
0	64	$12 \cdot 0 + 10 \cdot 64 =$ \$640

$$\text{Profit} = \underline{12s} + \underline{10t}$$

To maximize profit
make 20 sleds and
48 toboggans.

Max profit will be \$720.