

#1

Let x = the number of front orchestra seats
 y = the number of rear orchestra seats
 z = the number of front balcony seats

$$\begin{aligned}x + y + z &= 1000 \\80x + 60y + 50z &= 62800 \\x + y &= 2z + 400\end{aligned}$$

#2

$$\begin{array}{l} R_2 - 2R_1 \\ R_3 - R_1 \end{array} \begin{bmatrix} \textcircled{1} & -2 & 1 & 6 \\ 2 & 1 & -3 & -3 \\ 1 & -3 & 3 & 10 \end{bmatrix} \quad \frac{1}{5}R_2 \begin{bmatrix} \textcircled{1} & -2 & 1 & 6 \\ 0 & 5 & -5 & -15 \\ 0 & -1 & 2 & 4 \end{bmatrix}$$

$$\begin{array}{l} R_1 + 2R_2 \\ R_3 + R_2 \end{array} \begin{bmatrix} \textcircled{1} & -2 & 1 & 6 \\ 0 & \textcircled{1} & -1 & -3 \\ 0 & -1 & 2 & 4 \end{bmatrix} \quad \begin{array}{l} R_1 + R_3 \\ R_2 + R_3 \end{array} \begin{bmatrix} \textcircled{1} & 0 & -1 & 0 \\ 0 & \textcircled{1} & -1 & -3 \\ 0 & 0 & \textcircled{1} & 1 \end{bmatrix}$$

$$\begin{bmatrix} \textcircled{1} & 0 & 0 & 1 \\ 0 & \textcircled{1} & 0 & -2 \\ 0 & 0 & \textcircled{1} & 1 \end{bmatrix}$$

$$\begin{aligned}x &= 1 \\ y &= -2 \\ z &= 1\end{aligned}$$

#3a

$$x = -10$$

$$y = 2$$

unique solution

#3b

$$x + u = 1500$$

$$y - u = -200$$

$$z + u = 2000$$

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infinitely many solutions

#3c

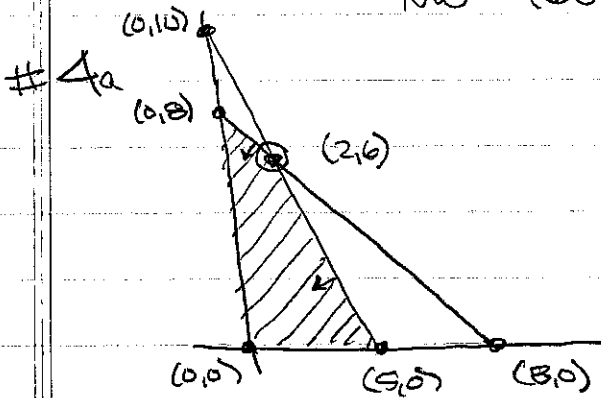
$$x = 4$$

$$y = -1$$

$$z = 3$$

$$0 = 1$$

No solution



#4c bounded

#4b

vertices	$Z = 4x + y$
(0,0)	0
(0,8)	8
(5,0)	20 Max.
(2,6)	14

#5

$$\begin{aligned}
 2x + y + 2z + s &= 14 \\
 2x + 4y + z + t &= 26 \\
 x + 2y + 3z + u &= 28 \\
 -2x - 2y - z + p &= 0
 \end{aligned}$$

#5a

	x	y	z	s	t	u	p	constants
s	2	1	2	1	0	0	0	14 ←
t	2	4	1	0	1	0	0	26 ←
u	1	2	3	0	0	1	0	28
p	-2	-2	-1	0	0	0	1	0

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 a i

#6a

$$\begin{aligned}
 x &= \frac{30}{3} = 10 \\
 y &= 0 \\
 z &= 0 \\
 p &= \frac{90}{1} = 90
 \end{aligned}$$

#6b

	x	y	z	s	t	p	constants
s	0	-7	0	1	-2	0	12
x	3	4	2	0	1	0	30 ←
p	0	7	-3	0	3	1	90

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#7

$$x = 72/9 = 8$$

$$y = 10/3 = 6$$

$$P = 78/1 = 78$$

#8

Maximize $P = 30x + 40y$
 Subject to

$$150x + 150y \leq 600000$$

$$x + y \leq 2500$$

$$x \geq 0, y \geq 0$$