

3. Determine the dual of the linear programming problem. Do NOT solve the problem!

(10 pts)

Minimize  $30x + 60y + 50z$  subject to the constraints

$$\begin{cases} 4x - 7z \geq 2 \\ -x + 2y + 5z \geq 3 \\ x \geq 0, y \geq 0, z \geq 0 \end{cases}$$

(salmon)

Maximize  $2u + 3v$  subject to

$$4u - v \leq 30$$

$$2v \leq 60$$

$$-7u + 5v \leq 50$$

$$u \geq 0, v \geq 0$$

Minimize  $8u + 7v$  subject to

$$5u - v \geq 120$$

$$3u \geq 70$$

$$-u + 2v \geq 90$$

$$u \geq 0, v \geq 0$$

4. Is the matrix below a simplex tableau? Justify your answer.

(8 pts)

$$\begin{array}{c|cccc|c} x & y & z & v & w & M & \\ \hline 0 & 3 & 1 & 0 & 1 & 15 & 15 \\ 1 & -1 & 0 & 0 & 2 & -5 & 10 \\ 0 & 2 & 0 & 0 & -5 & 4 & 23 \\ 0 & 11 & 0 & 1 & -7 & 6 & -9 \end{array}$$

Yes, the four columns of  $I = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$

appear as columns of  $x, z, v, M$  left of the vertical line in some order.