

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

- 1) Consider a linear programming problem given in standard form where the final simplex tableau for maximization is shown below.

$$\begin{array}{c}
 x \quad y \quad u \quad v \quad M \\
 \left[\begin{array}{cccc|c}
 1 & 0 & \frac{2}{7} & -\frac{1}{7} & 5 \\
 0 & 1 & -\frac{3}{7} & \frac{5}{7} & 14 \\
 \hline
 0 & 0 & \frac{2}{7} & \frac{11}{7} & 28
 \end{array} \right]
 \end{array}$$

If x and y are the original variables and u and v are the slack variables, what is the solution to the problem and to its dual?

- 2) Consider the following linear programming problem.

Maximize $M = 3x + 2y + 5z$ subject to

$$\begin{cases}
 x - 2z \leq 10 \\
 x + y + 6z \leq 80 \\
 x \geq 0, y \geq 0, z \geq 0.
 \end{cases}$$

The associated final simplex tableau is as follows:

$$\begin{array}{c}
 x \quad y \quad z \quad u \quad v \quad M \\
 \left[\begin{array}{cccc|c}
 1 & 0 & -2 & 1 & 0 & 10 \\
 0 & 1 & 8 & -1 & 1 & 70 \\
 \hline
 0 & 0 & 5 & 1 & 2 & 170
 \end{array} \right]
 \end{array}$$

- (a) Give the solution to the problem.
 (b) Give the solution to its dual.

Determine the dual problem of the given linear programming problem.

- 3) Minimize $3x + 4y$ subject to $\begin{cases} x + y \geq 10 \\ 2x + 3y \geq 30 \\ x \geq 0, y \geq 0 \end{cases}$

- 4) Maximize $9x + 15y$ subject to $\begin{cases} 2x + y \leq 17 \\ x + 2y \leq 12 \\ x + 3y \leq 16 \\ x \geq 0, y \geq 0 \end{cases}$

- 5) Minimize $2x + 5y + z$ subject to

$$\begin{cases}
 6x + 5y - 2z \geq 4 \\
 3x + z \geq 1 \\
 x \geq 0, y \geq 0, z \geq 0
 \end{cases}$$

- 6) Maximize $10x + 12y + 10z$ subject to

$$\begin{cases}
 x - 2y \leq 6 \\
 3x + z \leq 9 \\
 y + 3z \leq 12 \\
 x \geq 0, y \geq 0, z \geq 0
 \end{cases}$$

- 7) Determine the dual problem. Solve the dual by the simplex method and then give the solutions to both.

$$\text{Minimize } 20x + 30y \text{ subject to } \begin{cases} 2x + 4y \geq 10 \\ 5x + y \geq 16 \\ x \geq 0, y \geq 0 \end{cases}$$