

**OPRE 6398 Prescriptive Analytics
Solutions to Homework 2**

2. (1) It is seen from the Answer Report that there are 0 tons of wheat unused at optimality since the second constraint is binding with a slack of 0.
- (2) It is seen from the Answer Report that the total amount of noodle made exceeds the minimum production level required by 4.5 tons at optimality since the third constraint is nonbinding with a slack of 4.5.
- (3) It is seen from the Sensitivity Report that the current shadow price of labor is \$7/hour. Since $7 < 10$, the employee's offer should be rejected.
- (4) Since a decrease of 5 tons is less than the allowable decrease of 10 tons according to the Sensitivity Report, the current shadow price of \$40/pound will remain the same and the optimal total profit will decrease by $5(40) = \$200$.
- (5) A reduction of 35% in the per-ton profit margin of MR is equal to a decrease of $300(35\%) = \$105$. Since 105 is greater than the allowable decrease of 100 according to the Sensitivity Report, we cannot tell what the new optimal production plan will be without re-running Solver.
- (6) If the profit margin of ZT goes up to \$500 per ton, it represents an increase of $500 - 350 = 150$. Since 150 is less than the allowable increase of 175 according to the Sensitivity Report, the current production plan will remain optimal [but the optimal total profit will become $300(3.5) + 500(2) = \$2,050$].

3.

(a) Maximize $Z = 17y_1 + 25y_2 + 19y_3 + 48y_4$

$$\begin{array}{rcll} \text{Subject to:} & -8y_1 + 2y_2 & + 3y_4 & \geq 7 \\ & y_1 + & 14y_3 + 10y_4 & \leq 9 \\ & 25y_1 - 11y_2 + y_3 & & = -6 \\ & y_1, & y_4 & \geq 0 \\ & & y_2 & \text{UIS} \\ & & y_3 & \leq 0 \end{array}$$

b) Maximize $Z = 3y_1 - 5y_2 + 2y_3$

Subject to:

$$\begin{array}{rcl} y_1 + & 2y_3 & \leq 3 \\ -2y_1 + y_2 - & 3y_3 & = 2 \\ 3y_1 + 3y_2 - & 7y_3 & = -3 \\ 4y_1 + 4y_2 - & 4y_3 & \geq 4 \end{array}$$

$$y_1 \leq 0, y_2 \geq 0, y_3 \text{ is UIS}$$

c) Minimize $Z = 5y_1 - 4y_2 + y_3$

Subject to:

$$y_1 + 2y_2 + y_3 \geq 2$$

$$y_1 - y_2 + 0y_3 = 1$$

$$y_1 + 3y_2 - y_3 \geq 3$$

$$y_1 + 0y_2 + y_3 = 1$$

$y_1 \geq 0, y_3 \leq 0, y_2$ is UIS