

## MBA 515 - BLENDING PROBLEM - Prof. Richard B. Goldstein

American Foods produces two breakfast cereals: **Crunchies** and **Munchies**. Crunchies is a blend of wheat, oats, and rice. Munchies is a blend of wheat and oats. The cost per pound of wheat is \$0.60, oats are \$0.80, and rice is \$0.50. The cereals are sold to distributors: Crunchies for \$1.00 per pound and Munchies for \$0.90 per pound. The goal is to maximize the profit subject to the following constraints:

- (A) there is a daily demand for at least 500 lbs. of Crunchies
- (B) there is a daily demand for at least 400 lbs. of Munchies
- (C) Crunchies must be at least 40% wheat (by weight)
- (D) Crunchies must be at least 10% oats
- (E) Crunchies must be at most 30% oats
- (F) Munchies must be at least 50% wheat

Daily availability:

- (G) 400 lbs. of wheat
- (H) 300 lbs of oats
- (I) 500 lbs. of rice

Set up as a Linear Programming problem and solve on the computer. Include the Sensitivity Analysis.

Hint: Let  $X_1$  = lbs. of wheat used to make Crunchies  
 $X_2$  = lbs. of oats used to make Crunchies  
 $X_3$  = lbs. of rice used to make Crunchies  
 $X_4$  = lbs. of wheat to make Munchies  
 $X_5$  = lbs. of oats to make Munchies

	Wheat	Oats	Rice	Total
Crunchies	$X_1$	$X_2$	$X_3$	500
Munchies	$X_4$	$X_5$	-	400
Total	400	300	500	

SOLUTION/EQUATIONS :

$$\begin{aligned}
 \text{Max} \quad & 0.4x_1 + 0.2x_2 + 0.5x_3 + 0.3x_4 + 0.1x_5 \\
 \text{s.t.} \quad & x_1 + x_2 + x_3 \geq 500 \quad (\text{A}) \\
 & x_4 + x_5 \geq 400 \quad (\text{B}) \\
 & 0.6x_1 - 0.4x_2 - 0.4x_3 \geq 0 \quad (\text{C})^* \\
 & -0.1x_1 + 0.9x_2 - 0.1x_3 \geq 0 \quad (\text{D}) \\
 & -0.3x_1 + 0.7x_2 - 0.3x_3 \leq 0 \quad (\text{E}) \\
 & 0.5x_4 - 0.5x_5 \geq 0 \quad (\text{F}) \\
 & x_1 + x_4 \leq 400 \quad (\text{G}) \\
 & x_2 + x_5 \leq 300 \quad (\text{H}) \\
 & x_3 \leq 500 \quad (\text{I})
 \end{aligned}$$

Profit = 295

	Wheat	Oats	Rice	Total
Crunchies	200	50	250	500
Munchies	200	200	-	400
Total	400	250	250	

\* (C) is derived by:

$$\frac{X_1}{X_1 + X_2 + X_3} \geq 0.4 \Rightarrow X_1 \geq 0.4(X_1 + X_2 + X_3) \Rightarrow 0.6X_1 - 0.4X_2 - 0.4X_3 \geq 0$$