

**MATH 140: WEEK-IN-REVIEW 5 (3.4 & 4.1)**

Problem 1 *Are the following linear programming problems classified as standard maximization problems? Why or why not?*

(a) *OBJ: MAX* $P = 2x + 4y + 6z$

SUBJ TO: $x - 2y + 4z \leq 5$

$$x \geq y - 2$$

$$x \geq 0, y \geq 0, 0 \leq z \leq 3$$

(b) *OBJ: MAX* $P = 4x + 8y$

SUBJ TO: $2x + 5y \leq 50$

$$3x + 10y \leq 100$$

$$-x + 4y \leq -15$$

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



Problem 2 For the following linear programming problem, set up the initial simplex tableau, and determine the first pivot element.

$$\text{OBJ: MAX } P = 3x + 2y + 8z$$

$$\text{SUBJ TO: } x + 6y + 3z \leq 150$$

$$2x + y + 10z \leq 275$$

$$x \geq 0, 0 \leq y \leq 20, z \geq 0$$



Problem 3 *Box the next pivot element in the simplex process. Show work supporting your decision.*

$$\left[\begin{array}{cccccc|c} x & y & z & s_1 & s_2 & s_3 & P & \\ \hline 2/3 & 2 & 1 & 0 & 0 & 4 & 0 & 16 \\ 1 & 1/2 & 0 & 1 & 0 & -1 & 0 & 6 \\ -1/2 & -1 & 0 & 0 & 1 & 1/3 & 0 & 4 \\ \hline 10 & -4 & 0 & 0 & 0 & -5 & 1 & 5 \end{array} \right]$$

Problem 4 *Read the value of each variable shown in the simplex tableau below, and classify each variable as basic or non-basic.*

$$\left[\begin{array}{cccc|c} x & y & s_1 & s_2 & P & \\ \hline 0 & 6 & 1 & 3 & 0 & 73 \\ 1 & 5 & 0 & 2 & 0 & 25 \\ \hline 0 & -2 & 0 & 4 & 1 & 150 \end{array} \right]$$

What corner point does this solution correspond to, if the problem had been solved using the Method of Corners?

Is this solution the optimal solution to the corresponding linear programming problem? Why or why not?



Problem 5 *In each of the following, the variables from a final simplex tableau are read to have the given values.*

(i) *Is the solution a possible solution to a standard maximization linear programming problem? Why or why not?*

(ii) *If it is a possible solution and the variables actually represent real-world values in a word problem, are leftovers indicated? Why or why not?*

(a) $x = 50, y = 25, z = 0, s_1 = 0, s_2 = 20, s_3 = 0, P = 5000$

(b) $x = 6, y = 8, z = 9, s_1 = 0, s_2 = 0, s_3 = -1, P = 60$



Problem 6 Solve the following linear programming problem, using the Simplex Method.

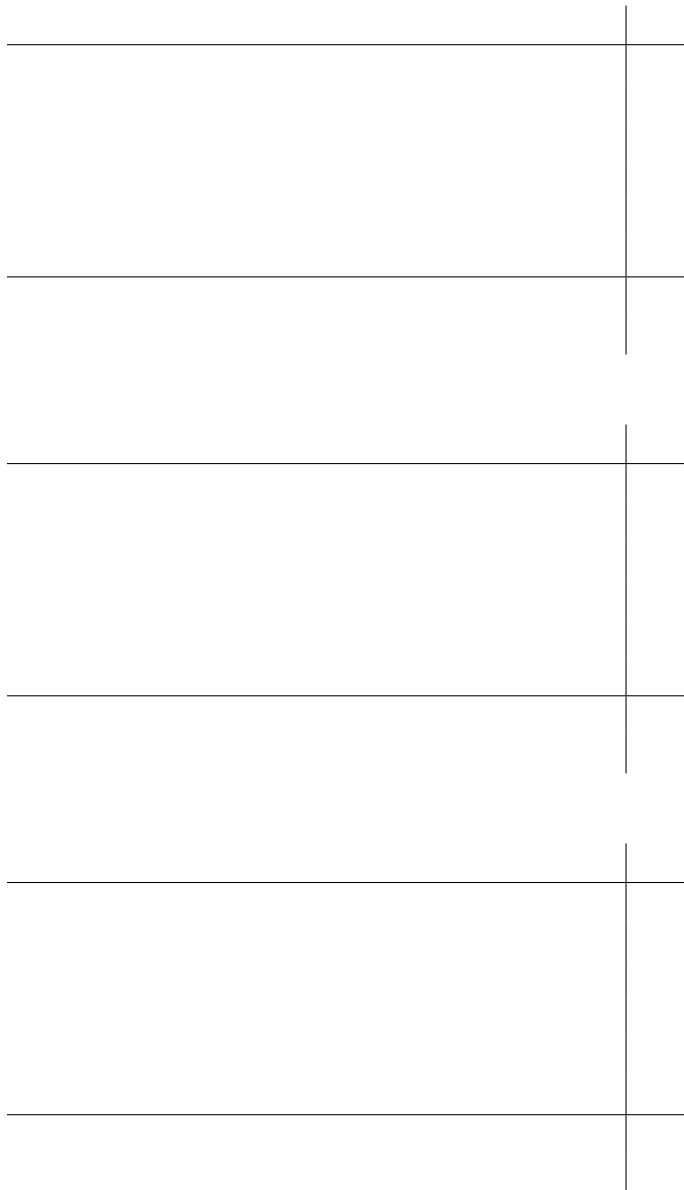
OBJ: $Max P = 8x + 5y$

SUBJ TO: $2x + y \leq 60$

$x + 7y \leq 80$

$x - y \leq 20$

$0 \leq x \leq 8, y \geq 0$





Problem 7 *Solve the following linear programming problem, using the Simplex Method.*

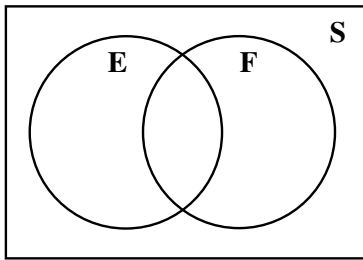
A crafter decides to make two sizes of decorated scrapbooks to sell: small and medium. Each small scrapbook uses 2 units of glitter, 1 package of stickers, and 1 embellishment. Each medium scrapbook uses 1 unit of glitter, 1 package of stickers and 2 embellishments. Each small scrapbook brings in a profit of \$30 and each medium scrapbook brings in a profit of \$40. If one week the crafter has 10 units of glitter, 7 packages of stickers and 12 embellishments with which to make all of her scrapbooks to sell that week, how many of each type should she make to maximize her profit that week? What is her maximum profit? Does she have any leftover materials?



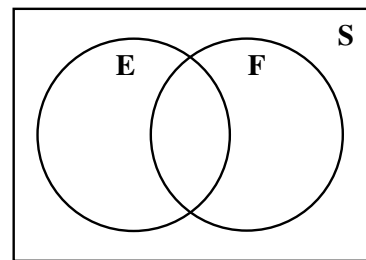


Problem 8 *Shade the area on the Venn diagram representing the given event.*

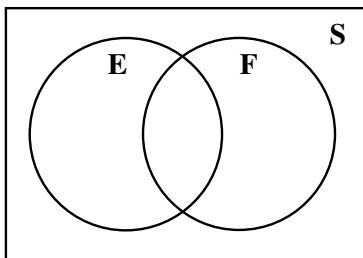
(a) F^C



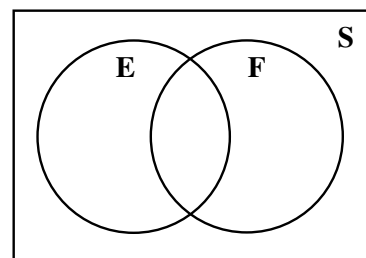
(b) $E \cup F$



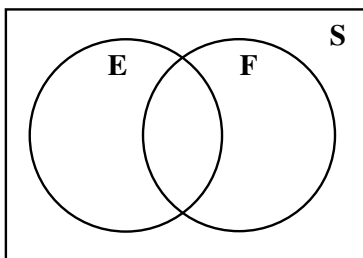
(c) $E \cap F^C$



(d) $(E \cap F)^C$



(e) $E^C \cup F$





Problem 9 You roll a fair 4-sided die and a fair 5-sided die, noting the numbers showing uppermost on each.

(a) Write an appropriate sample space for this experiment.

(b) Write the event, E , that a 2 is rolled.

(c) Write the event, F , that a sum of 3 or a sum of 4 is rolled.

(d) Write the event, G , that a sum of 10 is rolled.



(e) Write the event, H , that a 1 is rolled on the four-sided die.

(f) Write the event, K , that a sum of 5 is rolled.

(g) Verbally describe the event K^C .

(h) Are events H and K mutually exclusive? Why or why not?



Problem 10 *You toss a fair coin three times and note the side landing up on each toss.*

(a) *Write an appropriate sample space for this experiment.*

(b) *Write the event, E , that the third toss is “heads.”*

(c) *Write the event, F , that all tosses land on “tails.”*

(d) *Write the event $E \cup F$.*

(e) *Write the event $E \cap F$.*

(f) *Are event E and F mutually exclusive? Why or why not?*



Problem 11 You choose one card at random from a well-shuffled standard 52-card deck, noting the suit drawn, and then you choose a number at random from a bowl containing three pieces of paper, numbered 1-3, noting the number drawn.

(a) How many outcomes are in the sample space, S , of this experiment?

(b) How many simple events does this experiment have? Write one.

(c) How many total possible events does this experiment have?

(d) Write the event, E , that an odd number is drawn from the bowl.

(e) Write the event, F , that a black card and a number larger than 1 is drawn from the bowl.

(f) Write the event, G , that a heart is not drawn or a number less than 3 is drawn from the bowl.



Problem 12 Let the sample space, S , be the set of all people who watch TV.

Let A be the event that a person watches soap operas on TV.

Let G be the event that a person watches game shows on TV.

Let P be the event that a person watches sports on TV.

(a) Verbally describe the outcomes in each of the following events.

(i) A^C

(ii) $A \cap P^C$

(iii) $A \cup G \cup P$

(iv) $G \cap (A \cup P)$



Let the sample space, S , be the set of all people who watch TV.

Let A be the event that a person watches soap operas on TV.

Let G be the event that a person watches game shows on TV.

Let P be the event that a person watches sports on TV.

(b) Write each of the following using symbolic notation.

(i) The event that “a TV watcher watches soap operas or game shows.”

(ii) The event that “a TV watcher watches game shows, but not sports.”

(iii) The event that “a TV watcher watches only sports.”

(iv) The event that “a TV watcher watches soap operas or game shows, but not both.”