

Fall 2018
Math 140 Week-in-Review #6
Exam 2 Review

courtesy: Kendra Kilmer

(covering Sections 3.1-3.4, 4.1-4.4)

(Please note that this review is not all inclusive)

1. An experiment consists of rolling a fair four-sided die and drawing one marble out of a bowl containing 3 red, 7 blue, and 4 green marbles. The number landing facing up on the die and the color of the marble is observed.
 - (a) Find the sample space associated with the experiment.

 - (b) Find the event, E , that a number less than 3 is rolled.

 - (c) Find the event, F , that a green marble is selected.

 - (d) Are the events E and F mutually exclusive?

 - (e) How many events does this experiment have?

2. An experiment consists of flipping a fair coin (and observing whether it lands on heads or tails) and then randomly drawing one card out of a standard deck of cards and observing the rank of the card.

Note about the composition of a standard deck of cards: A standard deck of 52 cards has four suits (hearts, diamonds, clubs, and spades). Each suit has thirteen ranks (A,2,3,4,5,6,7, 8,9,10,J,Q,K). There are three face cards in each suit (J,Q,K). The hearts and diamonds are red. The clubs and spades are black.

 - (a) How many outcomes are in the sample space?

 - (b) How many outcomes are in the event that the card is an even number and the coin lands on tails?

 - (c) How many outcomes are in the event that the coin lands on heads or a face card is not drawn?

3. A pair of fair five-sided dice is rolled. What is the probability that
 - (a) exactly one of the dice lands on an even number and the sum of the dice is at most 5?

 - (b) the sum of the dice is six or at least one of the dice is showing a 3?

4. An experiment has a sample space, $S = \{a, b, c, d\}$ with a partially completed probability distribution given below. If $E = \{a, c\}$, $F = \{b, c\}$, and $G = \{a, b\}$, complete the probability distribution and then use it to answer the questions below.

Outcome	a	b	c	d
Probability	0.35		0.25	0.3

- (a) What is $P(E^c \cup F)$?
- (b) What is $P((E \cap F^c) \cup G)$?
5. If $P(E \cup F) = 5/7$, $P(E) = 32/63$, and $P(F) = 8/21$ what is $P(E \cup F^c)$?
6. A survey was done of Kindergarteners, First Graders, and Second Graders at a particular school. Each kid was asked how many Halloween activities they participated in. The results are given below:

	0	1	2	> 2	Total
Kinder	5	10	15	20	50
First	2	15	25	35	77
Second	3	10	30	40	83
Total	10	35	70	95	210

- (a) What is the probability that a randomly selected kid was not in second grade and participated in at most one Halloween activity?
- (b) What is the probability that a randomly selected kid participated in more than two Halloween activities or was not a First Grader?
7. A bowl contains four slips of paper with one number (1, 6, 9, 14) written on each slip of paper. An experiment consists of randomly selecting two slips of paper out of the bowl. Let X represent the sum of the two numbers. Find the probability distribution of X . What is the expected sum of the two numbers?

8. Chris and Katie decide to play a game that consists of randomly selecting one card out of a deck. If the card is a face card, Chris pays Katie \$2. If the card is a number between 5 and 10, inclusive, Katie pays Chris \$3. Otherwise, Chris pays Katie \$A. What value of A makes this game fair?

9. Determine graphically the solution set for the following system of linear inequalities.

$$x + 2y \leq 4$$

$$2x + y \leq 6$$

$$2x - y \geq -1$$

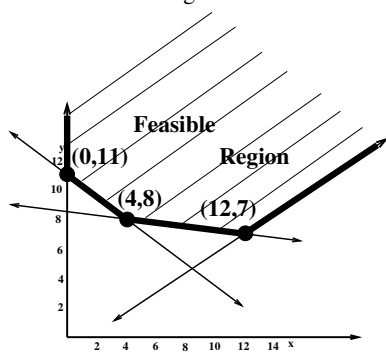
$$x \geq 0, y \geq 0$$

10. Clean-Hair Inc. produces three kinds of shampoos. It takes 2.5 hours to produce 1,000 bottles of formula I, 3 hours to produce 1,000 bottles of formula II, and 4 hours to produce 1000 bottles of formula III. The profits for each 1000 bottles of formula I, formula II, and formula III are \$180, \$200, and \$300 respectively. Suppose for a certain production run, there are enough ingredients on hand to make at most 9,000 total bottles of shampoo. Furthermore, suppose the time for the production run is limited to a maximum of 70 hours and they want to make no more than twice as many bottles of formula I as formula II. How many bottles of each formula should be produced in order to maximize the profit? Set-up the Linear Programming Problem but DO NOT SOLVE.

11. Solve the following linear programming problem using the Method of Corners and then solve using the Simplex Method.

Maximize $P = 10x + 2y$
Subject to $x + y \leq 12$
 $2x + y \leq 16$
 $x \geq 0, y \geq 0$

12. Use the feasible region below to find the maximum and minimum value(s) of $P = 3x + 4y$.



13. A restaurant makes three types of marinades: Bubba's Sauce, Hot & Tangy Sauce, and Mama's Secret Sauce. Although these sauces are each very special in their own way, they all contain garlic salt, pepper, and oregano. The table below lists the amount required for each bottle and the current inventory of the spices.

	Bubba's	Hot & Tangy	Mama's	Inventory
Garlic Salt	3 tsp.	4 tsp.	5 tsp.	725 tsp.
Pepper	1 tsp.	0.5 tsp.	0.75 tsp.	130 tsp.
Oregano	1 tsp.	0 tsp.	1 tsp.	70 tsp.

- Each bottle of Bubba's Sauce sells for \$8, Hot & Tangy Sauce sells for \$5, and Mama's Secret Sauce sells for \$6.

Here is the initial simplex tableau:

$$\left[\begin{array}{ccccccc|c} x & y & z & s_1 & s_2 & s_3 & R & \text{constant} \\ 3 & 4 & 5 & 1 & 0 & 0 & 0 & 725 \\ 1 & 0.5 & 0.75 & 0 & 1 & 0 & 0 & 130 \\ 1 & 0 & 1 & 0 & 0 & 1 & 0 & 70 \\ \hline -8 & -5 & -6 & 0 & 0 & 0 & 1 & 0 \end{array} \right]$$

Here is the final simplex tableau:

$$\left[\begin{array}{ccccccc|c} x & y & z & s_1 & s_2 & s_3 & R & \text{constant} \\ 0 & 0 & 0.8 & 0.2 & -1.6 & 1 & 0 & 7 \\ 0 & 1 & 1.1 & 0.4 & -1.2 & 0 & 0 & 134 \\ 1 & 0 & 0.2 & -0.2 & 1.6 & 0 & 0 & 63 \\ \hline 0 & 0 & 1.1 & 0.4 & 6.8 & 0 & 1 & 1174 \end{array} \right]$$

- (a) How many bottles of each type of marinade should be made from the available inventory in order to maximize the revenue?

- (b) After maximizing the revenue, is there any inventory left over?

Multiple Choice and True/False Questions:

14. Determine whether each of the following statements is True or False.

- (a) If you were asked to graph the inequality $y < -x + 5$, you would draw a solid line to represent $y = -x + 5$ and then shade below the line.
 (b) A simple event is an event that contains exactly one outcome.
 (c) The probability distribution for a random variable is given below. The value of c must be 0.52.

x	5	7	9
$P(X = x)$	0.36	c	0.12

- (d) If one card is randomly selected from a standard deck of cards, the probability that it is a club or a jack is $\frac{17}{52}$.

15. In graphing the system of linear inequalities below, what are the corner points of the solution set?

$$-x + 2y \leq 1$$

$$5x + 7y \geq -5$$

$$-11x + 5y \geq -91$$

- (a) $(-1, 0)$ and $(11, 6)$ only
 (b) $(-1, 0)$, $(11, 6)$, and $(6, -5)$ only
 (c) $(-1, 0)$, $(11, 6)$, and $\left(\frac{91}{11}, 0\right)$ only
 (d) $(11, 6)$ and $\left(\frac{91}{11}, 0\right)$ only
 (e) None of the above

16. A company manufactures small and large picture frames. A small picture frame costs \$2.00 to make and requires 1 unit of glass and 3 units of metal. A large picture frame costs \$3.50 to make and requires 2 units of glass and 4 units of metal. The company has 100 units of glass available, 400 units of metal available, and they want to make no more than four times as many large picture frames as small picture frames. How many picture frames of each size should the company manufacture if they want to minimize their cost?

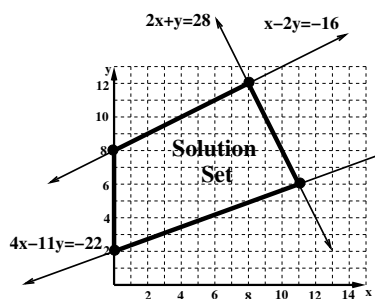
Which of the following linear programming problems would need to be solved to answer the above question? (Note: x is the number of small picture frames they manufacture and y is the number of large picture frames they manufacture.)

- (a) Minimize $C = 2x + 3.5y$
 Subject to $x + 2y \geq 100$
 $3x + 4y \geq 400$
 $y \leq 4x$
 $x \geq 0, y \geq 0$
- (b) Minimize $C = 2x + 3.5y$
 Subject to $x + 2y \leq 100$
 $3x + 4y \leq 400$
 $4y \leq x$
 $x \geq 0, y \geq 0$

- (c) Minimize $C = 2x + 3.5y$
 Subject to $x + 3y \leq 100$
 $2x + 4y \leq 400$
 $4y \leq x$
 $x \geq 0, y \geq 0$
- (d) Minimize $C = 2x + 3.5y$
 Subject to $x + 2y \leq 100$
 $3x + 4y \leq 400$
 $y \leq 4x$
 $x \geq 0, y \geq 0$

17. What system of linear inequalities would yield the solution set below?

- (a) $x - 2y \geq -16, 4x - 11y \geq -22, 2x + y \geq 28, x \geq 0, y \geq 0$
 (b) $x - 2y \geq -16, 4x - 11y \leq -22, 2x + y \leq 28, x \geq 0, y \geq 0$
 (c) $x - 2y \leq -16, 4x - 11y \leq -22, 2x + y \geq 28, x \geq 0, y \geq 0$
 (d) $x - 2y \leq -16, 4x - 11y \geq -22, 2x + y \leq 28, x \geq 0, y \geq 0$
 (e) None of the above



18. Below is the FINAL Simplex Tableau for a linear programming problem. What is the value of $y + 2z - s_1$?

x	y	z	s_1	s_2	s_3	P
1	$2/3$	0	0	$9/2$	$5/7$	8
0	$-4/3$	1	0	$7/4$	$-9/8$	17
0	$5/3$	0	1	$-7/4$	$3/8$	3
0	$7/3$	0	0	$16/3$	$2/3$	105

- (a) 23
 (b) 31
 (c) $2/3$
 (d) 39
 (e) None of the above
19. An experiment consists of selecting one card at random from a standard 52 card deck. What is the probability that a club and a face card is drawn?
 (a) $11/26$
 (b) $25/52$
 (c) $3/52$
 (d) $1/4$
 (e) None of the above
20. A bowl consists of one red marble, one green marble, and one yellow marble. John randomly selects a sample of two marbles from the bowl. If there are no green marbles in his sample, he pays Jaelan \$3. Otherwise, Jaelan pays John \$A. What value of A makes this game fair? (Answers are given to the nearest penny.)
 (a) \$1.50
 (b) \$0.67
 (c) \$1.00
 (d) \$1.75
 (e) None of the above