



EXAM 2 REVIEW OVER CHAPTERS 3 AND 4

- Setting Up Linear Programming Problems
- Graphing Systems of Linear Inequalities in Two Variables
- Graphical Solution of Linear Programming Problems
- Mathematical Experiments
- Basics of Probability
- Rules of Probability
- Probability Distributions and Expected Value

Pr 1. In an experiment, a fair standard 10-sided die is rolled, noting whether or not the number facing is a multiple of 5, and then a card is drawn from a well-shuffled deck, and noting the suit. Write the sample space for the experiment. Let A be the event that a red card is drawn, and let B be the event that a multiple of 5 is rolled.

(a) Write the sample space for the experiment that a red card is drawn.

(b) Is A a simple event?

(c) How many outcomes, simple events, and total events are there?

(d) Are A and B mutually exclusive? Why or why not?

(e) Construct the symbolic notation for the event 'a multiple of 5 is rolled or a red card is not drawn'.

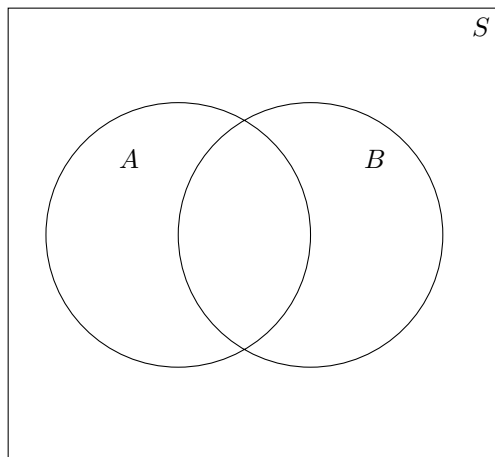
Pr 2. Suppose that we surveyed 1000 Math 140 students. We found that 750 of them have attended at least one BMTA office hour, and 200 students have attended at least one WIR. Suppose that 150 students have not gone to any office hours or WIRs.

Let A be the event that a student attended an office hour, and let B be the event that a student attended at least one WIR.

(a) Verbally describe the event $A \cap B^C$.

(b) Compute $P(A \cap B^C)$.

(c) Shade $A \cap B^C$ on the Venn Diagram. Your answer must be obvious to the instructor.



Pr 3. A survey of 50 veterans from the Air Force and Navy was taken to gather information on their service career and what life is like outside of the military. A breakdown of those surveyed is shown in the table. Suppose a randomly selected veteran from the Air Force or Navy is interviewed. What is the probability the person chosen is

	Air Force	Navy	Total
Private	5	8	13
Corporal	11	8	19
Sergeant			
Lieutenant		2	4
Captain	2		5
Total	25	25	50

(a) $P(\text{is a Corporal or in the Navy})$

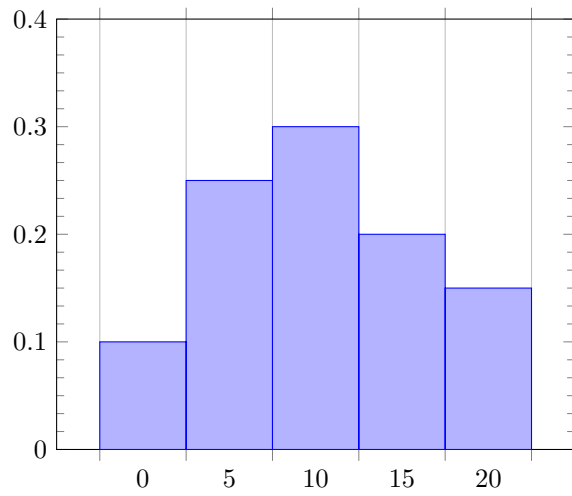
(b) $P(\text{in the Air Force or in the Navy})$

(c) $P(\text{is a Private and a Lieutenant})$

(d) $P(\text{is not in the Air Force, but is a Sergeant})$

(e) $P(\text{is not a Captain and is in the service})$

Pr 4. Consider the following histogram for a random variable X :



(a) Compute $P(X = 5)$

(b) Compute $P(X > 10)$

(c) Compute $P(5 < X \leq 15)$

Pr 5. Consider the experiment of rolling two distinguishable, fair four-sided die and then observing the sum of the two numbers appearing on the two uppermost faces.

(a) Write down the probability distribution for this experiment.

(b) Is the probability distribution uniform?

(c) Compute the probability that the sum is a multiple of 3?

Pr 6. A student organization decides to raise money at Maroon Night in downtown Bryan, using a game. The organization has a bag with 100 plushies in it. A contestant pulls a plushie out of the bag uniformly at random. If the contestant pulls out the only plush Reveille, they earn \$100. If they pull out one of the twenty-eight plush fish, they earn a dollar. The remaining plushies are all longhorns, and pulling one of those earns a hiss (and earning zero dollars).

(a) Let X be the random variable representing the amount won playing the game. What are the outcomes of X ?

(b) Write down the probability distribution for X .

(c) Compute the expected winnings of playing the game.

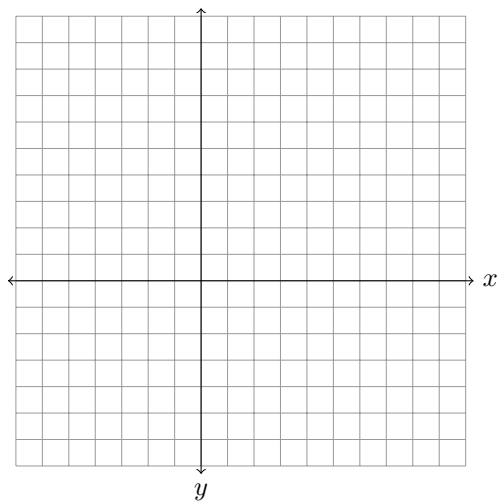
(d) How much should the student organization charge to play if they want the game to be fair?

Pr 7. Graph the system of inequalities below. Then determine if the solution set is bounded or unbounded and find all corner points of the solution set.

$$2x + y \geq 9$$

$$2x - 3y < 12$$

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

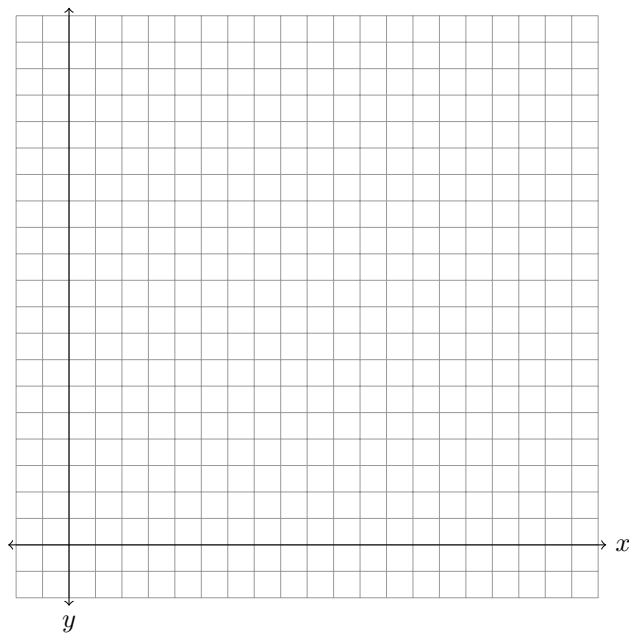


Pr 8. A breakfast diner sells a few different versions of biscuits and gravy. Their small plate consists of one biscuit, and two servings of gravy. Their large plate has two biscuits, and three servings of gravy. They currently have 300 biscuits and 600 servings of gravy, and they always sell at least twice as many large plates as small plates.

If they charge \$6 for the small plate, and \$12 for the large plate, then how many of each type of order of biscuits and gravy should they sell to maximize their revenue?

(a) Set up the linear programming problem.

(b) Graph the system of inequalities.



(c) Does the corresponding linear program have a solution? Why or why not?

(d) Identify the corner points of the feasible region.

(e) Use the method of corners to solve the linear programming problem.

(f) Suppose that they change the price to charge \$8 for the small plate. Now what is the optimal solution? Are there any leftovers?

Pr 9. For the following simplex tableau, identify the pivot row, pivot column, and pivot element. Also, identify the basic variables, non-basic variables, and the corresponding solution. Is the solution optimal?

$$(a) \left[\begin{array}{cccc|c} x & y & s_1 & s_2 & P & \text{constant} \\ 0 & 2 & 1 & 0 & 0 & 8 \\ 1 & \frac{1}{2} & 0 & \frac{1}{2} & 0 & 5 \\ \hline 0 & -1 & 0 & -\frac{3}{2} & 1 & 15 \end{array} \right]$$

$$(b) \left[\begin{array}{cccc|c} x & y & s_1 & s_2 & s_3 & P & \text{constant} \\ \frac{2}{3} & 0 & 1 & 0 & 0 & 0 & 2 \\ -1 & -1 & 0 & 1 & 0 & 0 & 1 \\ 3 & \frac{1}{3} & 0 & 0 & 1 & 0 & 4 \\ \hline -3 & -2 & 0 & 0 & 0 & 1 & 0 \end{array} \right]$$

$$(c) \left[\begin{array}{cccc|c} x & y & z & s_1 & s_2 & P & \text{constant} \\ 0 & 2 & 1 & 0 & 0 & 0 & 8 \\ 1 & \frac{1}{2} & 0 & \frac{1}{3} & 0 & 0 & 5 \\ \hline 0 & \frac{1}{2} & 0 & 2 & \frac{3}{2} & 1 & 15 \end{array} \right]$$

Pr 10. A 4-H member raises only goats and pigs. She has pen space for no more than 18 animals. She spends \$30 to raise each goat and \$60 to raise each pig and she has \$900 available for this project. Each goat produces \$15 in profit and each pig \$30 in profit. We find that the corresponding linear programming problem is given by:

$$\begin{aligned} &\text{maximize } P = 15x + 30y \\ &\text{subject to: } y \leq 18 - x \\ &\qquad\qquad\qquad 900 - 30y \geq 60x \\ &\qquad\qquad\qquad x \geq 0, y \geq 0 \end{aligned}$$

- (a) Is this a standard maximization problem?
- (b) Convert the constraints of a linear programming problem to linear equations with slack variables.
- (c) Construct the simplex tableau for this linear programming problem.
- (d) Identify the pivot row, pivot column, and pivot entry for the tableau.

A 4-H member raises only goats and pigs. She has pen space for no more than 18 animals. She spends \$30 to raise each goat and \$60 to raise each pig and she has \$900 available for this project. Each goat produces \$15 in profit and each pig \$30 in profit. Suppose that, after one pivot, we obtain the following tableau:

$$\left[\begin{array}{ccccc|c} x & y & s_1 & s_2 & P & \text{constant} \\ \frac{1}{2} & 0 & 1 & -\frac{1}{60} & 0 & 3 \\ \frac{1}{2} & 1 & 0 & \frac{1}{60} & 0 & 15 \\ \hline 0 & 0 & 0 & \frac{1}{2} & 1 & 450 \end{array} \right]$$

(e) What are the basic and non-basic variables?

(f) What is the corresponding solution for this tableau? Is this solution an optimal solution?

(g) Identify all leftovers, if there are any.