Section 3.4: Simplex Method

- Linear programming problem - standard form, introducing slack variables, constructing simplex tableau.
- pivot column, pivot row, and pivot element for a given simplex tableau.
- basic and non-basic variables, optimal solution, leftovers.
- Use technology to perform pivots on a simplex tableau to put the tableau in final form.

Pr 1. Determine if the following linear programming problems are standard maximization problems. If they are, then convert the constraints of the linear programming problem to linear equations with slack variables, and right down the corresponding tableau.

(a)

$$\begin{aligned} \text{maximize } & P = 2x + y \\ \text{subject to: } & 2y \leq 9 - x \\ & 8 - y \leq x \\ & x \geq 0, y \geq 0 \end{aligned}$$

(b)

$$\begin{aligned} \text{Maximize } & R = y - x \\ \text{subject to: } & 3y \leq 18 - 2x \\ & y - 2x + 10 \geq 0 \\ & x \geq 0, y \geq 0 \end{aligned}$$

Pr 2. For the following simplex tableau, identify the pivot row, pivot column, and pivot element.

(a)

x	y	s_1	s_2	P	constant
0	2	1	0	0	8
1	$\frac{1}{2}$	0	$\frac{1}{2}$	0	5
0	$\frac{-1}{2}$	0	$\frac{3}{2}$	1	15

(b)

x	y	s_1	s_2	s_3	P	constant
1	0	1	0	0	0	1
-1	-1	0	1	0	0	2
3	$\frac{1}{3}$	0	0	1	0	200
-2	-3	0	0	0	1	0

(c)

x	y	z	s_1	s_2	P	constant
0	2	1	0	0	0	8
1	$\frac{1}{2}$	0	$\frac{1}{3}$	0	0	5
0	$\frac{1}{2}$	0	2	$\frac{3}{2}$	1	15

Pr 3. For the following simplex tableau, identify the basic and non-basic variables. State the solution corresponding to the tableau, and determine if it is an optimal solution.

(a)

x	y	s_1	s_2	P	constant
0	2	1	0	0	8
1	$\frac{1}{2}$	0	$\frac{1}{2}$	0	5
0	$\frac{-1}{2}$	0	$\frac{3}{2}$	1	15

(b)

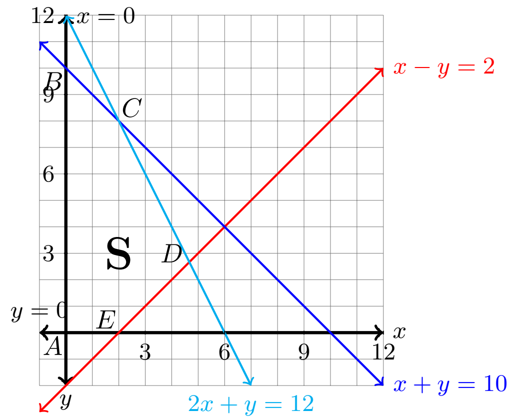
x	y	s_1	s_2	s_3	P	constant
1	0	1	0	0	0	1
-1	-1	0	1	0	0	2
3	$\frac{1}{3}$	0	0	1	0	200
-2	-3	0	0	0	1	0

(c)

x	y	z	s_1	s_2	P	constant
0	2	1	0	0	0	9
1	$\frac{1}{2}$	0	$\frac{1}{3}$	0	0	2
0	$\frac{1}{2}$	0	2	$\frac{3}{2}$	1	42

Pr 4. Solve using the simplex method. For each tableau, identify the corresponding corner point.

x	y	s_1	s_2	s_3	P	constant
2	1	1	0	0	0	12
1	−1	0	1	0	0	2
1	1	0	0	1	0	10
−4	−1	0	0	0	1	0



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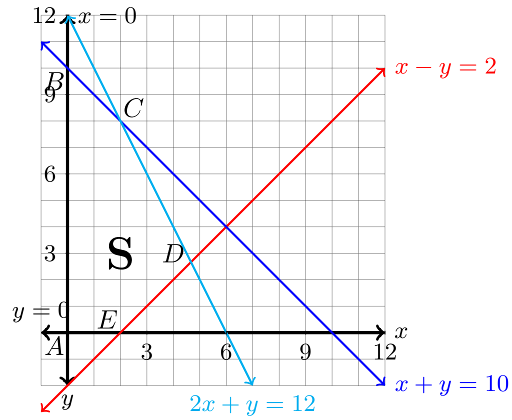


Pr 5. Solve.

Your burger company sells three different types of patty melts - the Big cheesy, the double decker, and the classic. These patty melts all use different amounts of cheese (slices), bread (slices), and patties, as given in the table.

	Cheese	Bread	Patties
Big Cheesy	3	2	2
Double Decker	2	3	2
Classic	1	2	1

The profit for the Big Cheesy is \$1, for the Double Decker is \$2 and for the Classic is \$1. Due to certain agreements, the company can make at most 250 Double Deckers. If the company has 300 slices of cheese, 600 slices of bread, and 800 beef patties, how many of each type of patty melt should be produced in order to maximize the profit? Are there any leftovers?

Section 4.1: Mathematical Experiments

- Sample space, **S** - a list of all possible outcomes in the mathematical experiments
- Event - a subset of the sample space
  - Simple Event
  - Certain Event
  - Impossible Event
- Using tree diagrams to determine a sample space in a two-stage experiment
- Venn Diagrams
- Operations on Events
  - Complement, A^C
  - Intersection, $A \cap B$
  - Union, $A \cup B$
- Mutually Exclusive Events

Pr 1. State the sample space for each experiment:

(a) Selecting a letter at random from the word "mathematics" and noting the letter.

(b) Identical ping pong balls are numbered 0 to 10, one ping pong ball is drawn at random, noting the number on the ball.

(c) A standard 120-sided die is rolled and it is noted whether the number is a multiple of 3 or is not a multiple of 3.

(d) The numbers 0, 1,2, 3, and 4 are written on separate pieces of paper and put in a hat. Two pieces of paper are drawn at the same time and the product of the numbers is noted.

(e) A card is drawn from a standard deck of 52-cards, noting the color, and then a fair 4-sided die is rolled, noting which number is on the bottom face.

Pr 2. Consider the experiment of selecting a letter at random from the word "business" and noting the letter.

(a) State all the simple events for the experiment.

(b) State the certain event for the experiment.

(c) Give an example of an impossible event for the experiment.

(d) State the total number of possible events.

(e) Write the outcomes in the event, J, "a consonant is draw."

Pr 3. A card is drawn from a standard deck of 52-cards, noting the color, and then a fair 4-sided die is rolled, noting which number is on the bottom face.

(a) State all the simple events for the experiment.

(b) State the certain event for the experiment.

(c) Give an example of an impossible event for the experiment.

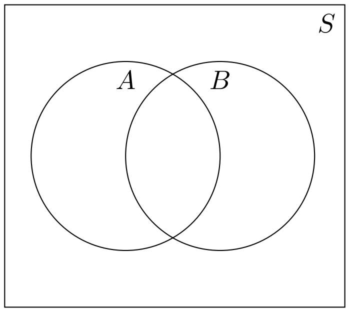
(d) State the total number of possible events.

(e) Write the outcomes in the event, M, "a red card is drawn or the die lands on an even number."

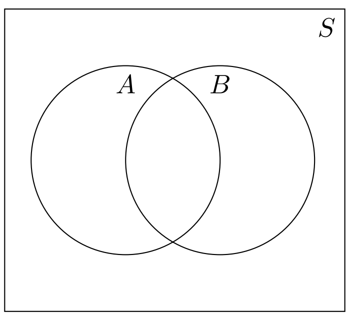
Pr 4. Let A and B be two events of the sample space, S.

Use a two-circle Venn diagram to illustrate which region(s) contain the outcomes of the resulting events.

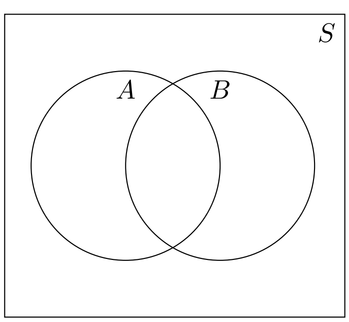
a. $B \cap A^C$



b. $(A \cap B) \cup A^C$



c. $(A^C \cap B)^C$



Pr 5. An experiment consists of rolling a six-sided die, noting the number showing uppermost and then spinning a spinner with four equal regions (red, white, blue, and maroon), noting the color.

Let

$V :=$ the event "a number greater than 3 is rolled"

$W :=$ the event "an odd is rolled"

$X :=$ the event "the spinner lands on blue"

$Y :=$ the event "the spinner lands on a color other than maroon"

$Z :=$ the event "the spinner lands on white or maroon."

(a) Write the symbolic notation for the event, D, that "an even is rolled or the spinner lands on white or maroon."

(b) Write the symbolic notation for the event, H, that "a number less than or equal to 3 is rolled or the spinner lands on a color other than maroon, but not blue."

(c) Describe the event $Y^C \cap W$.

(d) Describe the event $W \cup (Y^C \cup Z^C)$

(e) Are event V and event W mutually exclusive? Explain why or why not.