

104 Venn Diagrams

Sample Space: The set of all possible outcomes for a chance process.

Event/Subset: An outcome or set of outcomes from the sample space.

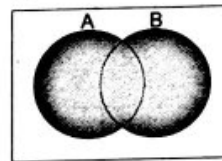
Complement (A^c): "Not" $\sim A$

- All outcomes in the sample space that are not part of the event.

Chance Process	Sample Space	Event/Subset	Complement
Flip a coin	$S = \{\text{heads, tails}\}$	$B = \{\text{heads}\}$	$B^c = \{\text{tails}\}$
Roll a die	$S = \{1, 2, 3, 4, 5, 6\}$	even numbers $E = \{2, 4, 6\}$	$E^c = \{1, 3, 5\}$
Pick a letter in the word "probability"	$S = \{P, R, O, B, A, I, L, T, Y\}$	vowels $V = \{O, A, I, Y\}$	$V^c = \{P, R, B, L, T\}$

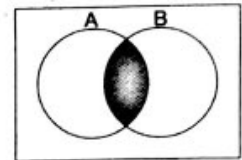
Union ($A \cup B$): "Or", "Either"

- All of the elements that are in A or B or both.



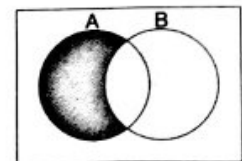
Intersection ($A \cap B$): "And", "Both", "Overlap", "In common"

- All of the elements that are in both A and B .
- If the two sets don't have anything in common, the intersection is the "empty set", indicated by \emptyset or $\{ \}$.



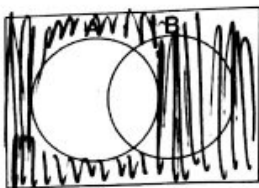
Note: If you want to write "everything in A that isn't in B ," you can write either

$A \cap B^c$ or $A - B$. *Subtract sign "take away"* *erase*

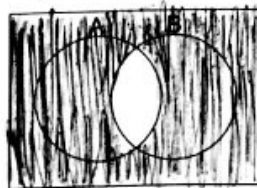


Examples: Shade the appropriate portion of the Venn diagram.

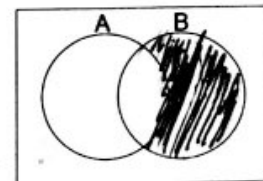
1. A^c



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



3. $B - A$ *Take away*



Examples:

- Chance Process: Rolling a 10-sided die.
 - Event A: Rolling an odd number
 - Event B: Rolling a prime number

a. What is the sample space?

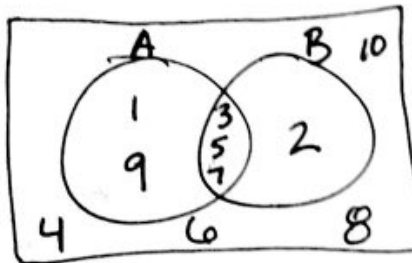
$$S = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$$

b. List the outcomes in each event.

$$A = \{1, 3, 5, 7, 9\}$$

$$B = \{2, 3, 5, 7\}$$

c. Draw a Venn diagram representing the sample space with subsets A and B.



d. List all the outcomes in $A \cup B$.
 ← union "or"
 $\{1, 2, 3, 5, 7, 9\}$



e. List all the outcomes in $A \cap B$.
 ↓ Intersect "and"
 $\{3, 5, 7\}$



f. List all the outcomes in A^c .
 ← not
 Everything not in A
 $\{2, 4, 6, 8, 10\}$



g. List all the outcomes in $(A \cup B)^c$.
 ← not
 Everything not in A or B
 $\{4, 6, 8, 10\}$



h. List all the outcomes in $A - B$.
 Everything in A but not in B
 $\{1, 9\}$



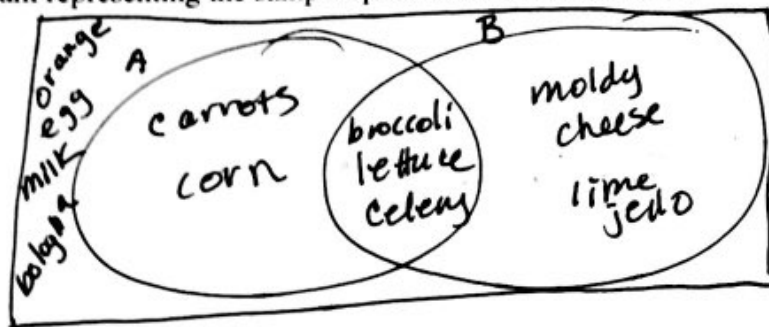
- Chance Process: Reaching into a messy refrigerator and grabbing a food at random.
- Sample Space: $S = \{\text{broccoli, carrots, moldy cheese, milk, orange, lettuce, lime jello, bologna, egg, corn, celery}\}$
 - Event A: Picking a vegetable
 - Event B: Picking something green

a. List the outcomes in each event.

$$A = \{\text{broccoli, carrot, lettuce, corn, celery}\}$$

$$B = \{\text{moldy cheese, ~~milk, bologna~~, lime jello, broccoli, lettuce, celery}\}$$

b. Draw a Venn diagram representing the sample space with subsets A and B.



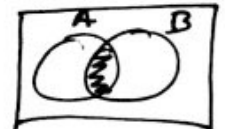
c. List all the outcomes in $A \cup B$.

$$\{\text{carrots, corn, broccoli, lettuce, celery, moldy cheese, lime jello}\}$$



d. List all the outcomes in $A \cap B$.

$$\{\text{broccoli, lettuce, celery}\}$$



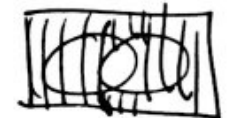
e. List all the outcomes in B^c .

$$\{\text{carrots, orange, egg, corn, milk, bologna}\}$$



f. List all the outcomes in $(A \cap B)^c$.

$$\{\text{orange, egg, milk, bologna, carrots, corn, moldy cheese, lime jello}\}$$



g. List all the outcomes in $B - A$.

$$\{\text{moldy cheese, lime jello}\}$$



Examples:

A political ad was run on TV and on radio.

- 33% of people saw it on TV.
- 21% heard it on the radio.
- 10% of people both saw it on TV and heard it on the radio.

Determine what percent:

a) only saw it

23%

b) only heard it

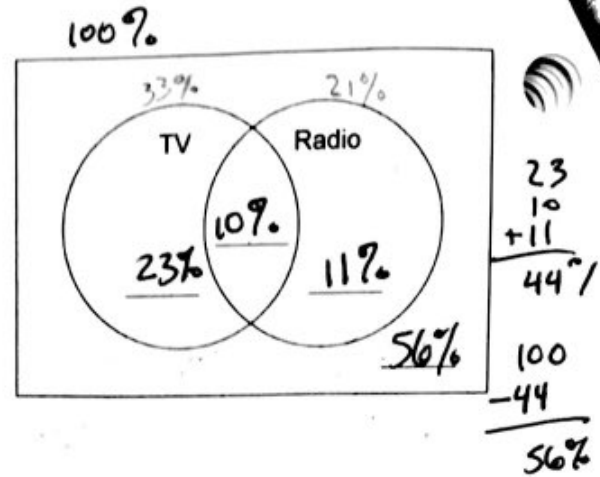
11%

c) neither heard it or saw it

56%

d) did not see it

$11 + 56 = 67\%$



A sample of 60 people are asked if they enjoy watching basketball and if they enjoy watching football.

- 25 people say they enjoy watching football
- 40 people say they enjoy watching basketball
- 15 people say they enjoy watching both

Determine how many people:

a) enjoy football but not basketball

10

b) enjoy basketball but not football

25

c) don't enjoy either basketball or football

10

d) don't like football

$25 + 10 = 35$

