

Working with Sets

A Set is a well-defined collection of distinct objects. Each object in a set is called an **element** of the set. A set is often denoted by writing the elements in braces. { }

The set with **no elements** is an empty set denoted by \emptyset .

The set of **all elements** under consideration is the Universal Set denoted by U.

Identifying the number of elements in a set is important for calculating probabilities.

Set	Set Notation	Number of elements in the Set
Universal Set (U) is all natural numbers less than 10.	$U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$	$n(U) = 9$
Set A is the set of prime numbers less than 10.	$A = \{2, 3, 5, 7\}$	$n(A) = 4$
Set B is the set of even natural numbers less than 10.	$B = \{2, 4, 6, 8\}$	$n(B) = 4$
Set C is the set of natural numbers less than 10 that are a multiple of 4.	$C = \{4, 8\}$	$n(C) = 2$

Term	Notation	Example	Venn Diagram
A <u>Subset</u> exists when every element of one set is part of another set.	$C \subset B$ Inside	$B: \{2, 4, 6, 8\}$ $C: \{4, 8\}$ all elements of set C are part of set B	
An <u>Intersection</u> of sets is the similar elements in both sets.	$A \cap B$	$A: \{1, 2, 3, 5, 7\}$ $B: \{2, 4, 6, 8\}$ $A \cap B: \{2\}$ are the elements in set A AND set B	
A <u>union</u> of sets is the set of all the elements in either set.	$A \cup B$	$A \cup B: \{1, 2, 3, 5, 7, 4, 6, 8\}$ are the elements in set A OR set B	
A <u>Compliment</u> of a set is the set of all elements in the universal set (U) that are not in the set.	A^c	$U: \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$ $A: \{1, 2, 3, 5, 7\}$ $A^c: \{4, 6, 8, 9\}$ are the elements NOT in set A	

Calculating Probabilities

A Probability Experiment is an activity involving chance.

Each possible result of the experiment is called an outcome.

A set of outcomes is known as an event.

Probability is measuring how likely an event is to occur when all the outcomes of an experiment are equally likely. For example: The probability that event A would occur in the sample space S is given by the following.

$$P(A) = \frac{\text{number of outcomes for the event}}{\text{number of outcomes in the sample space}} = \frac{n(E)}{n(S)}$$

Your grocery basket contains one bag of each of the following items: oranges, green apples, green grapes, broccoli, cauliflower, carrots, and spinach. You are getting ready to transfer the items from your basket to the conveyor belt for check-out. Event A is picking a bag containing a vegetable first. Event B is picking a bag containing a green food first. All bags have an equal chance of being picked first.

1. What is the universal set for your grocery basket?

$$U = \{or, ga, gg, br, cf, cur, sp\}$$

$$n(U) = 7$$

2. What is set A? $A = \{br, cf, cur, sp\}$

$$n(A) = 4$$

$$P(A) = \frac{n(A)}{n(U)} = \frac{4}{7} = 0.57 \text{ or } 57\%$$

$$n(B) = 4$$

3. What is the set $A \cup B$? $\{ga, gg, br, cf, cur, sp\}$

$$n(A \cup B) = 6$$

$$P(A \cup B) = \frac{6}{7} = 0.86 \text{ or } 86\%$$

4. What is the set $A \cap B$? $\{br, sp\}$

$$n(A \cap B) = 2$$

$$P(A \cap B) = \frac{2}{7} = 0.28 \text{ or } 28\%$$

The numbers 1 through 30 are placed in a hat to determine the order in which students will give an oral report. Event A is being one of the first 10 students to give their report. Event B is picking a multiple of 6. If you pick first, calculate each of the following:

5. What is set A? $\{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ 6. What is set B? $\{6, 12, 18, 24, 30\}$

7. $P(A) = \frac{10}{30} = 0.\bar{3} \approx 33.\bar{3}\%$

8. $P(A \cup B) = \frac{14}{30} \approx 46.\bar{6}\%$

$$P(A \cup B) = \frac{n(A \cup B)}{n(U)} = \frac{14}{30} = 0.4\bar{6}$$

9. $P(A \cap B) = \frac{1}{30} \approx 3.3\%$

$$P(A \cap B) = \frac{n(A \cap B)}{n(U)} = \frac{1}{30} = 0.0\bar{3} \approx 3.3\%$$

10. $P(A^c) = \frac{20}{30} = 0.\bar{6} \approx 66.\bar{6}\%$

$$P(A) = \frac{10}{30} \quad P(A^c) = \frac{20}{30} \approx 66.\bar{6}\%$$

In the previous examples, you may have noticed that the probability of an event occurring and the probability of the event not occurring (the Complement of an event), have a sum of 1.

Meaning that:

Set A and set A^c is all in Universal set.