Chapter 1: SETS AND PROBABILITY

1.1 Introduction to Sets

A ***set*** is a collection of objects.

The objects in a set are the ***elements*** or ***members*** of the set.

→ Always enclose the elements of a set in curly brackets.

A set with the numbers $-1,1,0$ would be written as

where is read "is an element of"

Define S =

More notation:

- 0 is the symbol for the real number zero
- $\{0\}$ is a set with one element, the real number zero
- $\varnothing$ is a set with zero elements, the empty set. Alternative is $\{\}$.
- $\{\varnothing\}$ is a set with one element, the symbol for the empty set.

Two sets are ***equal*** (=) if they contain exactly the same elements (order doesn't matter).

They are ***not equal*** ($\neq$) if they don't contain the same elements.

Set builder notation: Describe the set in terms of its properties,

Roster notation: List the elements of the set.

Subset: Set B is a subset of set A (written $B \subseteq A$) if every element in B is in A.

Proper Subset: Set B is a proper subset of set A (written $B \subset A$) if $B \subseteq A$ and $A \neq B$.

Universal set: The set from which all the member of other sets will be drawn. Called U.

Venn Diagram notation:

- A rectangle represents the universal set
- Circles are sets in the universal set.

Example

Show the relationship between A and B (defined above) in a Venn diagram.

Given a set A and a universal set U, the elements that are in U and are NOT in A is called the ***complement*** of A or A^c.

Example

From the last example, A is the set of even integers, what is A^c in roster notation?

Those elements that belong to both A ***and*** B are in the ***intersection*** of A and B, $A \cap B$.

Example

Let $U = \{x|x \text{ is a card in a standard deck of 52 playing cards}\}$

$R = \{x|x \text{ is a red card}\}$

$Q = \{x|x \text{ is a queen}\}$

Find $R \cap Q$ in roster notation.

If two sets have no elements in common, that is $A \cap B = \varnothing$, then the sets are disjoint.

Example

If K = {x|x is a king}, find $K \cap Q$ in roster notation.

Those elements that belong to A ***or*** B are in the ***union***, $A \cup B$.

$A \cup B =$

Note: this is the ***inclusive or***, not the exclusive or

Example

Let U = {x|x is a card in a standard deck of 52 playing cards}
H = {x|x is a heart card}
Q = {x|x is a queen}

Find $H \cup Q$ in roster notation.

Example

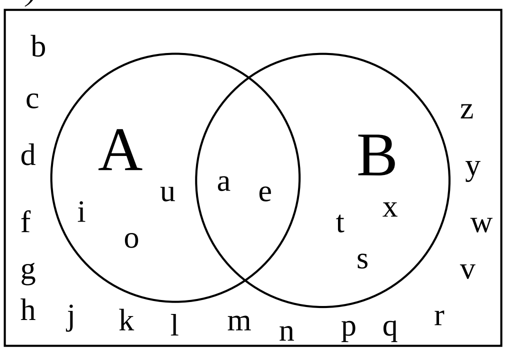
Let $U = \{x|x \text{ is a letter in the English alphabet}\} = \{\text{a, b, c, ..., z}\}$

$A = \{x|x \text{ is a vowel}\} = \{\text{a, e, i, o, u}\}$

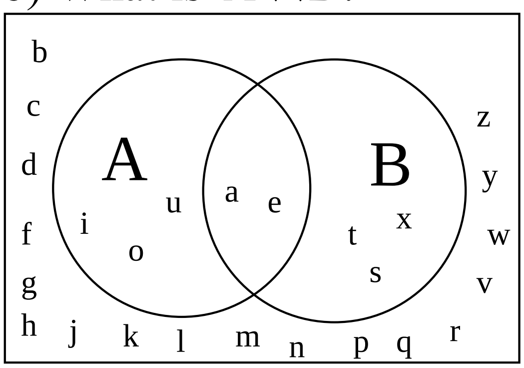
$B = \{x|x \text{ is a letter in the word texas}\} = \{\text{ t, e, x, a, s}\}$

Find the following sets in roster notation.

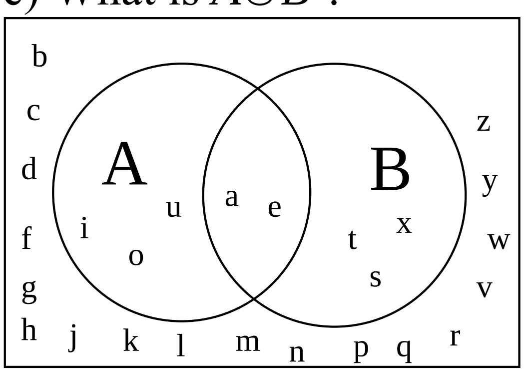
a) What is $A \cap B$?



b) What is $A^c \cap B$?



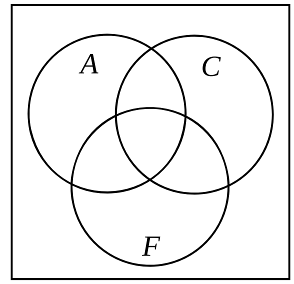
c) What is $A \cup B^c$?



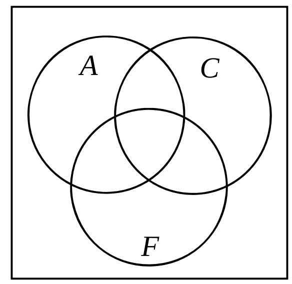
Example

People at a home show were surveyed to see if they planned on replacing their kitchen countertops (*C*), their kitchen floor (*F*) or their kitchen appliances (*A*). Shade the following regions on the Venn diagram and express the region in set notation.

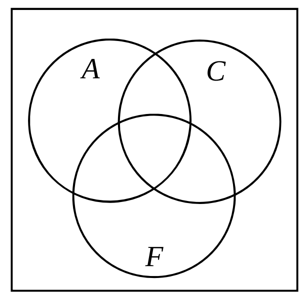
People who planned to replace their countertops and floor



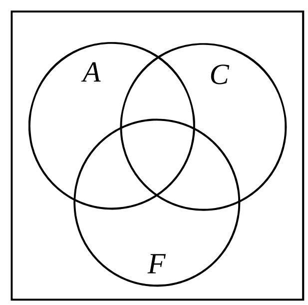
People who planned to remodel all three features



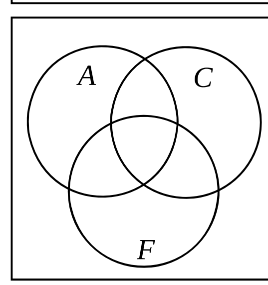
People who planned to replace their appliances or countertops



People who planned to replace exactly one of these features



People who planned to replace their kitchen appliances or floor, but not their countertops.

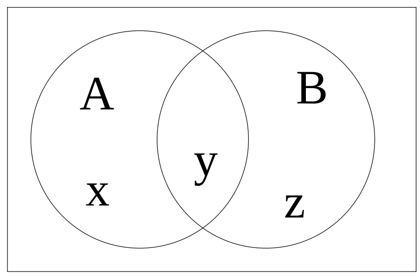


1.2 The Number of Elements in a Set

The number of elements in set A is $n(A)$.

if $A = \{x|x \text{ is a letter in the English alphabet}\}$, then $n(A)=26$.

If $A = \varnothing$ then $n(A) = 0$.



$n(A \cup B) =$

Example
A store has 150 clocks in stock. 100 of these clocks have AM or FM radios. 70 clocks had FM circuitry and 90 had AM circuitry.

a) How many had both AM and FM?

b) How many were AM only?

c) How many were FM only?

Example

We are given the following data about the contents of some delivery trucks,

- 34 trucks carried early peaches
- 61 trucks carried late peaches
- 50 trucks carried extra late peaches
- 25 trucks carried early and late peaches
- 30 trucks carried late and extra late peaches
- 8 trucks carried early and extra late peaches
- 6 trucks carried all three kinds of peaches
- 9 trucks carried no peaches

Display this information in a Venn diagram.

How many carried only late peaches?

How many carried only one kind of peaches?

How many trucks went out?

Example

One hundred shoppers are interviewed about the contents of their bags and the following results are found:

- 19 bought Twinkies
- 37 bought diet soda
- 18 bought broccoli
- 1 bought broccoli, diet soda and Twinkies
- 11 bought Twinkies and diet soda
- 0 bought only Twinkies and broccoli
- 24 bought only diet soda

Display this information in a Venn diagram.

Example

Fifty-two people at a home show were surveyed to see if they planned on replacing their kitchen countertops (*C*), their kitchen floor (*F*) or their kitchen appliances (*A*). The following results were found:

- 22 people planned to replace exactly one of these features
- 18 people were planning to replace their kitchen appliances or floor, but not their countertops.
- 6 people planned to only replace their kitchen countertops
- 2 people planned to remodel all three features.
- 25 people planned to replace their countertops.
- 36 people planned to replace their appliances or countertops
- 9 people planned to replace their countertops and floor.

Display this information in a Venn diagram.