Section 2.2 Subsets + Set Operations Pg 1/8

The universal set is given by U and is the set of all elements being considered in a particular problem.

The complement of a set A is written as A' and is the set of elements that are in the universe but NOT in set A.

For ex: $U = \{\text{students at PSC}\}$
and $A = \{\text{math majors}\}$
What is A'?

$A' = \{\text{PSC students who are not math majors}\}$

Set A is a subset of set B if every element in set A is also in set B.
We write this as $A \subseteq B$.

* Every set is a subset of itself.
* The empty set is a subset of every set.

If A is a subset of set B but not equal to B then we say A is a proper subset of B, written $A \subset B$.

ex 1 Label the following as true or false.

a) $\{8, 10\} \subseteq \{\text{even natural numbers}\}$

$\{2, 4, 6, 8, \ldots\}$

True

b) $\{\text{even natural numbers}\} \subseteq \{8, 10\}$

False

c) $\emptyset \subseteq \{1, 3, 5, 7\}$

True The empty set is a subset of every set.

d) $\{a, b, c\} \subseteq \{a, c, b\}$

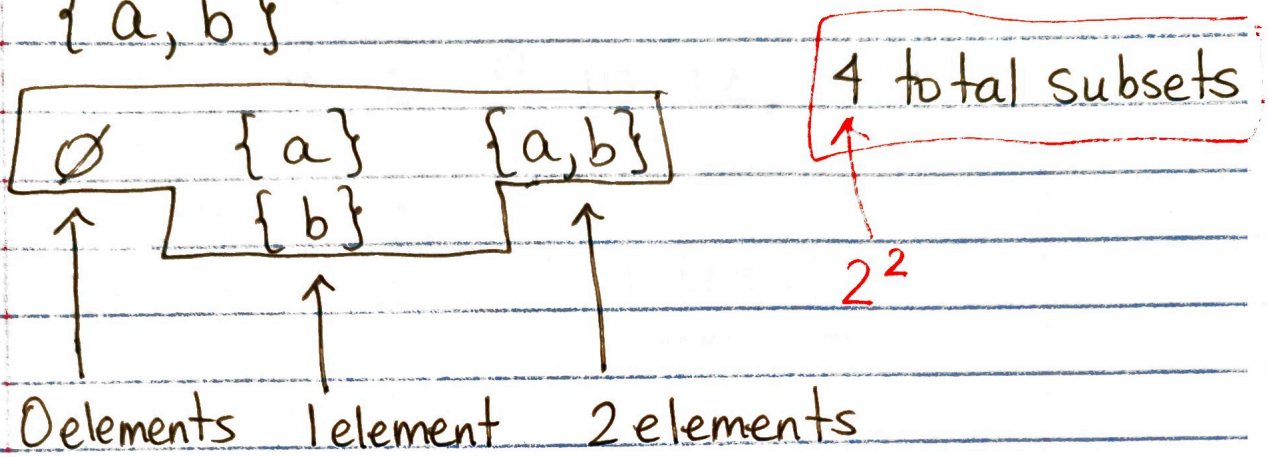
True

e) $\{4, 7\} \subseteq \{4, 7, 10, 13, \ldots\}$

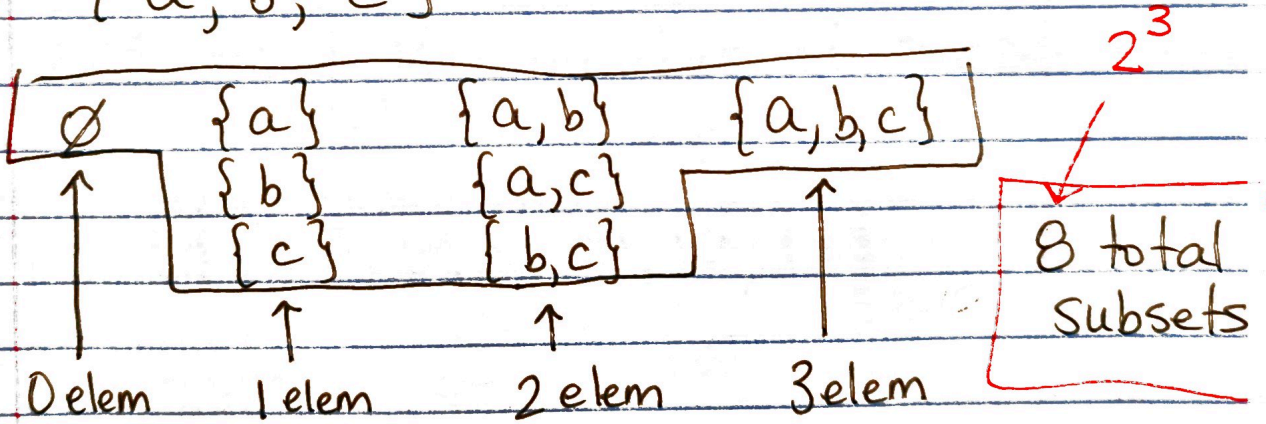
True

ex 2 List all of the subsets.

a) $\{a, b\}$



b) $\{a, b, c\}$



* The number of subsets is always 2^n where n is the number of elements in the set.

ex 3 Find the number of subsets.
Do not list them out.

$\{2, 4, 6, 8, 10, 12, 14\}$

7 elements
subsets $= 2^7 =$ **128**

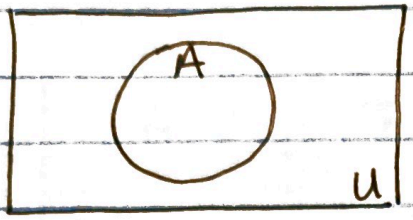
ex 4 Find the number of proper subsets.
Do not list them out.

$\{2, 4, 6, 8, 10, 12, 14\}$

proper subsets $= 2^7 - 1 = 128 - 1$
$=$ **127**

 # subsets $= 2^n$
 # proper subsets $= 2^n - 1$

We can represent sets visually using Venn Diagrams.



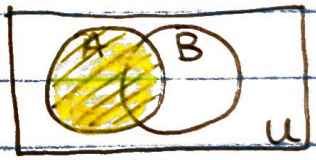
Everything inside the rectangle is the universe.
Everything inside the circle is in set A.

We will do more with Venn Diagrams in sections 2.3 and 2.4.

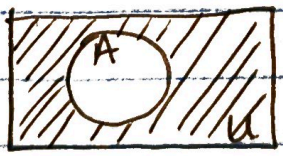
Shade the Venn Diagram for:

A 

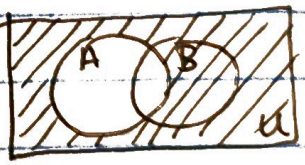
or



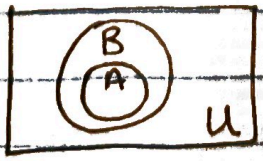
A' ← complement "not"



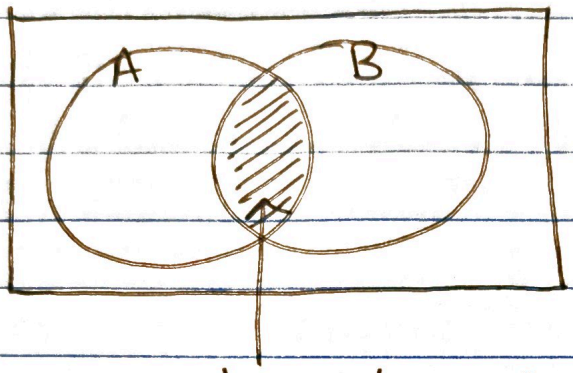
or



$A \subset B$

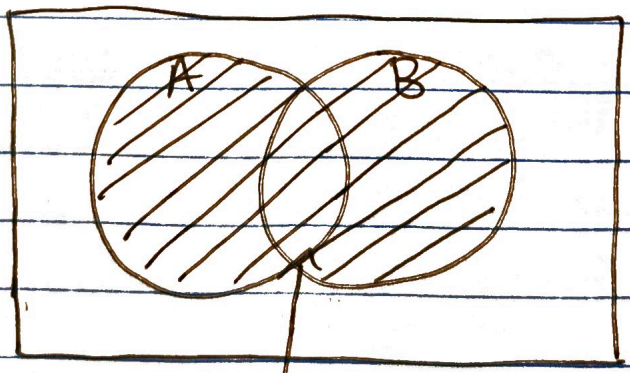


The set of elements that are in <u>both</u> sets A and B are in the intersection of A and B written $A \cap B$.



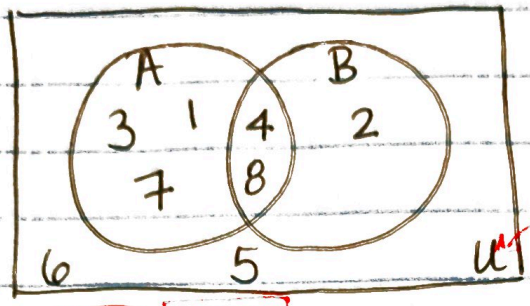
intersection (overlap)

The set of elements that are in either set A or set B or both are in the union of A and B written $A \cup B$.



union (one or the other or both)

ex 5 Use the Venn Diagram to find the elements in the sets below.



a) $A \cup B$ $\{3, 1, 7, 4, 8, 2\}$

b) $A \cap B$ $\{4, 8\}$

c) A' ← stuff not in circle A $\{6, 5, 2\}$

d) U $\{6, 5, 3, 1, 7, 4, 8, 2\}$ everything in the rectangle

ex 6 Given $U = \{1, 2, 3, \ldots, 10\}$
$A = \{1, 3, 5\}$
$B = \{2, 4, 6, 8\}$
$C = \{1, 2, 3, 4\}$

Find:

a) $A \cap B$ $\{\}$ or $\emptyset$ ← overlap

b) $A \cap C$ $\{1, 3\}$

c) $A \cup C$ $\{1, 3, 5, 2, 4\}$

↳ smoosh A and C together don't write repeats

d) C' ← stuff in univ but not in C

{5, 6, 7, 8, 9, 10}

e) $B \cap U$ ← overlap

{2, 4, 6, 8}

f) U'

{ } or $\emptyset$

g) $\emptyset'$

U or {1, 2, 3, ..., 10}