1 0 1 1 0 0 0 0 1 0 0 0   1 0 1 1 0 0 0 0 1 0 0 0   1 0 1 1 0 0 0 0 1 0 0 0   1 0 1 1 0 0 0 0 1 0 0 0   1 0 1 1 0 0 0 0 1 0 0 0

CSCI 2824: Discrete Structures

Lecture 13: More Set Operations

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1 0 1 1 0 0 0 0 1 0 0 0   1 0 1 1 0 0 0 0 1 0 0 0   1 0 1 1 0 0 0 0 1 0 0 0   1 0 1 1 0 0 0 0 1 0 0 0   1 0 1 1 0 0 0 0 1 0 0 0

Set Operations

Example: Draw a Venn Diagram relating the set of all vowels to the set of all letters in the English alphabet.

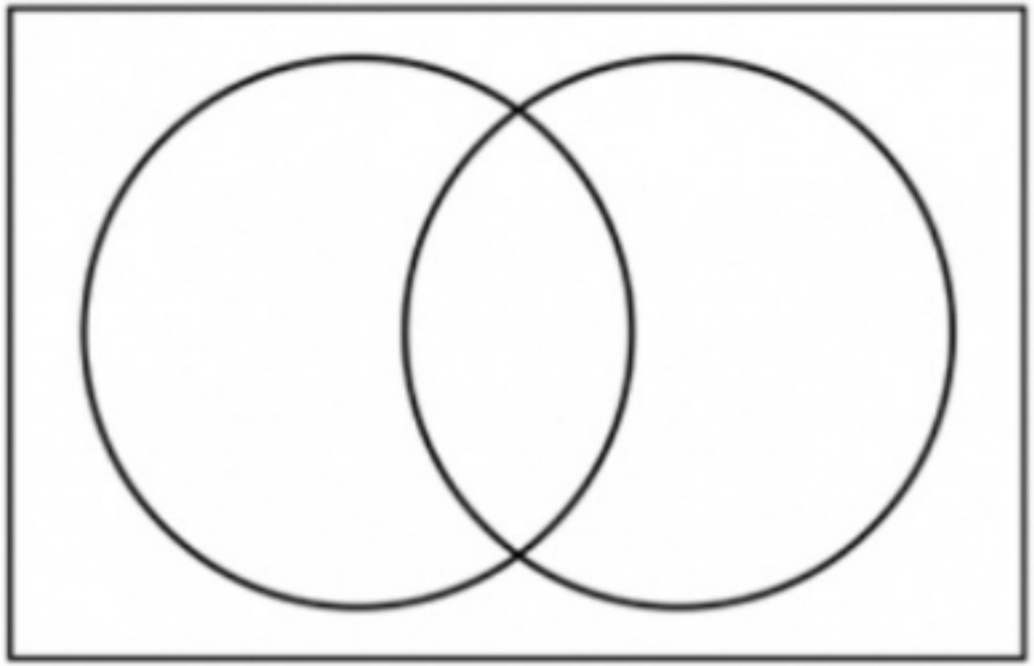
Example: Draw a Venn diagram relating the set of all prime numbers and the set of odd numbers. (prime numbers are numbers that are only divisible by 1 and itself.

Set Operations

Example: Consider the sets $A = \{dumbo, jumbo\}$ and $B = \{a, b, c\}$. What is $A \times B$?

Set Operations

Example: How many elements are in the set $A \cup B$?



Set Operations

- **Python** has some nice functionality that can help you convert lists of elements into sets, and perform some operations on them.

```
In [8]: mylist = [1,2,3,1,4]

In [9]: myset = set(mylist)

In [10]: print(myset)
{1, 2, 3, 4}
```

- **If/when** the time comes, you should feel free to explore these functions for manipulating sets…
  … he said with a knowing grin.

```
In [15]: A = set([1,2,3,4])

In [16]: B = set([3,4,5,6])

In [17]: print(set.intersection(A,B))
{3, 4}

In [18]: print(set.union(A,B))
{1, 2, 3, 4, 5, 6}

In [19]: print(set.difference(A,B))
{1, 2}

In [20]: print(set.difference(B,A))
{5, 6}
```

Set Operations

Example: Use set identities to prove $\overline{A \cup (B \cap C)} = (\overline{C} \cup \overline{B}) \cap \overline{A}$

Set Operations

- **Definition:** The equivalent set-version of a truth table is called a **membership table**.
  - We can use these to prove set equivalences.

- **Example:** Show (again) that DeMorgan's law holds: $\overline{A \cup B} = \overline{A} \cap \overline{B}$

A	B	$\overline{A}$	$\overline{B}$	$A \cup B$	$\overline{A \cup B}$	$\overline{A} \cap \overline{B}$

Set Operations

Example: If P is the set of prime numbers, then what is $\overline{P}$?

Set Operations

Example: Suppose $A = \{b, c, d\}$ and $B = \{a, b\}$. Find:

(a) $(A \times B) \cap (B \times B)$

(b) $(A \times B) \cup (B \times B)$

(c) $(A \times B) - (B \times B)$

(d) $(A \cap B) \times A$

(e) $(A \times B) \cap B$

(f) $\mathscr{P}(A) \cap \mathscr{P}(B)$

(g) $\mathscr{P}(A) - \mathscr{P}(B)$

(h) $\mathscr{P}(A \cap B)$

(i) $\mathscr{P}(A) \times \mathscr{P}(B)$