MATH3160 — Portfolio 1.1-2.1

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1 Deliverables

1.1 Sample Space

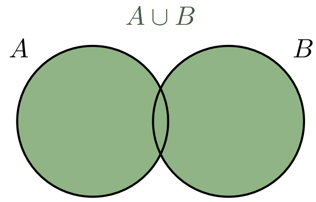
Definition: The Sample Space S with respect to an Experiment E is a the set of all possible outcomes for the given experiment.

1.1.1 Examples

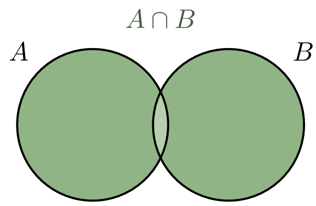
- A coin flip has a sample space of $\{H, T\}$.
- A die roll has a sample space of $\{1, 2, 3, 4, 5, 6\}$.

1.2 Set Operations

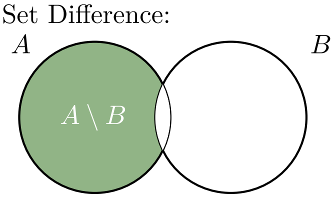
- Set Union:



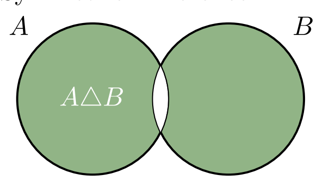
- Set Intersection:



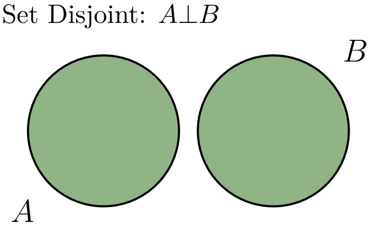
- Set Difference:



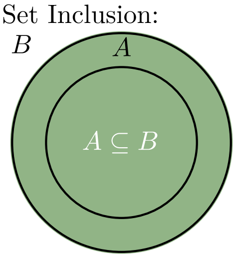
- Symmetric Difference: $A \triangle B$



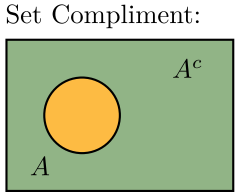
- Set Disjoint: $A \perp B$



- Set Inclusion:



- Set Compliment:



1.3 Events $\Leftrightarrow$ Sets

Event	**Set**
Sure Event	**S** (Entire Sample Space)
Impossible Event	$\emptyset$ (Empty Set)
Event A	The subset all of favorable outcomes to A
Event A or B	A $\cup$ B
Event A and B	A $\cap$ B
Event A implies B	Set B is included in Set A
Event A, B incompatible	Set A and Set B are disjoint
Contrary of Event A	A^c with respect to the sample space S

1.4 Combinatorics: n-choose-k

Definition: The number of ways of choosing k objects from a set of n objects is denoted by $\binom{n}{k}$.

This can be accomplished by utilizing the following formula, where n represents the number of elements in the set, and k represents the amount being chosen.

$$\binom{n}{k} = \frac{n!}{k!(n-k)!}$$

1.4.1 Examples

- Given the set $N = \{1, 2, 3, 4, 5, 6, 7\}$, how many ways are there to choose 3 *ordered* objects from N?
  - For the first entry, there are seven possibilities, for the second entry, there are six possibilities, and so on. Therefore, according to the definition of **n-choose-k**, there are $7 * 6 * 5$ different choices for choosing three ordered elements from the seven element set.
- Given the same set N, how many ways are there to choose 3 *different* objects from N?
  - There are $\frac{7!}{4! * 3!}$ ways to choose three different objects from the set.

1.5 Binomial Theorem

1.6 Classical Definition of Probability

1.7 Axiomatic Definition of Probability