Mathmatics Background

Probability theory is based on the mathematics of sets. A set can be used to define a "Sample Space" which enumerates the possible outcomes of an "experiment". Probability can be defined as the ratio of the number of positive outcomes to the number of all possible outcomes in an experiment.

We will now review some set theory to have some tools we can use in this course.

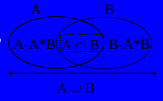
Later in the course we will also need to review Sums, Calculus, Integral Transforms, and some Linear Algebra.

Background Material

- Set Theory
  - Definitions
  - Laws
- Functions

Set Theory - Definitions

- Set: "A" is a set of elements {a, b, c, d}
  - "c" is an element of "A" $c \in A$
  - Null Set {}
  - Universal Set "S"



- Set Algebra
  - B is contained in A (subset) $B \subset A$
  - A contains B (superset) $B \supset A$
  - A + B (sum, union) $B \cup A$
  - A*B (product, intersection) $B \cap A$

Set Theory - More Definitions

- Mutually Exclusive - Sets that have no elements in common. $A*B = \{\}$
- Collectively Exhaustive - Sets whose union is the universal set. $A+B+C+D = S$

Set Theory - Laws

- Idempotent: $A+A=A$; $A*A=A$
- Commutative $A+B=B+A$; $A*B=B*A$
- Associative $A+(B+C)=(A+B)+C$ $A*(B*C)=(A*B)*C$
- Distributive $A*(B+C)=A*B+A*C$
- Product Identities $\{\}*A=\{\}$; $S*A=A$
- Sum Identities $\{\}+A=A$; $S+A=S$

Set Theory - More Laws

- Consistency $A \subset B$; $A*B = A$; $A + B = A$
- Universal Bounds $\varnothing \subset A \subset S$
- Involution $\overline{(\overline{A})} = A$
- Complementary $A + \overline{A} = S$; $A * \overline{A} = \{\}$
- De Morgan's First Law $\overline{A+B} = \overline{A}*\overline{B}$
- Demorgan's Second Law $\overline{A*B} = \overline{A} + \overline{B}$

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- Set Theory
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Functions

- Function - A rule that maps every element, x, of a given set, D (the domain), into elements, f(x), of another set, R (the range).