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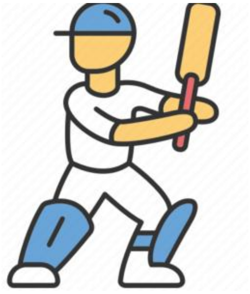
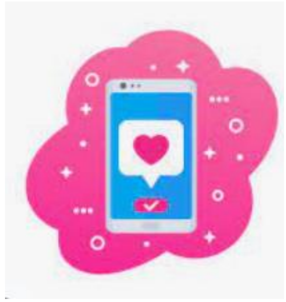
Finishing School

The Elements of Chance (Nothing in life is certain)

The Randomness everywhere !





The Elements of Chance (Nothing in life is certain)

The Randomness everywhere !

The study of these chances is the subject matter of Probability Theory !

Set Theory

Experiments, sample spaces, events

Axioms of probability

Random Variables

Distributions

Exceptions

Overview of Set Theory

Set is a collection of elements

S = { a, e, I, o, u}

E = {0, 2, 4 ………94, 96, 98, 100}

E = { x: $0 \leq x \overset{\leq}{\cancel{\geq}} 100, x \% 2 = 0\}$ (Compact notation useful for large data set)

$x \in S$, mean x belongs to set S,

$2 \in E$, $3 \notin E$

Overview of Set Theory

Set is a collection of elements

Subsets and equal sets

I = set of all integers

$S = \{ x : x \in I, x < 0 \}$

Every element of S in contained in I

$S \subset I$ subset

Equal Sets:

$A = B$ if $A \subset B$ and $B \subset A$ equal sets

Overview of Set Theory

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Universal set

Every set of interest is a subset of the universal set

Ω = set of 52 cards

A : set of all aces $A \subset \Omega$

H : set of all hearts $H \subset \Omega$

B : set of all black $B \subset \Omega$

F : set of all face $F \subset \Omega$

Empty Set:

Set with no elements (null set)

$\emptyset = \{ \}$

Overview of Set Theory

Set Operations

Complement:

$$A^C = \{x : x \in \Omega \text{ and } x \notin A\}$$

Union (2 Sets)

$$A \cup B = \{x : x \in A \overset{or}{\cancel{and}}\; x \in B\}$$

Intersection (2 Sets)

$$A \cap B = \{x : x \in A \overset{and}{\cancel{or}}\; x \in B\}$$

Overview of Set Theory

Properties of Set Operations

Commutativity

$A \cup B = B \cup A$

$A \cap B = B \cap A$

Associativity

$A \cup (B \cup C) = (A \cup B) \cup C$

III $A \cap (B \cap C) = (A \cap B) \cap C$

Distributive laws

$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

Proof: Distributive laws

$X \in A \cap (B \cup C) = x \in A \text{ and } x \in (B \cup C)$

$= x \in A \text{ and } x \in B \text{ or } x \in C$

$= x \in A \text{ and } x \in B \text{ or } x \in A \text{ and } x \in C$

$= x \in (A \cap B) \cup (A \cap C)$

Overview of Set Theory

Properties of Set Operations

De Morgan's Laws

$(A \cup \mathrm{B})^C = A^C \cap B^C$

$(A \cap \mathrm{B})^C = A^C \cup B^C$

Proof: De Morgan's Laws

$\mathrm{X} \in (A \cap \mathrm{B})^C = \mathrm{x} \in A^C \cap B^C$

not eq

$= \mathrm{x} \in A^C \text{ or } \mathrm{x} \in B^C$

$= \mathrm{x} \in A^C \cup B^C$