Lec 8/26

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an experiment: process w/ outcome subject to uncertainty

sample space S: set of all possible outcomes

Ex: $S = \{x \mid x \text{ is a playing card}\}$

Ex: $S = \{1, 2, 3, 4, 5, 6\}$ $S = \{0, 1, 2, \ldots\}$

$S = \{\text{odd}, \text{even}\}$

S can be finite
countably infinite
uncountably infinite
} discrete

continuous

Event: $A \subseteq S$

Ex: A: drawing a heart. $A = \{AH, kH, \ldots 2H\}$

let t denote the lifetime of a laptop (in months)

$S = (0, \infty)$

events:

A: laptop lasts at least 36 months

$= \{t \in S \mid t \geq 36\}$

B: laptop lasts less than a year

$= \{t \in S \mid t < 12\}$

$A \cup B = \{x \mid x \in A \text{ or } x \in B \text{ or Both}\}$ or

$\ldots \in B\}$ and

$A \cup B = \{x \mid x \in A \text{ or } x \in B \text{ or Both}\}$ or 

$A \cap B = \{x \mid x \in A \text{ and } x \in B\}$ and 

$A \cap B \subseteq A \subseteq A \cup B$

$A \cap B \subseteq B \subseteq A \cup B$

$A' = \{x \in S \mid x \notin A\} = S \setminus A$ $\quad A \cup A' = S$

↳ a complement

A and A' are mutually exclusive

$A \cap B = \emptyset \iff$ A and B are mutually exclusive aka disjoint

$A' \cup B' = (A \cap B)'$ (demorgan's laws)

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

Probability

$P(A)$: probability of event A occuring

if S is discrete then the following axioms hold:

1) $\forall A \subseteq S, \quad P(A) \geq 0$

2) $P(S) = 1$

3) if $A_1, A_2, A_3, \ldots$ (infinite or finite sequence) $\subseteq S$, and $A_i \cap A_j = \emptyset \quad \forall i \neq j$
then $P(A_1 \cup A_2 \cup A_3 \cup \ldots) = P(A_1) + P(A_2) + P(A_3) + \ldots$
(special addition rule)