Stat 401

Sec 1.1 - Introduction.

def| Probability.

- measure of uncertainty about the occurrence of events.

1. Deterministic.
   - nothing is random.
2. Uncertainty.
   - Something happens, but we don't know the outcome.

Probability = MATH.

ex| Random Experiment.

- flip a coin twice.

Possible outcomes:

$$\mathcal{C} = \underbrace{\{(H,H);(H,T);(T,H);(T,T)\}}_{\text{sample space}}.$$

def) Sample Space.

- collection of all possible outcomes.
- denoted by $\mathscr{C}$ $\mathscr{D}$

script C script D

other books: Ω

Stat 381: S

def) Event.

- Subset of the combinations of outcomes of a sample space.
- denote by a capital letter

$A, B, C, D, \ldots$

<u>def</u>) Element.

- member of the sample space.
- denote by lower case letters

$a, b, c, d, \ldots$

<u>ex</u>)

Let A = event that 1^{st} outcome is a head.

$= \{ (H, H); (H, T) \}$

Let B = event that 1^{st} = head 2^{nd} = head.

$= \{ (H, H). \}$

Sec 1.2 - Set theory

def) set

- a well-defined collection of objects.
- events.
- denote by $A, B, C, D, \ldots$

def) Well-Defined.

- any element can be classified as belonging to the set or not belonging to the set.

ex) $C = \{ x \mid 0 \le x \le 1 \}$

such that

$= \{ x : 0 \le x \le 1 \}$

$\frac{3}{4} \in C$

element of

ex) $A = \{1, 3, 5, 7, \ldots\}$

\# in list or not.

ex) Barber Paradox

- not well defined.

- 1 Barber in a small town.
- He follows this rule:

"He shaves all those, and those only, who do not shave themselves."

def) Countable.

- A set C is countable if C is finite or has as many elements as there are positive integers.

ex) $C_1 = \{x : 0 < x < 1\}$ not countable def] Subset.

- If each element of a set C_1 is also an element of a set C_2, we say C_1 ~~to~~ is a subset of C_2.

- Denote by $C_1 \subset C_2$

ex] $C_1 = \{1, 2\}$

$C_2 = \{1, 2, 3\}$

$C_1 \subset C_2$

$C_2 \not\subset C_1$

is not a subset.

ex] What if $C_1 \subset C_2$ and $C_2 \subset C_1$?

Then $C_1 = C_2$.

(0.5, 0.5)
(1, 1)
(0, 0).

ex]. $C_1 = \{(x, y) : 0 \le x = y \le 1\}$

$C_2 = \{(x, y) : \underbrace{0 \le x, y \le 1}_{0 \le x \le 1 \text{ and } 0 \le y \le 1}\}$

$C_1 \subset C_2$