# Probability

Note Title 9/3/2008

Experiment – random

outcome is unknown before experiment occurs.

long-term behavior of outcome & experiment is known.

All possible outcomes = $S$ ← set

sample space

1. Flip a coin $S = \{\text{Heads}, \text{Tail}\}$ 2
2. Birthdays of 26 people in room. $S = \{\underbrace{111\cdots1}_{26}, 2\underbrace{11\cdots1}_{25} \cdots \cdots\}$ $365^{26}$

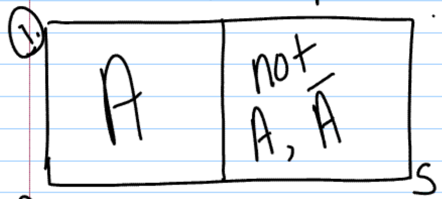
Events = outcomes in $S$.

$A$, $B$, $C$ etc. also can use subscripts on letters.

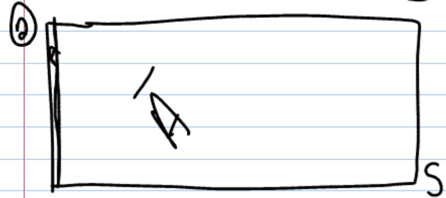
1. $A$ = obtaining Heads when flipping coin.
2. $A$ = everyone in room share the same birthday.

## Set Theory

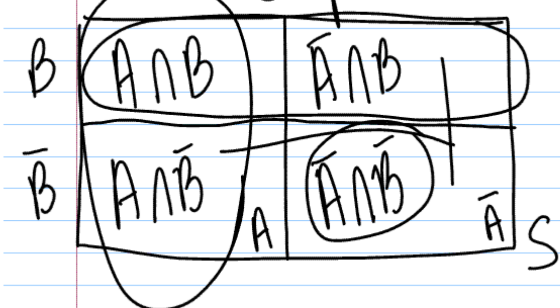
S = sample space. Events = A, B




$\bar{A}$ = all events in S that are not in A.




## Relationship Between Events A & B




$A \cap B$ = all events in both A & B.

$A \cap \bar{B}$ = all events in both A + $\bar{B}$.

$\bar{A} \cap \bar{B}$ = all events in both $\bar{A}$ + $\bar{B}$

$\bar{A} \cap B$ = all events in both $\bar{A}$ + B.

$A \cup B$ = all events in A or B or both.

$= (A \cap B) \cup (A \cap \bar{B}) \cup (\bar{A} \cap B)$

$\overline{(A \cup B)} = \bar{A} \cap \bar{B}$

$\overline{(A \cap B)} = (\bar{A} \cap B) \cup (\bar{A} \cap \bar{B}) \cup (A \cap \bar{B})$

$= (\bar{A} \cup \bar{B})$

Disjoint Events (mutually exclusive events).

$A \cap B = \emptyset \leftarrow$ empty sets (Set with no outcomes).

When you have an events B + its $\bar{B}$.

$A = (A \cap B) \cup (A \cap \bar{B})$

A + its $\bar{A}$.

$B = (A \cap B) \cup (\bar{A} \cap B)$