Q 1. What is a random experiment? Give an example of a random experiment.

An experiment where the outcome cannot be predicted with certainty.

Example 1: Flipping a coin.

Example 2: Rolling a 6-sided die.

Q 2. What is a sample space? What is an element?

A collection of ALL POSSIBLE OUTCOMES. Denoted by S (S = sample space)

Example 1: Flipping a coin → S = {T, H}

Example 2: Rolling a 6-side die → S = {1, 2, 3, 4, 5, 6}

Element: An outcome from the S (sample space)

Q 3. What is an event? Give an example of an event.

Event: Subset of combinations of outcomes of a sample space. Event is denoted by CAPITAL LETTER: A, B, C, D, ...

Example 1: Toss 2 coins S = {HH, HT, TH, TT}

Let event A = at least one head A = {HH, HT, TH}
B = Exactly one tail B = {HT, TH}

Q 4. What are some rules that can be used to deal with events?

1. $\varnothing$ **= Empty Set (no elements), = { }**

2. $A \cup B$ **= All elements of A + All elements of B**

   Union/OR

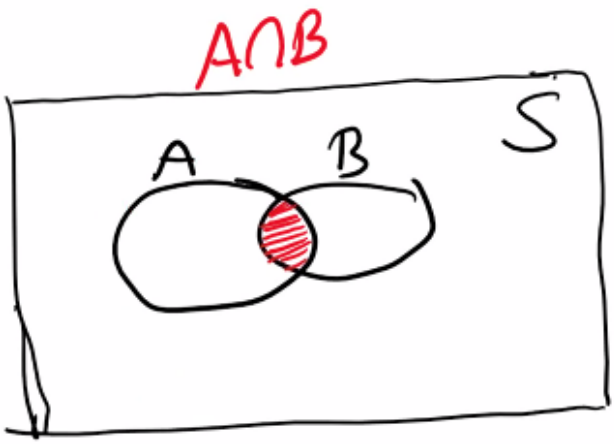
3. $A \cap B$ **= Elements in BOTH A and B (A and B overlap)**

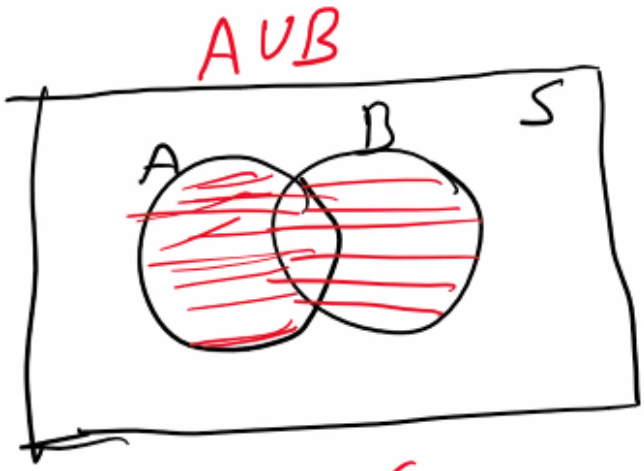
   Intersection/AND

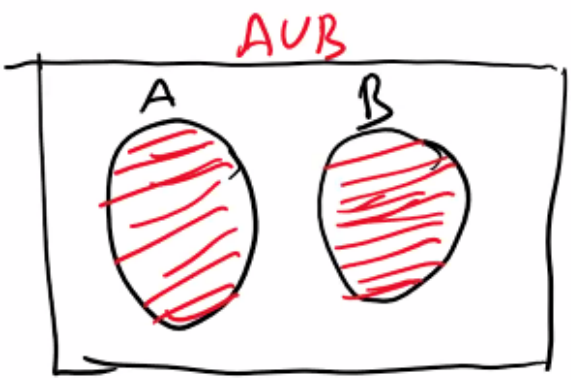
4. A^c **= All elements in the sample space that are NOT in A**

Complement/NOT **Some books use A' in complements of A**

Q 5. What is a visual way to picture events / sets?







Q 6. What are De Morgan's Laws?

① $(A \cup B)^c = A^c \cap B^c$

② $(A \cap B)^c = A^c \cup B^c$

Q 7. What are mutually exclusive events or disjoint events?

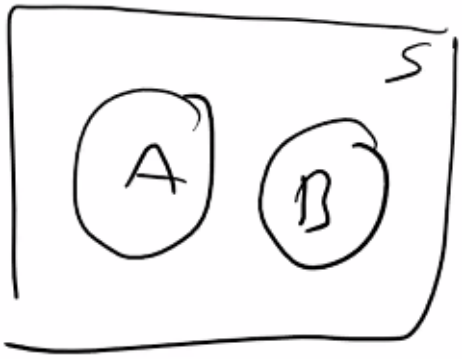
SAME

No elements in common

Intersection is empty

$A \cap B = \emptyset$

No Overlap



A and B are disjoint (mutually ex)

Example 2. In Example 1, are A and B disjoint? Why or why not?

Disjoint because $A \cap B = \emptyset$

(or No common elements in both A and B)

Remark: $A \cap C = \{4\}$ **So A and C are NOT DISJOINT**

Example 1. Suppose $S = \{1, 2, 3, 4, 5, 6\}$. We have 3 events defined as follows:

$A = \{\text{even numbers in } S\}$ = {2, 4, 6}
$B = \{\text{odd numbers in } S\}$ = {1, 3, 5}
$C = \{3, 4\}$

Find the following:

(a) $A \cup B$

= {1, 2, 3, 4, 5, 6}
= S

(b) $A \cap B$

(c) $A \cup C$

= {2, 4, 6, 3}
(Order doesn't matter)

(d) $B \cup C$

= {1, 3, 4, 5}
(Order doesn't matter)

(e) $A \cap C$

= {4}

(f) $B \cap C$

= {3}

(g) A^c

= {1, 3, 5}
= B

(h) B^c

= {2, 4, 6}
= A

(i) $(A \cup B)^c \cap C$

Remark: $S^c = \emptyset$

$= \emptyset \cap C = \emptyset$

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

$\{2, 4, 6\} \cap \{1, 3, 4, 5\}$ (A; $B \cup C$)

$= \{4\}$