Basic concepts in probability

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Experiments

An **experiment** is any activity that produces or observes an outcome.

- Throwing a dice
- Playing a round of fantasy premier league
- Running a marathon

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Sample Space

The **sample space S** is the set of all possible outcomes for an experiment:

- For throwing a dice: {1,2,3,4,5,6}
- For a Fantasy Premier League round: all integer numbers (including negative ☹). {….-3,-2,-1,0,1,2,3, ….}
- For running a marathon: all real numbers greater than 0.

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Events

- An **event** is an outcome or a set of outcomes of an experiment and thus a subset of the sample space:

  - Obtaining a four or higher when throwing a dice
  - Getting more than 100 points in a Fantasy Premier League
  - Running below three hours in a marathon.

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Example:

- **Experiment:** Throwing a dice.
- **Sample space**: **S = {1,2,3,4,5,6}**
- **Events: {2}, {less than 4} = {1,2,3}**

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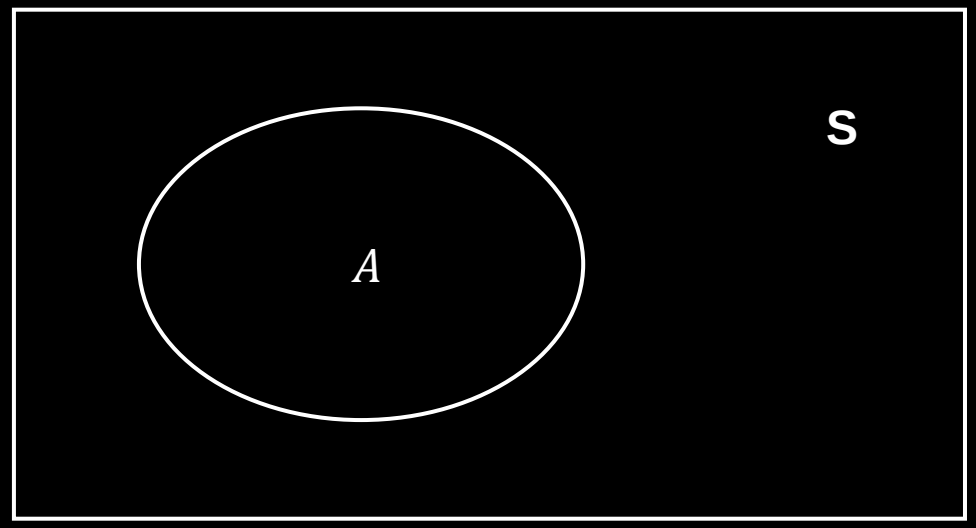
Venn Diagram

- A **Venn diagram** is a picture that represents the outcomes of an experiment.
- It generally consists of a box that represents the sample space (**S**)
- While circles or ovals represent events.



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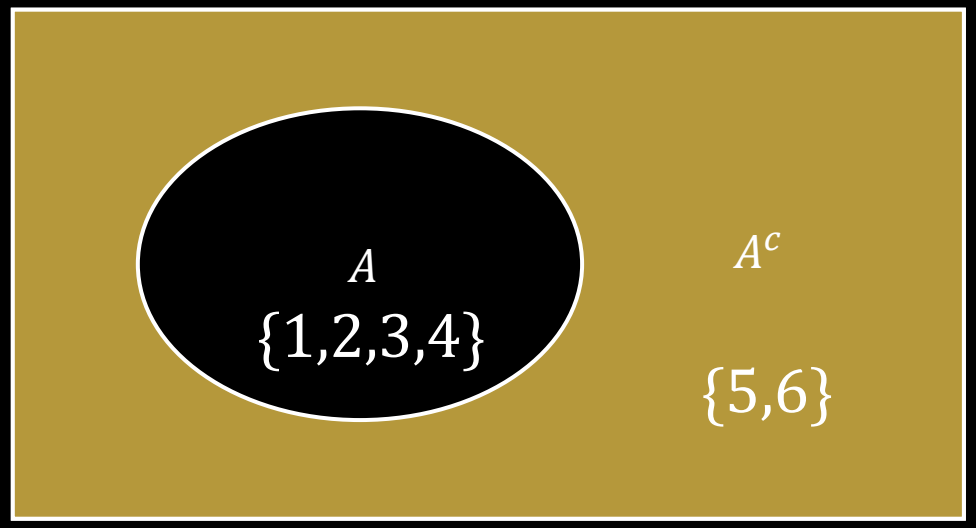
Complementary event

- The **complement** A^C of any event A, is the event that A does not occur and thus consists of all outcomes that are not in A



Example: Throwing a dice.

$A = \{1,2,3,4\}$

$A^c = \{5,6\}$

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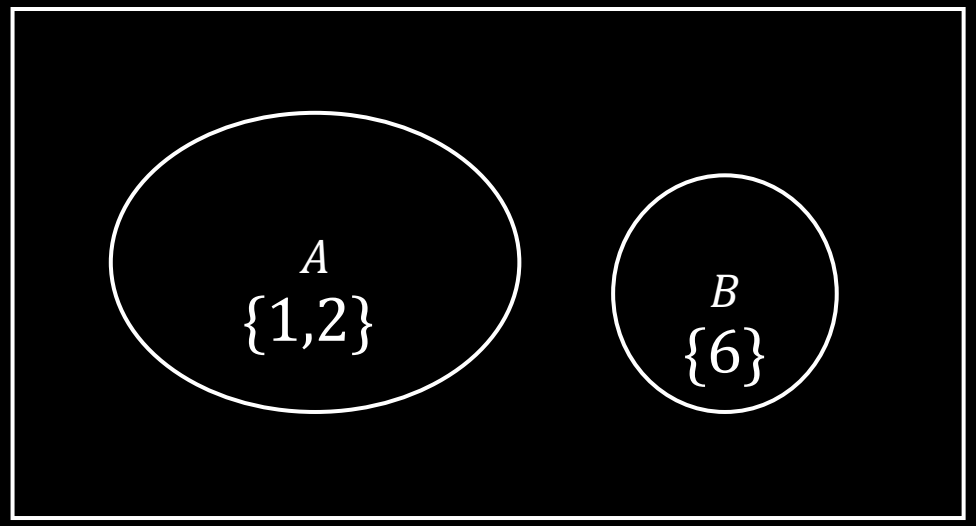
Disjoint events

- Two events A and B are **disjoint** if they have no outcomes in common
- Disjoint events can never occur together



Example: Throwing a dice.

$$A = \{1,2\}$$

$$B = \{6\}$$

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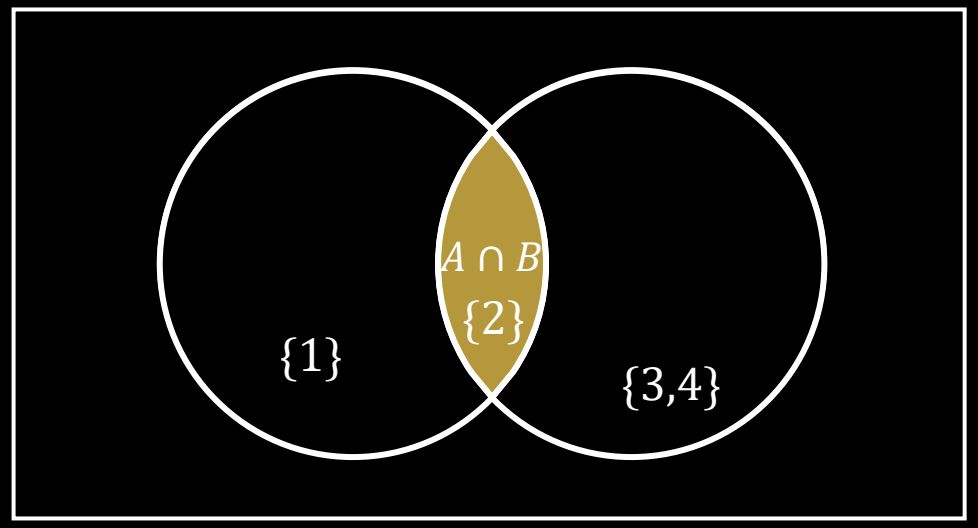
INTERSECTION

- The **intersection** of any collection of events is the event that all the events occur.
- For two events A and B, the intersection $A \cap B$ is the event that A and B both occur.
- The symbol ∩ can be read «and»



Example: Throwing a dice.

$$A = \{1,2\}$$

$$B = \{2,3,4\}$$

$$A \cap B = \{2\}$$

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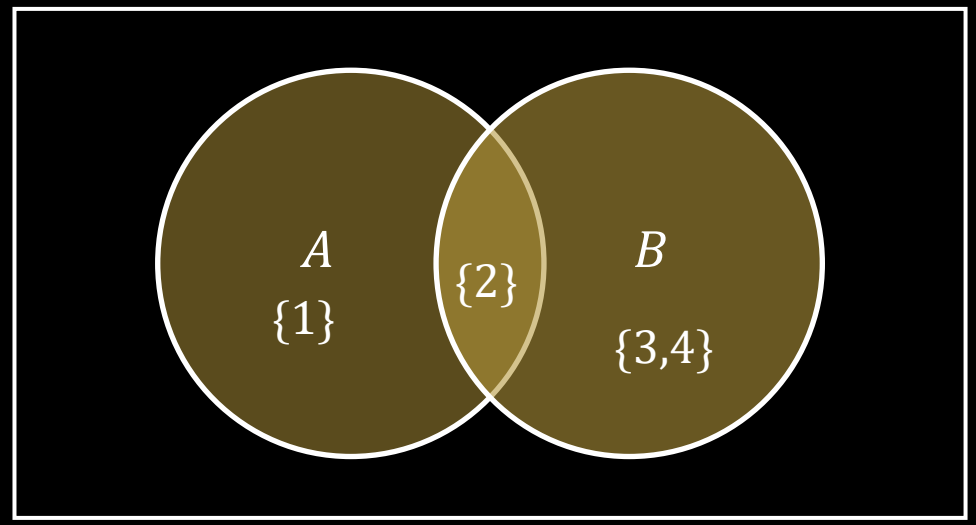
Union

- The **union** of any collection of events is the event that at least one of the events occurs.
- For two events A and B, the union $A \cup B$ is the event that A or B or both occur.
- The symbol ∪ can be read «and/or»



Example: Throwing a dice.

$$A = \{1,2\}$$

$$B = \{2,3,4\}$$

$$A \cup B = \{1,2,3,4\}$$

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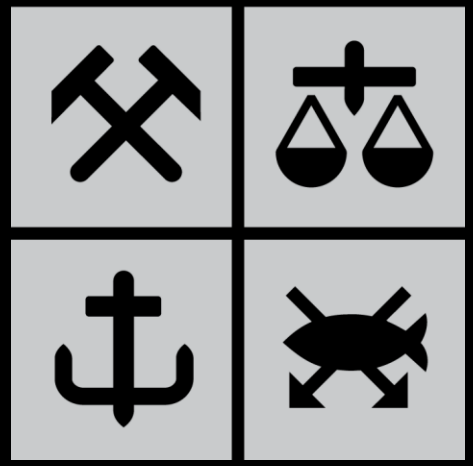

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