The second axis : Experiment and Event

1- Experiment: An experiment is any procedure that can be infinitely repeated and has a well-defined set of possible outcomes.

For Example **:**

- The experiment that consists of rolling a single die.
- The experiment that consists of tossing a single coin.

- **Sample Space (S):** This is the **Universal Set** of all possible outcomes.
  - *Example:* Tossing a coin twice. S = {HH, HT, TH, TT}.
- **Outcome:** A single element within the sample space.
  - *Example:* Landing on {HT}.

2-The Event (The "Test")

In set theory, an **Event** is simply a subset of the Sample Space. When we "test" for something, we are asking: *"Did the outcome fall into this specific subset?"*

For example: Construct a sample space for the experiment that consists of rolling a single die. Find the events that correspond to: “an even number is rolled”

Solution : The outcomes could be labeled according to the number of dots on the top face of the die. Then the sample space is the set :

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

The outcomes that are even are 2, 4 and 6 , so the event that corresponds to: “an even number is rolled” is the set : {2, 4, 6} which it is natural to denote by the letter A.

We write A = {2, 4, 6}

3-Types of Events:

Simple Events: Simple events are the most basic type of event. A **simple** event is an outcome or occurrence that has a single result. Examples ... A = {2}

Compound Event. As opposed to a simple **event**, if there is more than one sample point on a sample space, such an **event** is called **Compound Event**. Example:A = {2, 4, 6}

I**mpossible event** is an event that contains no outcomes from the sample space. In set theory, this is represented by the **Empty Set** {} / Ø

Set Definition: A={} / A=Ø

Examples: Rolling a **7** on a standard six-sided die.

Sure event (Certain Events) is an event that includes every single possible outcome in the sample space. In set theory, a sure event is identical to the **Universal Set (S or U)**. **Set Definition:** A = S

Examples: Rolling a number **less than 7** on a standard die.

Complementary Event is the "flip side" of any specific event. If event A is what you are looking for, its complement (denoted as A^c, A', or bar A) is the event that A **does not happen**.

Every experiment is essentially a split between the event you're interested in and its complement.

Incompatible Events : when 2 Events have no chance of happening at the same time. The chances are 0.
Example : a die is rolled.

Event A : observing an outcome less than 3
Event B : observing an outcome greater than 4
Event A and Event B are incompatible since you cannot have a number that is less then 3 and greater than 4 at the same time.

Compatible Events : when 2 Events happen at the same time.
Example : a die is rolled.

Event A : observing an outcome less than or equal to 3
Event B : observing an outcome greater than or equal to 1
Event A and Event B are compatible since you can have a number that is less then or equal to 3 and greater than or equal to 1 at the same time.

Independent Events : two events A and B are said to be independent if the occurrence of one event does not affect of the occurrence of the other.
Dependent events are events that are affected by the outcome of another event.