Lec 01 :

An **experiment** involves randomness and results in an **outcome**.

Ex : Experiment : Flip 2 coins

Outcome possibilities :

HH , HT , TH , TT

Exactly one outcome occurs.

Ex : Roll 1 die

Outcome possibilities are : 1, 2, 3, 4, 5, 6

Def : A **sample space** is the set of all possible outcomes of an experiment.

Ex :

1 coin flip : $S = \{H, T\}$

2 coin flips : $S = \{HH, HT, TH, TT\}$

3 coin flips $S = \{HHH, HHT, \ldots, TTT\}$

$\vdots$

n coin flips $|S| = 2^n$

<u>Ex</u>: Roll 2 dice

$$S = \left\{ \begin{array}{llll} (1,1), & (1,2), & \ldots, & (1,6) \\ (2,1), & \ldots & & (2,6) \\ \vdots & & & \\ (6,1) & \ldots & & (6,6) \end{array} \right\}$$

$$|S| = 36$$

<u>Def</u>: An <u>event</u> is any subset of the sample space.

<u>Ex</u>: Flip 2 coins

Some events:

$E = \{HH, TT\}$ = "both flips are the same"

$E = \{HT, TH, TT\}$ = "at least one Tail"

$E = \{HH, HT\}$ = "1st flip is Heads"

If $E = \phi$ (empty set)
then E is called the null event.

If $E = S$ (entire sample space)
then E is called the sure event.

We say that an event occurred (or happened) if the outcome of the experiment lies in the event.

For an event $E \subseteq S$,
$P(E)$ will be a probability

Review: unions
intersections
complements
Venn diagrams
DeMorgan's law
disjoint

Set theory

Notation: The intersection of sets A, B is usually denoted $A \cap B$.

In probability (ie. ECE 109) we use the abbreviated notation.

AB to mean $A \cap B$.

Union is $A \cup B$.

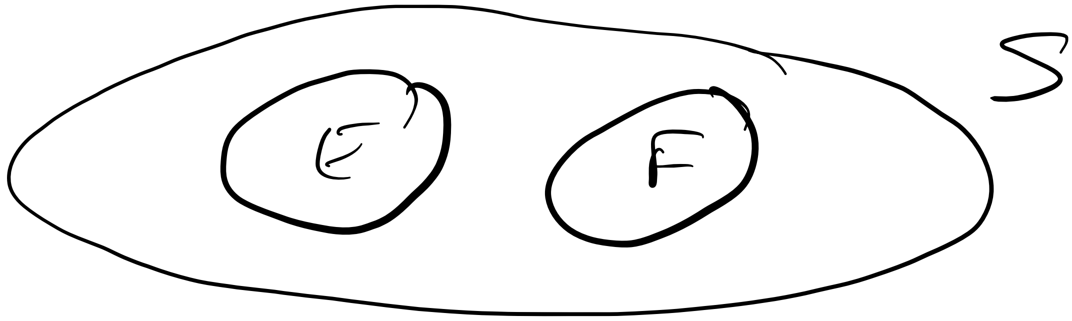
The **complement** of events E is

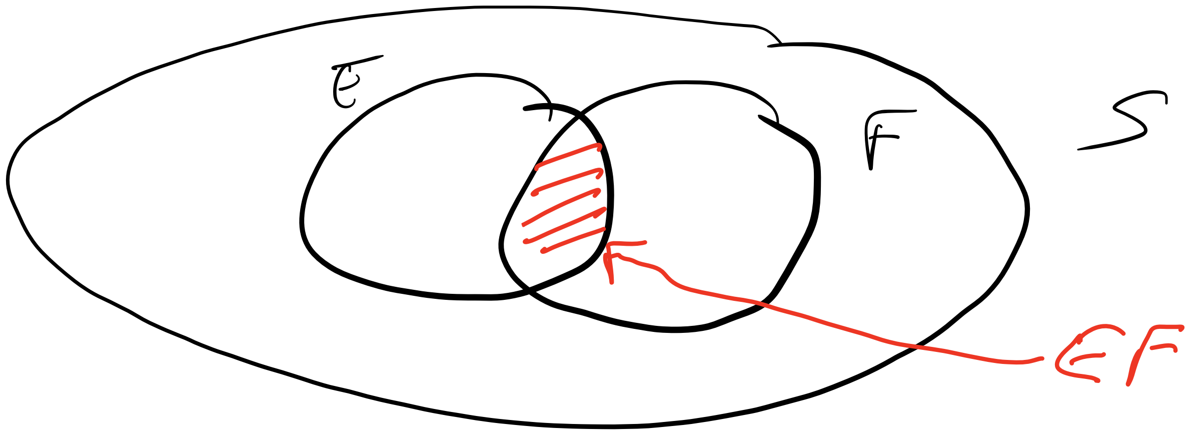
$$E^c = \{x \in S : x \notin E\}$$

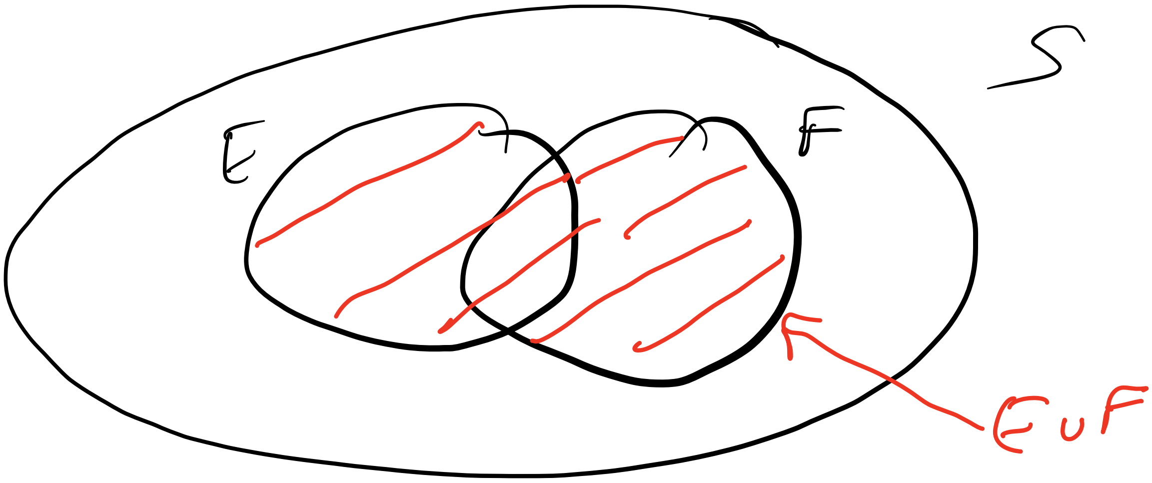
Other notation: $S - E$

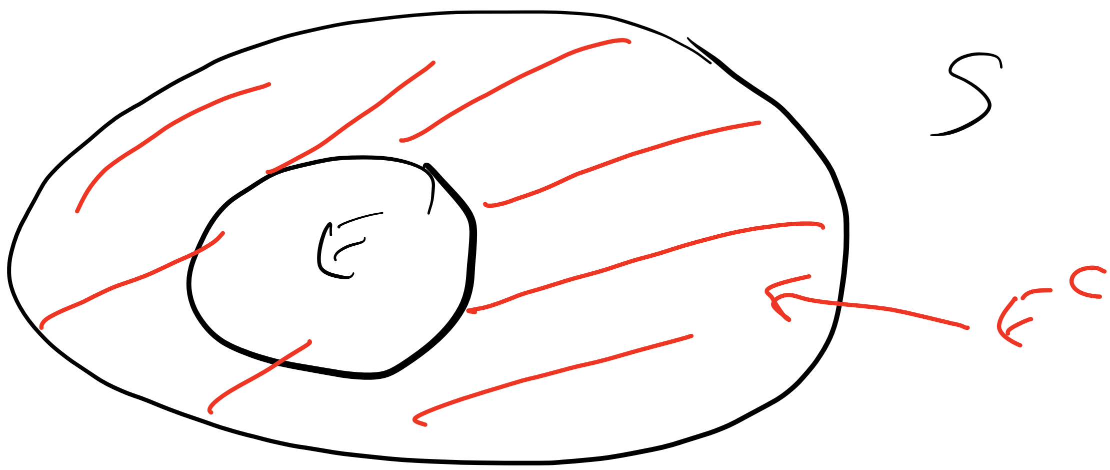
$S \setminus E$

Def: Sets E and F are **disjoint** if $EF = \Phi$.









Ex: Flip 2 coins

$E = \{HH, HT\}$

$F = \{TT, HT\}$

we get:

$$EF = \{HT\}$$

$$E \cup F = \{HH, TT, HT\}$$

$$= \{TH\}^c$$

$$E^c = \{TT, TH\}$$

which of these events below occurred if the experiment's outcome is TT?

E No

E^c Yes

F

F^c ⋮

$E \cup F$

EF

$(EF)^c$

$(E \cup F)^c$