Topic 7: Probability

1) The Basics of Counting:

a) Fundamental Principle Of Counting:

If one event has **m** possible outcomes and a second event has **n** possible outcomes, then there are **m** x **n** total possible outcomes for the two events together.

e.g. 2 starters and 5 main courses => 10 possible dinner options

b) A Deck Of Cards:

- 52 Cards in a deck
- 4 suits: Spades & Clubs (black), Hearts & Diamonds (red)
- Picture Cards: Jack, Queen and King in each suit (12 in total)

c) Different Strategies:

1) We can simply list all possible outcomes.

2) We can make out a **two-way table**, if there are more than two trials.

e.g. tossing a coin two or more times

3) Sometimes it can be useful to make out a **tree diagram**, for showing all possible outcomes of two or more trials.

e.g. chance of picking one yellow and a blue bead from a bag of 6 yellow, 5 blue

2) Basics of Probability:

a) Definition of Probability:

- The probability of an event occurring is:

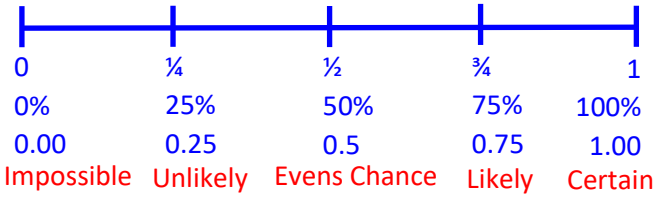
$$\frac{number\ of\ successful\ outcomes}{total\ number\ of\ outcomes}$$

e.g. bag with 5 red and 4 green beads

P(Green) = $\frac{4}{9}$

Note:

➢ Probability values must be between 0 and 1 (see scale below)



b) Terminology:

1. **Trial:** doing an experiment in probability e.g. tossing a coin
2. **Outcome:** one of the possible results of the trial e.g. a 6 when throwing a die
3. **Sample space** is the set of all possible outcomes in a trial.
4. **Event** is the occurrence of one or more specific outcomes.
5. **Probability** is the measure of the chance of an event happening.

c) Relative Frequency and Carrying Out Experiments:

- We can carry out an experiment or trials to estimate the probability of an event occurring.
  e.g. throwing a die to see how many 6's we get
- If you throw a die 20 times and a 6 comes up 3 times we could estimate the probability of throwing a 6 to be $\frac{3}{20}$.
- This estimate we get from carrying out trials, is called the **Relative Frequency**.
- More trials are done => closer the rel freq and probability.

3) Set Theory and Probability:

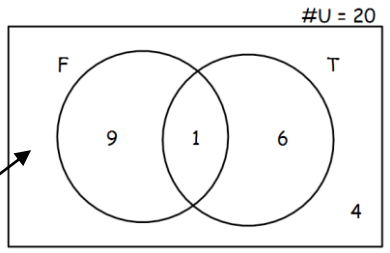
Notes:

➢ Sets can be used to help solve probability problems.

➢ Remember that A ∩ B represents A AND B whereas A ∪ B represents A OR B.

Example 1: 20 people asked if they preferred Facebook or Twitter. 10 said Facebook, 7 said Twitter and 4 said neither. Person selected at random from the group…what is the probability that the person selected: i) chose Facebook and Twitter ii) chose Facebook or Twitter iii) chose Facebook only?

- Firstly, we need to draw a Venn Diagram to represent the problem.
- 4 people chose neither => 16 people chose Facebook or Twitter
- As 10 chose Facebook and 7 chose Twitter => 1 person chose both
- The Venn Diagram for this problem is shown on the right.



i) P(Chose Facebook AND Twitter) = $F \cap T = \frac{1}{20}$

ii) P(Chose Facebook OR Twitter) = $F \cup T = \frac{16}{20} = \frac{4}{5}$

iii) P(Chose Facebook Only) = $\frac{9}{20}$

4) Combined Events:

Remember:

$$AND = \times$$

$$OR = +$$

Example 1: Probability of Paul scoring a free throw is 0.8. What is the probability of:
i) scoring three free throws in a row ii) scoring the first and missing the next two iii) scoring two of the three free throws?

i) P(Score 1st AND Score 2nd AND Score 3rd) = 0.8 x 0.8 x 0.8 = 0.512

ii) P(Score 1st AND Miss 2nd AND Miss 3rd) = 0.8 x 0.2 x 0.2 = 0.032

iii) P(Score 1st and 2nd AND Miss 3rd) OR (Miss 1st AND Score 2nd AND 3rd) OR (Score 1st AND Miss 2nd AND Score 3rd)
= (0.8 x 0.8 x 0.2) + (0.2 x 0.8 x 0.8) + (0.8 x 0.2 x 0.8) = 0.128 + 0.128 + 0.128 = 0.384