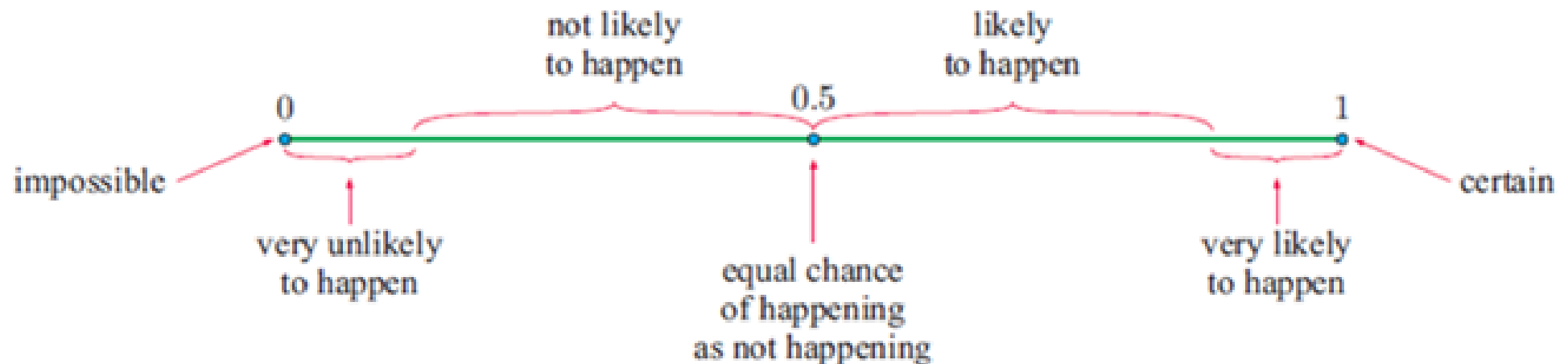


22A – Experimental Probability

Probability – the chance or likelihood of an event happening (assigned a value between 0 and 1).

An **impossible event** has 0% chance of happening (probability of 0).

A **certain event** has 100% chance of happening (probability of 1).



Experimental Probability:

An estimate of the probability of a successful event, calculated using experimental results (i.e. observed results).

Number of trials – the total number of times the experiment is repeated.

Outcomes – the different results possible for one trial.

Frequency – the number of times an outcome is observed.

Relative Frequency – the frequency of the outcome expressed as a fraction or percentage of the total number of trials.

Example: A die is rolled 6000 times and the number "4" occurs 935 times.

Number of Trials: 6000

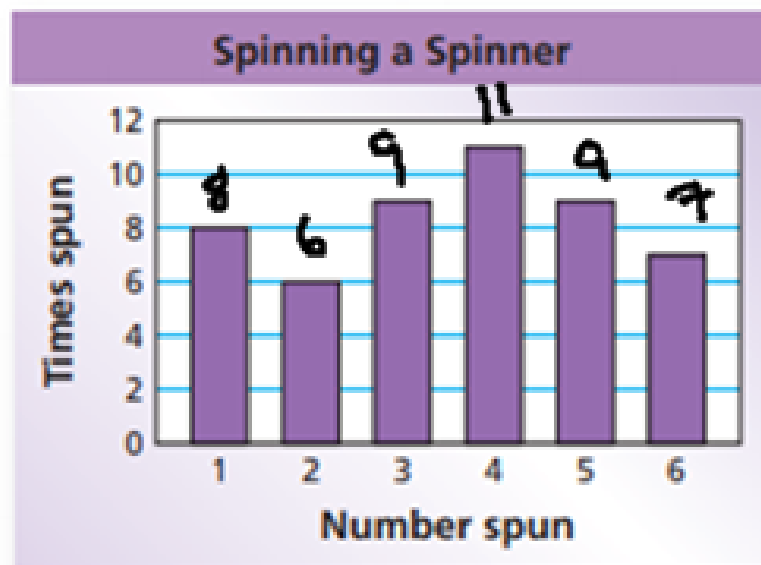
Outcomes: rolling 1, 2, 3, 4, 5, 6

Frequency: 935

Relative Frequency: $\frac{935}{6000}$

Experimental Probability = Relative Frequency

Example:



Use the graph to estimate the chance of:

$$\begin{aligned} \text{Total trials} &= 8 + 6 + 9 + 11 + 9 + 7 \\ &= 50 \end{aligned}$$

(A) Spinning a 6 $\frac{7}{50}$

(B) Spinning an even number
 $= \frac{6 + 11 + 7}{50}$

(C) Not spinning a 1
 $= \frac{6 + 9 + 11 + 9 + 7}{50}$ or $\frac{50 - 8}{50}$

(D) Spinning a number less than 3
 $= \frac{6 + 8}{50}$

(E) Spinning a 1 or a 3
 $= \frac{8 + 9}{50}$

(F) Spinning a 7
 $= \frac{0}{50}$

22B – Sample Space

A sample space is the set of all possible outcomes on an experiment. It is also referred to as the **universal set**, U .

Represent sample spaces by:

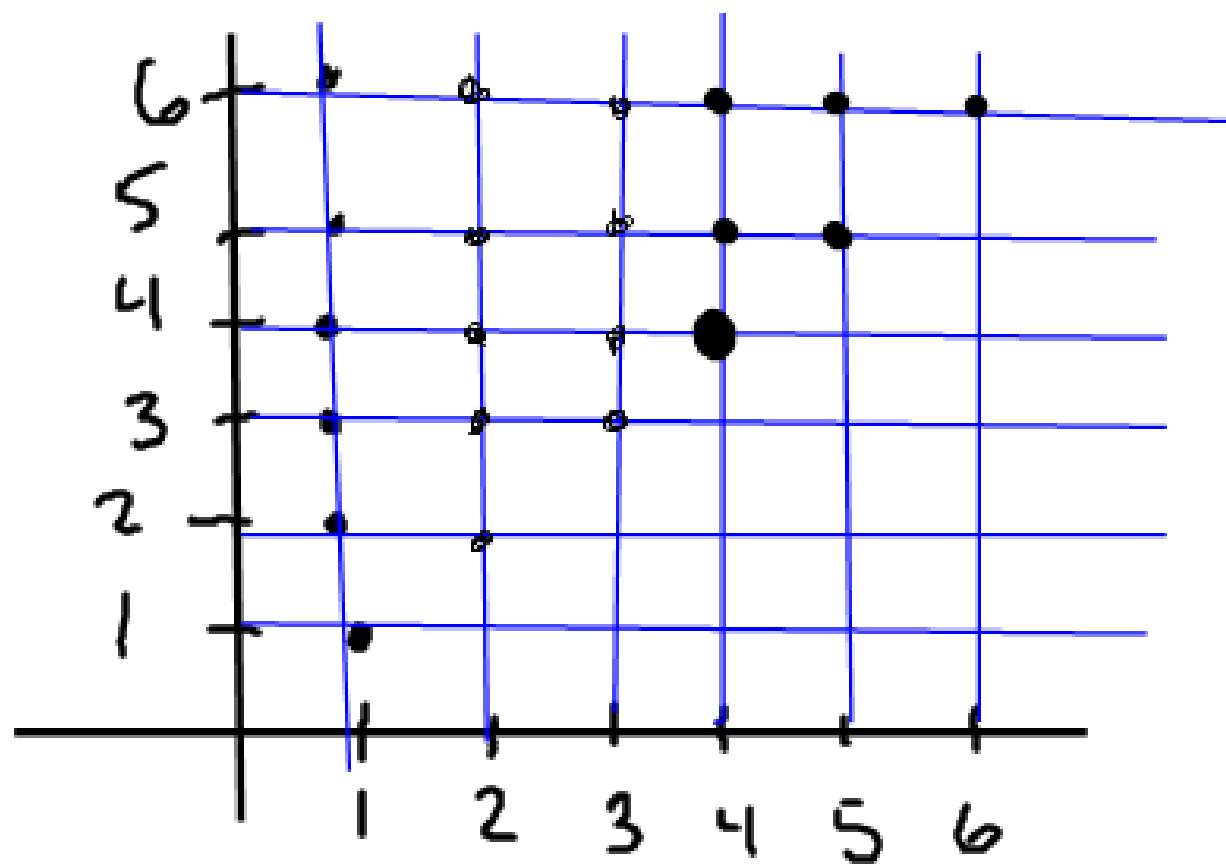
- lists
- tables of outcomes
- 2-dimensional grids
- Venn diagrams
- tree diagrams

Example:

List the sample space of possible outcomes, then illustrate using a tree diagram and a 2-dimensional grid, when rolling 2 dice.

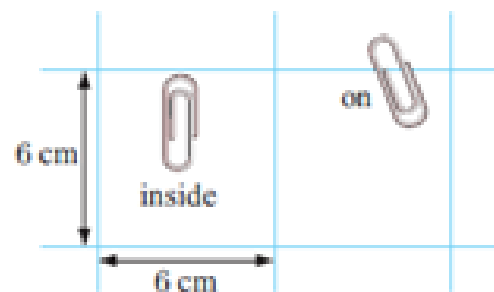
Sample space: $\{11, 12, 13, 14, 15, 16, 22, 23, 24, 25, 26, 33, 34, 35, 36, 44, 45, 46, 55, 56, 66\}$





EXERCISE 22A

- 1 When a batch of 145 paper clips was dropped onto 6 cm by 6 cm squared paper, it was observed that 113 fell completely inside squares and 32 finished up on the grid lines. Find, to 2 decimal places, the experimental probability of a clip falling:



- a inside a square b on a line.

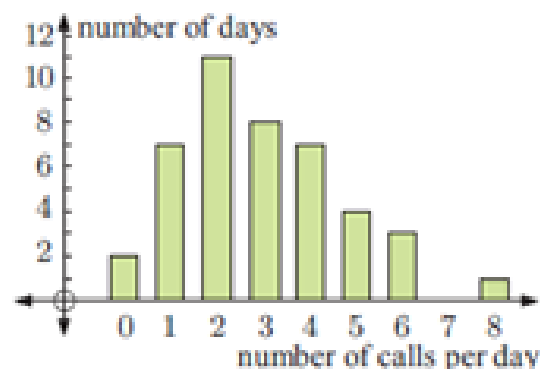
Length	Frequency
0 - 19	17
20 - 39	38
40 - 59	19
60+	4

Jose surveyed the length of TV commercials (in seconds). Find, to 3 decimal places, the experimental probability that a randomly chosen TV commercial will last:

- a 20 to 39 seconds b more than a minute
c between 20 and 59 seconds (inclusive).

- 3 Betul records the number of phone calls she receives over a period of consecutive days.

- a For how many days did the survey last?
b Estimate Betul's chance of receiving:
i no phone calls in a day
ii 5 or more phone calls in a day
iii less than 3 phone calls in a day.



- 4 Pat does a lot of travelling in her car, and she keeps records on how often she fills her car with petrol. The table alongside shows the frequencies of the number of days between refills. Estimate the likelihood that:

- a there is a four day gap between refills
b there is at least a four day gap between refills.

Days between refills	Frequency
1	37
2	81
3	48
4	17
5	6
6	1

EXERCISE 22B

- 1 List the sample space for the following:
 - a twirling a square spinner labelled A, B, C, D
 - b the sexes of a 2-child family
 - c the order in which 4 blocks A, B, C and D can be lined up
 - d the 8 different 3-child families.

- 2 Illustrate on a 2-dimensional grid the sample space for:
 - a rolling a die and tossing a coin simultaneously
 - b rolling two dice
 - c rolling a die and spinning a spinner with sides A, B, C, D
 - d twirling two square spinners, one labelled A, B, C, D and the other 1, 2, 3, 4.

- 3 Illustrate on a tree diagram the sample space for:
 - a tossing a 5-cent and a 10-cent coin simultaneously
 - b tossing a coin and twirling an equilateral triangular spinner labelled A, B, and C
 - c twirling two equilateral triangular spinners labelled 1, 2, and 3, and X, Y, and Z
 - d drawing two tickets from a hat containing a large number of pink, blue, and white tickets.

