



10 – Probability

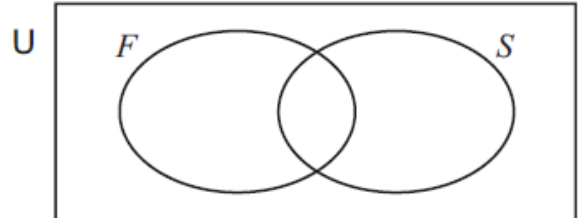
Student name: _____ **Answers** _____ Score: _____

1. Sara records some information about the number of cars in a car park.

$$U = \{\text{cars in the car park}\}$$

$$F = \{\text{5-door cars}\}$$

$$S = \{\text{silver cars}\}$$



You may use the Venn diagram to help you answer the following questions.

(a) $n(U) = 12$, $n(F) = 7$, $n(F \cap S) = 2$, $n(F \cup S) = 11$.

Find

(i) $n(S)$,

..... **6** [1]

(ii) $n(S \cup F')$.

..... **7** [1]

(b) Sara chooses a car from the car park at random.

Find the probability that it is a 5-door car.

..... **$\frac{7}{12}$** [1]

(c) Sara chooses a silver car at random.

Find the probability that it is a 5-door car.

..... **$\frac{2}{6}$** [1]

2. Paulo goes to a supermarket.

The probability that he buys orange juice is 0.65 .

The probability that he does not buy milk is 0.30 .

The probability that he buys milk but does not buy orange juice is 0.15 .

(a) Complete the table of probabilities.

	Buys milk	Does not buy milk	Total
Buys orange juice	0.55	0.1	0.65
Does not buy orange juice	0.15	0.2	0.35
Total	0.7	0.30	1.00

[2]

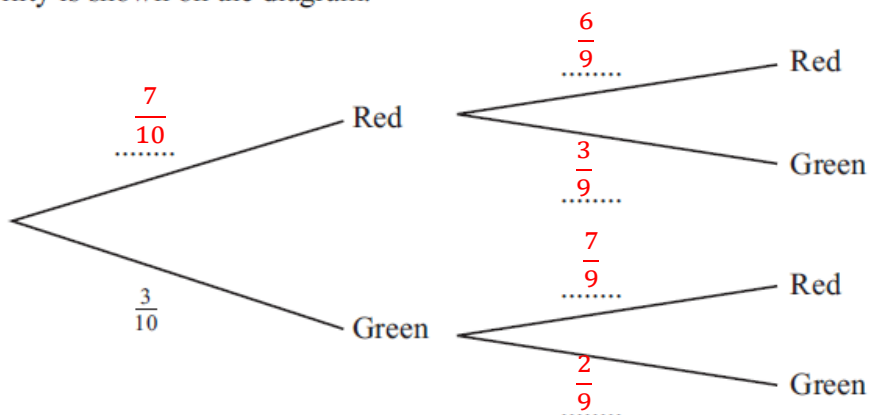
(b) Find the probability that Paulo buys either orange juice or milk but not both.

..... **0.25** [2]



3. A bag contains 10 discs, 7 are red and 3 are green.
A disc is picked at random and not replaced.
A second disc is then picked at random.

- (a) Complete the tree diagram.
One probability is shown on the diagram.



[2]

- (b) Find the probability that

- (i) both discs are red,

..... $\frac{7}{15}$ [2]

- (ii) at least one disc is red.

..... $\frac{14}{15}$ [3]

4. Ann, Babar, Chan and Demi each throw the same **biased** die.
They want to find the probability of throwing a six with this die.
They each throw the die a different number of times.

These are their results.

	Ann	Babar	Chan	Demi
Number of throws	200	20	100	500
Number of sixes	60	5	30	200

- (a) Complete the table below to show the relative frequencies of their results.
Write your answers as decimals.

	Ann	Babar	Chan	Demi
Relative frequency of throwing a six	0.3	0.25	0.3	0.4

[2]

- (b) Give a reason why Demi's result gives the best estimate of the probability of throwing a six with the biased die.

More throws [1]

- (c) Estimate the number of times that Demi could expect to get a six if he throws the die 1600 times.

640 [1]



5. Anneke, Babar, Céline, and Dieter each throw the same **biased** die. They want to find the probability of throwing a six with this die. They each throw the die a different number of times.

These are their results.

	Anneke	Babar	Céline	Dieter
Number of throws	200	40	100	500
Number of sixes	46	12	15	100

	Anneke	Babar	Céline	Dieter
Relative frequency of throwing a six	0.23	0.3	0.15	0.2

[2]

- (b) Whose result gives the best estimate of the probability of throwing a six with the biased die? Give a reason for your answer.

..... **Dieter** because **More throws**

..... [1]

- (c) The probability of throwing a six with a different biased die is 0.41. Find the expected number of sixes when this die is thrown 600 times.

..... **246** [1]

6. Luis has a large jar containing red, yellow, green and blue beads. He takes a bead at random from the jar, notes its colour and replaces it. He repeats this 200 times. The table shows his results.

Colour	Red	Yellow	Green	Blue
Number of beads	26	72	64	38
Relative frequency	0.13	0.36	0.32	0.19

- (a) Complete the table to show the relative frequencies. [2]
 (b) (i) There are 5000 beads in the jar altogether.

Estimate the number of green beads in the jar.

..... **1600** [1]

- (ii) Explain why this is a good estimate.

Sufficient trials

..... [1]



7. A biased die, that has six faces, is numbered 1 to 6.
The table shows the results when the die is rolled 60 times.

Number	1	2	3	4	5	6
Frequency	3	12	8	16	7	14

- (a) Jose rolls the die.

Find the probability that the number shown is even.

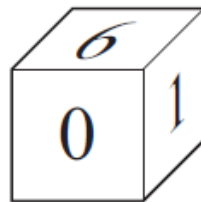
$$\frac{42}{60} \dots\dots\dots [1]$$

- (b) Jose rolls the die 1200 times.

Find the expected number of times that the number shown on the die is even.

$$840 \dots\dots\dots [1]$$

8.



The die in the diagram has a number on each face.
The numbers are 0, 0, 1, 2, 4, 6.
The die is rolled until it shows 0 on the top face.

Find the probability that this happens for the first time on the third roll.

$$\frac{4}{27} \dots\dots\dots [2]$$

9. Sanjay asks a random sample of 200 students how they travel to school.
These are his results.

Method of travel	Walk	Cycle	Bus	Car	Train
Frequency	52	47	62	27	12

- (a) Find the relative frequency of a student travelling by bus.

$$\frac{62}{200} \dots\dots\dots [1]$$

- (b) The school has 1200 students.

- (i) Explain why it is reasonable to use your answer to part (a) as the probability that a student chosen at random from the school travels by bus.

Large sample $\dots\dots\dots [1]$

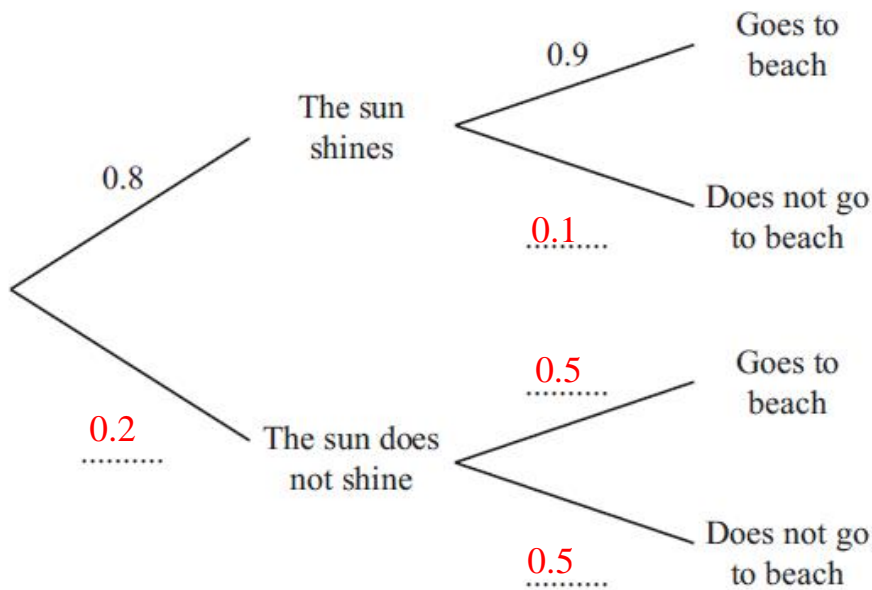
- (ii) Estimate the number of students in the school who travel by bus.

$$372 \dots\dots\dots [1]$$



10. In Hurghada the probability that the sun will shine on any day is 0.8.
 If the sun shines, the probability Ahmed will go to the beach is 0.9.
 If the sun does not shine, the probability he will go to the beach is 0.5.

(a) Complete the tree diagram.



[2]

(b) Find the probability that Ahmed will go to the beach on a given day.

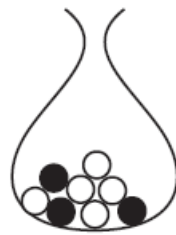
..... 0.82 [2]

11. A bag has 3 blue balls and 7 green balls only.
 One ball is chosen at random and not replaced.
 A second ball is then chosen at random.

Find the probability that both balls chosen are the same colour.
 Give your answer in its simplest form.

..... $\frac{8}{15}$ [4]

12.

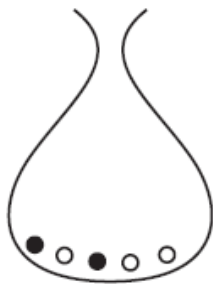


The bag contains 5 white beads and 3 black beads.
 Two beads are taken from the bag at random, without replacement.

Find the probability that the two beads are different colours.

..... $\frac{30}{56}$ [3]

13. (a)

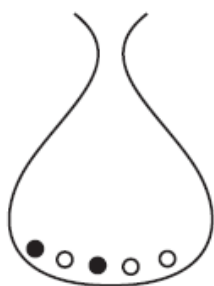


A bag contains 3 white beads and 2 black beads.
Two beads are taken out of the bag at random, without replacement.

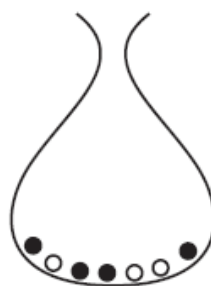
Calculate the probability that both beads are white.

$$\frac{6}{20} \dots\dots\dots [2]$$

(b)



Bag A



Bag B

Bag A contains 3 white beads and 2 black beads.
Bag B contains 3 white beads and 4 black beads.

One bead is taken out of **each** bag at random.

Calculate the probability that one bead is white and one bead is black.

$$\frac{18}{35} \dots\dots\dots [3]$$

14 A bag contains 10 discs.
5 discs are red, 4 are blue and 1 is green.
A disc is chosen at random and not replaced.
A second disc is then chosen at random.

Find the probability that

(a) both discs are green,

$$\frac{0}{90} \dots\dots\dots [1]$$

(b) both discs are the same colour.

$$\frac{32}{90} \dots\dots\dots [3]$$

15. Two fair dice, each numbered 1, 2, 3, 4, 5, 6, are rolled and the **total** score is recorded.

Find the probability that the total score is

(a) 12, $\frac{1}{36}$ [2]

(b) 13, 0 [2]

(c) 7. $\frac{6}{36}$ [2]

16. One day there were 720 students at a school.

The table shows the type of transport the students used to get to school.

Type of transport	Walk	Bus	Car	Bicycle
Number of students	117	280	240	x

(a) Find the value of x . $x = 83$ [1]

(b) Find the relative frequency of students who went to school by car.
Give your answer as a fraction in its lowest terms. $\frac{1}{3}$ [2]

17. A bag contains 2 blue balls, 3 red balls and 5 green balls only.
One ball is chosen at random.

Find the probability that this ball is red. 0.3 [1]

18. A factory makes soft centre chocolates and hard centre chocolates only.
The probability that a chocolate chosen at random has a hard centre is 0.6 .
Three chocolates are chosen at random.

Find the probability they are all soft centre chocolates. 0.064 [3]

19. Jamil has a biased 6-sided die.
He rolls it 350 times.
The results are shown in the table.

Number on die	1	2	3	4	5	6
Frequency	20	50	72	68	56	84

(a) Find the relative frequency of getting a 2 with Jamil's die. $\frac{50}{350}$ [1]

(b) Explain why your answer to **part (a)** is a good estimate of the probability of getting a 2.
Is a large sample..... [1]

(c) Estimate the number of times Jamil will get a 2 if he rolls the die 1400 times. 200 [1]



20. A bag contains 2 blue balls, 3 red balls and 5 green balls only.
 John takes a ball out of the bag at random.
 He records the colour and puts the ball back in the bag.
 Flavia takes a ball out of the bag at random and records the colour.

Find the probability that both balls are red.

0.09 [2]

21. A biased four-sided spinner is spun 150 times.
 The number of times that the spinner lands on each number is shown in the table.

Number on spinner	1	2	3	4
Frequency	34	63	27	26

- (a) Write down the relative frequency of the spinner landing on 2. $\frac{63}{150}$ [1]
- (b) Explain why it is reasonable to use your answer to **part (a)** as the probability of this spinner landing on 2.
 ... Large sample [1]
- (c) The spinner is spun 3000 times.

Find the expected number of times that the spinner lands on 2.

1260 [2]

22. A bag contains 12 discs.
 7 discs are red and 5 discs are green.
 A disc is picked at random and not replaced.
 A second disc is then picked at random.

Find the probability that

- (a) both discs are green, $\frac{20}{132}$ or $\frac{5}{33}$ [2]
- (b) at least one disc is green. $\frac{90}{132}$ or $\frac{15}{22}$ [3]

23. The faces of a die are numbered 1, 1, 2, 3, 3 and 4.
 When it is rolled it is equally likely to show any face.
 The die is rolled twice.

Find the probability that it shows an odd number both times.

$\frac{16}{36}$ or $\frac{4}{9}$ [2]



24. Karen has 3 blue hats, 5 red hats and 2 white hats.
She also has 4 blue scarves, 3 red scarves and 1 white scarf.

(a) Karen takes a hat at random and replaces it.

Find the probability that it is white.

..... $\frac{2}{10}$ or $\frac{1}{5}$ [1]

(b) Karen takes a hat and a scarf at random.

Find the probability that both the hat and the scarf are blue.

..... $\frac{12}{80}$ or $\frac{3}{20}$ [2]

25. John goes to a shop that sells newspapers and magazines only.

(a) Complete the table of probabilities of John buying something at the shop.

	Buys a newspaper	Does not buy a newspaper	Total
Buys a magazine	0.3	0.1	0.40
Does not buy a magazine	0.25	0.35	0.6
Total	0.55	0.45	1.00

[2]

(b) Find the probability that John buys a magazine but not a newspaper.

..... 0.1 [1]

26. A bag has 5 black counters, 4 white counters and 1 red counter.
One counter is chosen at random and is replaced.
A second counter is then chosen at random.

Find the probability that the two counters chosen are different colours.

..... 0.58 or $\frac{29}{50}$ or $\frac{58}{100}$ [4]

27. Eggs are graded into four sizes: extra large, large, medium and small.
A farmer records the sizes of a sample of 100 eggs that she collects.
The results are shown in the table.

Size	Extra large	Large	Medium	Small
Number of eggs	28	36	24	12

(a) Find the relative frequency for large eggs.

..... $\frac{36}{100}$ or $\frac{9}{25}$ [1]

(b) In one month, the farmer collects 2500 eggs.

Calculate an estimate for the number of these eggs that are small.

..... 300 [2]



28. The probability that it rains today is 0.3 .
 If it rains today, the probability that it will rain tomorrow is 0.4 .
 If it does not rain today, the probability that it will rain tomorrow is 0.15 .

Find the probability that it will rain tomorrow.

.....0.225..... [3]

29. A bag contains 8 blue balls, 3 red balls and 4 green balls only.
 One ball is chosen at random.

Find the probability that this ball is red.
 Give your answer as a fraction in its simplest form.

..... $\frac{3}{15}$ or $\frac{1}{5}$ [2]

30. A bag contains 4 red balls and 5 blue balls only.
 Two balls are chosen at random without replacement.

Find the probability that the two balls chosen are different colours.

..... $\frac{40}{72}$ or $\frac{5}{9}$ [3]

31. At a railway station, the probability that any train departs on time is $\frac{7}{8}$.

The number of trains in one day is 72.

Work out the expected number of trains that depart on time.

.....63..... [1]

32. An archer fires three arrows at a target.

The probability that the archer hits the target with each arrow is $\frac{3}{5}$.

Find the probability that the archer hits the target exactly twice.

..... $\frac{54}{125}$ [3]

33. 200 students record the method they use most to travel to school.
 The results are shown in the table.

Method of travel	Bus	Car	Walk	Cycle
Number of students	40	98	37	25

- (a) Find, as a fraction, the relative frequency of a student travelling to school by bus.
 $\frac{40}{200}$ [1]

- (b) Give a reason why it is reasonable to use your answer to **part (a)** to estimate the probability that a student travels to school by bus.
Large sample..... [1]

- (c) The school has 1800 students.
 Estimate the number of students who travel to school by bus.
360..... [1]



34. Pierre records the colour of each of 200 cars passing his home.
The table shows the results.

Colour	Silver	Black	Red	Green	Blue	Other
Frequency	23	68	35	20	32	22

- (a) Write down the relative frequency of a silver car.
 $\frac{23}{200}$ or 0.115 [1]
- (b) Explain why it is reasonable to use the answer to **part (a)** as the probability that the next car which passes will be silver.
 Large sample [1]
- (c) Over the whole day 1200 vehicles pass Pierre's home.
 Estimate the number of these cars that are silver.
 138 [1]

35. Mia carries out a survey in a school to find out what students will do when they leave school.
These are her results.

	University	Job	Training	Travelling	Total
Frequency	112	43	27	18	200

- (a) Find the relative frequency of university.
 $\frac{112}{200}$ or 0.56 [1]
- (b) There are 1600 students in this school.
- (i) Explain why the result in **part (a)** is a reasonable estimate of the probability that a student from this school will go to university.
 Large sample [1]
- (ii) Calculate an estimate for the number of students in this school who will go travelling.
 144 [2]

36. There are 640 students in a school.
The table shows the favourite colour of each of the students.

Favourite colour	Blue	Green	Red	Yellow
Number of students	120	2x	280	x

- (a) Find the value of x .
 $x = 80$ [2]
- (b) Find the relative frequency of students whose favourite colour is red.
 Give your answer as a fraction in its lowest terms.
 $\frac{7}{16}$ [2]

37. A bag contains 12 discs.
 There are 2 red discs, 4 blue discs, 5 green discs and 1 yellow disc.
 A disc is chosen at random and not replaced.
 A second disc is then chosen at random.

Find the probability that both discs are the same colour.

$$\frac{34}{132} \text{ or } \frac{17}{66}$$

..... [3]

38. Bag A contains balls numbered 2, 4, 4, 4.
 Bag B contains balls numbered 1, 1, 2, 3, 4, 4.
 Bag C contains balls numbered 1, 2, 3, 4.

One of these three bags is chosen at random.
 A ball is chosen at random from this bag.

Find the probability that the ball chosen is numbered 4.
 Give your answer as a fraction.

$$\frac{16}{36} \text{ or } \frac{4}{9}$$

..... [3]

39. A biased 5-sided spinner is spun 200 times.
 The results are shown in the table.

Number	1	2	3	4	5
Frequency	24	48	63	38	27

- (a) Find the relative frequency of the spinner landing on 2.

$$\frac{48}{200} \text{ or } \frac{6}{25}$$

..... [1]

- (b) The spinner is spun 1000 times.

Find the expected number of times that the spinner lands on 2.

$$240$$

..... [1]

40. An unbiased six-sided die is numbered 1, 2, 3, 4, 5, 6.
 The die is rolled.

Find the probability that it shows

- (a) 6,

$$\frac{1}{6}$$

..... [1]

- (b) a number greater than 6.

$$0$$

..... [1]