WORKSHEET - General 2 Mathematics

Topic Areas:

Probability

PB2 – Multi-stage events and Applications of Probability

- # Combinations
- Multi-stage Events
- Financial Expectation

Teacher: PETER HARGRAVES

Source: HSC exam questions

Exam Equivalent Time: 97.5 minutes

Worked Solutions: Included

Note: Each question has designated marks. Use this information as both a guide to the question's difficulty and as a timing indicator, whereby each mark should equate to 1.5 minutes of working (examination) time.

Questions

1. Probability, 2UG 2008 HSC 18 MC

New car registration plates contain two letters followed by two numerals followed by two more letters eg $\mathrm{AC\ 12\ DC}$. Letters and numerals may be repeated.

Which of the following expressions gives the correct number of car registration plates that begin with the letter M?

(A) $26^3 \times 10^2$

(B) $25^3 \times 10^2$

(C) $26^4 \times 10^2$

(D) $25^4 \times 10^2$

2. Probability, 2UG 2014 HSC 6 MC

A cafe menu has 3 entrees, 5 main courses and 2 desserts. Ariana is choosing a three-course meal consisting of an entree, a main course and a dessert.

How many different three-course meals can Ariana choose?

(A) 3

(B) 10

(C) 15

(D) 30

3. Probability, 2UG 2011 HSC 5 MC

The letters A, B and C are used to make a three-letter company name. Each letter is used only once.

How many different company names can be made?

(A) 3

(B) 6

(C) 9

(D) 27

4. Probability, 2UG 2009 HSC 7 MC

Two people are to be selected from a group of four people to form a committee.

How many different committees can be formed?

(A) 6

(B) 8

(C) 12

(D) 16

5. Probability, 2UG 2010 HSC 14 MC

A restaurant serves three scoops of different flavoured ice-cream in a bowl. There are five flavours to choose from.

How many different combinations of ice-cream could be chosen?

(A) 10

(B) 15

(C) 30

(D) 60

6. Probability, 2UG 2012 HSC 3 MC

A pair of players is to be selected from 6 people.

How many different pairs of players can be selected?

(A) 6

(B) 12

(C) 15

(D) 30

7. Probability, 2UG 2013 HSC 18 MC

Two unbiased dice, each with faces numbered $1, 2, 3, 4, 5, 6,$ are rolled.

What is the probability of obtaining a sum of 6?

(A) $\frac{1}{6}$

(B) $\frac{1}{12}$

(C) $\frac{5}{12}$

(D) $\frac{5}{36}$

8. Probability, 2UG 2014 HSC 19 MC

Jaz has 2 bags of apples.

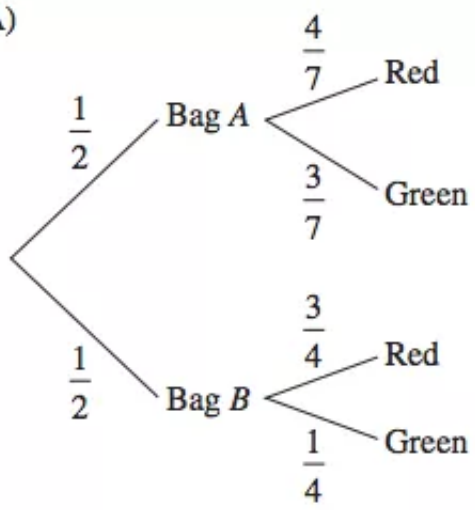
Bag A contains 4 red apples and 3 green apples.

Bag B contains 3 red apples and 1 green apple.

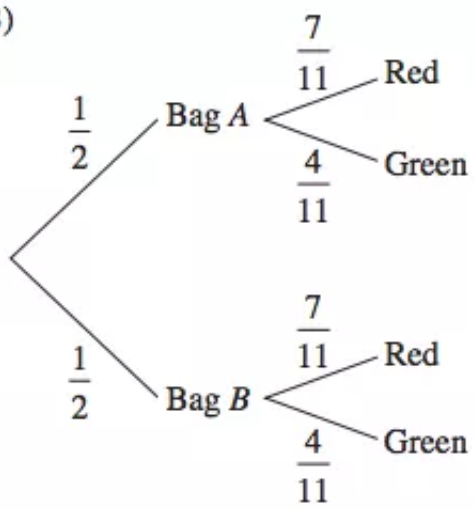
Jaz chooses an apple from one of the bags.

Which tree diagram could be used to determine the probability that Jaz chooses a red apple?

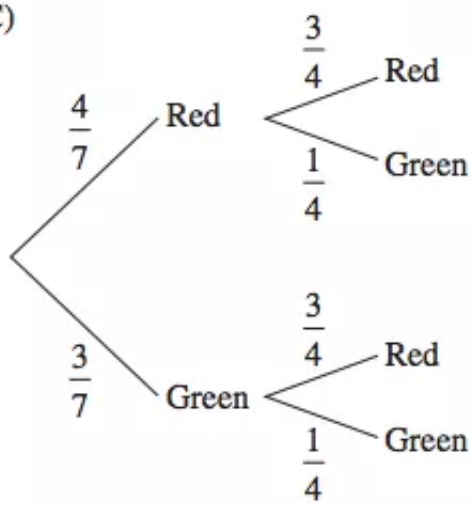
(A)



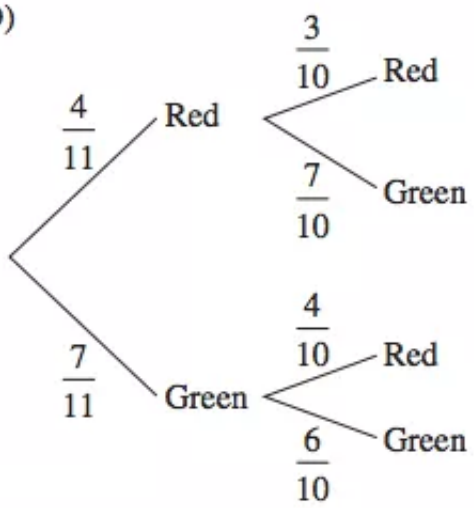
(B)



(C)



(D)



9. Probability, 2UG 2012 HSC 12 MC

Two unbiased dice, each with faces numbered $1, 2, 3, 4, 5, 6,$ are rolled.

What is the probability of a 6 appearing on at least one of the dice?

(A) $\frac{1}{6}$

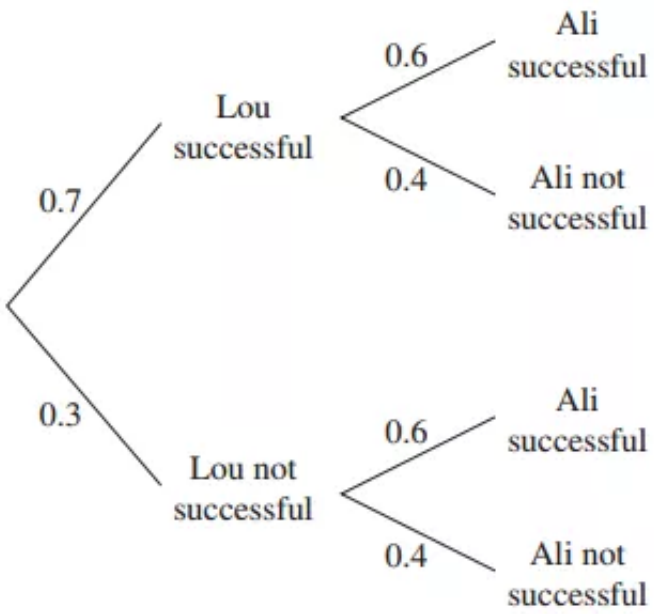
(B) $\frac{11}{36}$

(C) $\frac{25}{36}$

(D) $\frac{5}{6}$

10. Probability, 2UG 2010 HSC 20 MC

Lou and Ali are on a fitness program for one month. The probability that Lou will finish the program successfully is 0.7 while the probability that Ali will finish successfully is 0.6. The probability tree shows this information



What is the probability that only one of them will be successful ?

(A) 0.18

(B) 0.28

(C) 0.42

(D) 0.46

11. Probability, 2UG 2014 HSC 16 MC

In Mathsville, there are on average eight rainy days in October

Which expression could be used to find a value for the probability that it will rain on two consecutive days in October in Mathsville?

(A) $\frac{8}{31} \times \frac{7}{30}$

(B) $\frac{8}{31} \times \frac{7}{31}$

(C) $\frac{8}{31} \times \frac{8}{30}$

(D) $\frac{8}{31} \times \frac{8}{31}$

12. Probability, 2UG 2008 HSC 22 MC

A die has faces numbered 1 to 6. The die is biased so that the number 6 will appear more often than each of the other numbers. The numbers 1 to 5 are equally likely to occur.

The die was rolled 1200 times and it was noted that the 6 appeared 450 times.

Which statement is correct?

(A) The probability of rolling the number 5 is expected to be $\frac{1}{7}$.

(B) The number 6 is expected to appear 2 times as often as any other number.

(C) The number 6 is expected to appear 3 times as often as any other number.

(D) The probability of rolling an even number is expected to be equal to the probability of rolling an odd number.

13. Probability, 2UG 2009 HSC 27c

In each of three raffles, 100 tickets are sold and one prize is awarded.

Mary buys two tickets in one raffle. Jane buys one ticket in each of the other two raffles.

Determine who has the better chance of winning at least one prize. Justify your response using probability calculations. ***(4 marks)***

14. Probability, 2UG 2012 HSC 26a

Postcodes in Australia are made up of four digits eg 2040.

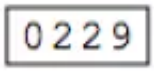
(i) How many different postcodes beginning with a 2 are possible? ***(1 mark)***

(ii) Peta remembers that the first two digits of a town's postcode are 2 and then 4. She is unable to remember the rest of the postcode. ***(1 mark)***

What is the probability that Peta guesses the correct postcode?

15. Probability, 2UG 2009 HSC 23b

A personal identification number (PIN) is made up of four digits. An example of a PIN is



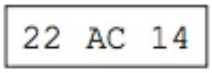
(i) When all ten digits are available for use, how many different PINs are possible? ***(1 mark)***

(ii) Rhys has forgotten his four-digit PIN, but knows that the first digit is either 5 or 6.

What is the probability that Rhys will correctly guess his PIN in one attempt? ***(1 mark)***

16. Probability, 2UG 2010 HSC 26a

A design of numberplates has a two-digit number, two letters and then another two-digit number, for example



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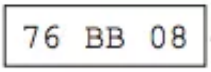
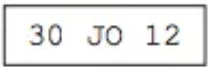


(i) How many different numberplates are possible using this design? ***(1 mark)***

(ii) Jo's birthday is 30 December 1992, so she would like a numberplate with either



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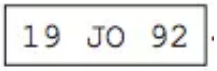


Jo can order a numberplate with 'JO' in the middle but will have to have randomly selected numbers on either side.

What is the probability that Jo is issued with one of the numberplates she would like? ***(2 marks)***

17. Probability, 2UG 2013 HSC 26c

The probability that Michael will score more than 100 points in a game of bowling is $\frac{31}{40}$.

(i) A commentator states that the probability that Michael will score less than 100 points in a game of bowling is $\frac{9}{40}$.

Is the commentator correct? Give a reason for your answer. ***(1 mark)***

(ii) Michael plays two games of bowling. What is the probability that he scores more than 100 points in the first game and then again in the second game? ***(1 mark)***

18. Probability, 2UG 2013 HSC 29c

Mary is designing a website that requires unique logins to be generated.

She plans to generate the logins using two capital letters from the alphabet followed by a series of numerals from 0 to 9 inclusive. All logins will have the same number of numerals. Repetition of letters and numerals is allowed.

What is the minimum number of numerals required for each login so that Mary can generate at least 3 million logins?

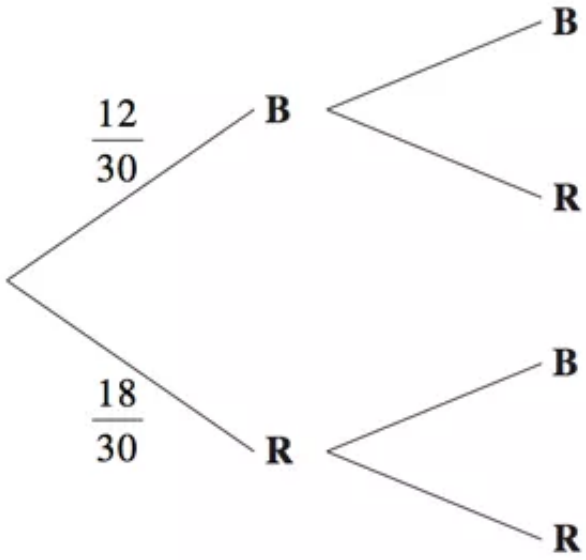
Justify your answer with suitable calculations. ***(2 marks)***

19. Probability, 2UG 2008 HSC 25b

In a drawer there are 30 ribbons. Twelve are blue and eighteen are red.

Two ribbons are selected at random.

(i) Copy and complete the probability tree diagram. ***(1 mark)***



(ii) What is the probability of selecting a pair of ribbons which are the same colour? ***(2 marks)***

20. Probability, 2UG 2008 HSC 26c

Joel is designing a game with four possible outcomes. He has decided on three of these outcomes.

	Chance of occurring	*Result*
Outcome 1	10%	Win \$12
Outcome 2	40%	Win \$6
Outcome 3	30%	Win \$3
Outcome 4		

What must be the value of the loss in Outcome 4 in order for the financial expectation of this game to be \$0? ***(2 marks)***

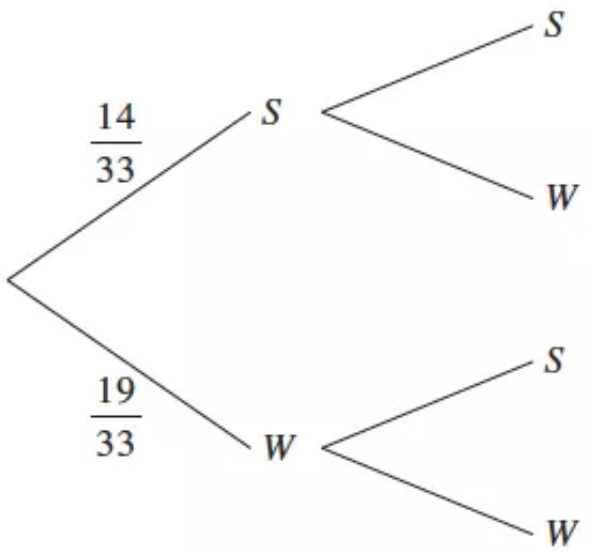
21. Probability, 2UG 2014 HSC 28c

A fair coin is tossed three times. Using a tree diagram, or otherwise, calculate the probability of obtaining two heads and a tail in any order. ***(2 marks)***

22. Probability, 2UG 2012 HSC 27e

A box contains 33 scarves made from two different fabrics. There are 14 scarves made from silk (S) and 19 made from wool (W).
Two girls each select, at random, a scarf to wear from the box.

(i) Copy and complete the probability tree diagram in your answer booklet. ***(2 marks)***



(ii) Calculate the probability that the two scarves selected are made from silk. ***(1 mark)***

(iii) Calculate the probability that the two scarves selected are made from different fabrics. ***(2 marks)***

23. Probability, 2UG 2010 HSC 26c

Tai plays a game of chance with the following outcomes.

- $\frac{1}{5}$ chance of winning $\$10$
- $\frac{1}{2}$ chance of winning $\$3$
- $\frac{3}{10}$ chance of losing $\$8$

The game has a $\$2$ entry fee.

What is his financial expectation from this game? ***(2 marks)***

24. Probability, 2UG 2011 HSC 26a

The two spinners shown are used in a game.

Spinner A

Spinner B

Each arrow is spun once. The score is the total of the two numbers shown by the arrows.
A table is drawn up to show all scores that can be obtained in this game.

		Spinner B			
		1	**1**	**2**	**3**
Spinner A	**1**	2	2	3	4
	1	2	2	3	4
	3	4	4	X	6

(i) What is the value of X in the table? ***(1 mark)***

(ii) What is the probability of obtaining a score less than 4? ***(1 mark)***

(iii) On Spinner B, a 2 is obtained. What is the probability of obtaining a score of 3? ***(1 mark)***

(iv) Elise plays a game using the spinners with the following financial outcomes.

- Win \$12 for a score of 4
- Win nothing for a score of less than 4
- Lose \$3 for a score of more than 4

It costs \$5 to play this game. Will Elise expect a gain or a loss and how much will it be?

Justify your answer with suitable calculations. ***(3 marks)***

25. Probability, 2UG 2013 HSC 29d

Jane plays a game which involves two coins being tossed. The amounts to be won for the different possible outcomes are shown in the table.

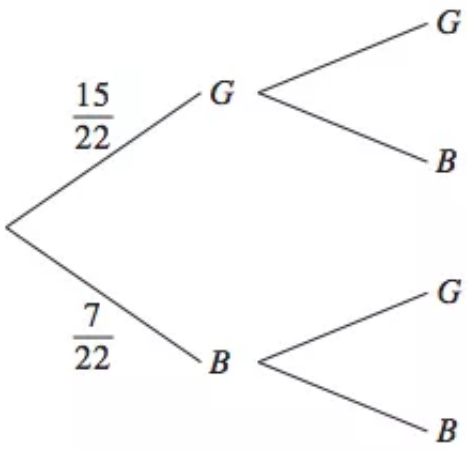
Win	\$6	for two heads
Win	\$1	for one head and one tail
Win	\$2	for two tails

It costs $\$4$ to play one game. Will Jane expect a gain or a loss, and how much will it be? Justify your answer with suitable calculations. ***(3 marks)***

26. Probability, 2UG 2013 HSC 30b

In a class there are 15 girls (G) and 7 boys (B). Two students are chosen at random to be class representatives.

(i) Copy and complete the tree diagram in your answer booklet. ***(2 marks)***



(ii) What is the probability that the two students chosen are of the same gender? ***(2 marks)***

27. Probability, 2UG 2008 HSC 24b

Three-digit numbers are formed from five cards labelled $1,\ 2,\ 3,\ 4$ and 5.

(i) How many different three-digit numbers can be formed? ***(1 mark)***

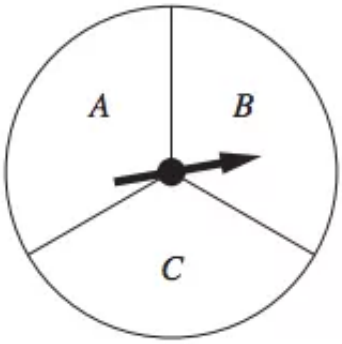
(ii) If one of these numbers is selected at random, what is the probability that it is odd? ***(1 mark)***

(iii) How many of these three-digit numbers are even? ***(1 mark)***

(iv) What is the probability of randomly selecting a three-digit number less than 500 with its digits arranged in descending order? ***(2 marks)***

28. Probability, 2UG 2014 HSC 28a

James plays a game involving a spinner with sectors of equal size labelled A, B and C, as shown.



He pays $\$2$ to play the game. He wins $\$5$ if the spinner stops in A and 50 cents if it stops in B or C.

Calculate James's financial expectation for the game. ***(2 marks)***

29. Probability, 2UG 2009 HSC 28d

In an experiment, two unbiased dice, with faces numbered $1, 2, 3, 4, 5, 6$ are rolled 18 times.

The difference between the numbers on their uppermost faces is recorded each time. Juan performs this experiment twice and his results are shown in the tables.

Experiment 1

Difference	*Frequency*
0	3
1	3
2	2
3	4
4	3
5	3

Experiment 2

Difference	*Frequency*
0	4
1	4
2	3
3	3
4	2
5	2

Juan states that Experiment 2 has given results that are closer to what he expected than the results given by Experiment 1.

Is he correct? Explain your answer by finding the sample space for the dice differences and using theoretical probability. ***(4 marks)***

Worked Solutions

1. Probability, 2UG 2008 HSC 18 MC

$$\begin{aligned}
&\#\text{ Plates beginning with M} \\
&\quad = 1 \times 26 \times 10 \times 10 \times 26 \times 26 \\
&\quad = 26^3 \times 10^2 \\
&\Rightarrow A
\end{aligned}$$

2. Probability, 2UG 2014 HSC 6 MC

$$\begin{aligned}
\#\text{ Combinations} &= 3 \times 5 \times 2 \\
&= 30 \\
&\Rightarrow D
\end{aligned}$$

3. Probability, 2UG 2011 HSC 5 MC

$$\begin{aligned}
\#\text{ Outcomes} &= 3 \times 2 \times 1 \\
&= 6 \\
&\Rightarrow B
\end{aligned}$$

4. Probability, 2UG 2009 HSC 7 MC

$$\begin{aligned}
\#\text{ Committees} &= \frac{4 \times 3}{2 \times 1} \\
&= 6 \\
&\Rightarrow A
\end{aligned}$$

♦ *Mean mark 38%*

5. Probability, 2UG 2010 HSC 14 MC

$$\begin{aligned}
\#\text{ Combinations} &= \frac{5 \times 4 \times 3}{3 \times 2 \times 1} \\
&= 10 \\
&\Rightarrow A
\end{aligned}$$

♦♦♦ *Mean mark 21%*
COMMENT: Students must be comfortable with calculations for unordered groups. Here, we ***divide*** by (3x2x1) because the 3 ice-cream scoops are unordered.

6. Probability, 2UG 2012 HSC 3 MC

$\text{Arrangements of } 2 = 2 \times 1 = 2$

$\#\text{ Different pairs } = \dfrac{6x5}{2x1} = 15$

$\Rightarrow C$

♦ *Mean mark 40%*
COMMENT: Calculating #combinations involving unordered pairs has proven very challenging to a majority of students in past exams. Ensure you understand this concept.

7. Probability, 2UG 2013 HSC 18 MC

$\text{Total outcomes} = 6 \times 6 = 36$

♦♦ *Mean mark 35%*

$\text{Outcomes that sum to 6} = (1,5)\ (5,1)\ (2,4)\ (4,2)\ (3,3) = 5$

$\therefore\ P(6) = \dfrac{5}{36}$

$\Rightarrow D$

8. Probability, 2UG 2014 HSC 19 MC

The tree diagram needs to
identify 2 seperate events.

1st event - which bag is chosen

2nd event - choosing a red apple
for a particular bag

$\Rightarrow A$

9. Probability, 2UG 2012 HSC 12 MC

$P\ (\text{at least 1 six})$

$= 1\ - P\ (\text{no six}) \times P\ (\text{no six})$

$= 1\ - \dfrac{5}{6} \times \dfrac{5}{6}$

$= \dfrac{11}{36}$

$\Rightarrow B$

♦♦♦ *Mean mark 25%*
COMMENT: The term "at least" should flag that calculating the probability of $1 - P(\text{event not happening})$ is likely to be the most efficient way to solve the problem.

10. Probability, 2UG 2010 HSC 20 MC

♦ *Mean mark 48%*

Let $P(\text{Lou successful}) = P(L)$

Let $P(\text{Ali successful}) = P(A)$

$$\begin{aligned} P(\text{only 1 successful}) &= P(L) \times P(\text{not } A) + P(\text{not } L) \times P(A) \\ &= (0.7 \times 0.4) + (0.3 \times 0.6) \\ &= 0.28 + 0.18 \\ &= 0.46 \end{aligned}$$

$\Rightarrow\ D$

11. Probability, 2UG 2014 HSC 16 MC

♦♦♦ *Mean mark 16%. Lowest mark of any MC question in 2014!*

$$P(\text{rains}) = \frac{8}{31}$$

Since each day has same probability

$$P(R_1 R_2) = \frac{8}{31} \times \frac{8}{31}$$

$\Rightarrow\ D$

12. Probability, 2UG 2008 HSC 22 MC

$$P(6) = \frac{450}{1200} = \frac{3}{8}$$

$\#$ Times 1-5 rolled $= 750$

$\Rightarrow$ Each number expected to appear

$$\frac{750}{5} = 150 \text{ times}$$

$$\begin{aligned} P(\text{specific number} \neq 6) \\ = \frac{150}{1200} = \frac{1}{8} \end{aligned}$$

$\Rightarrow\ C$

13. Probability, 2UG 2009 HSC 27c

$$P\,(\text{Mary wins}) = \frac{2}{100}$$
$$= \frac{1}{50}$$

$$P\,(\text{Jane wins at least 1}) = 1 - P(\text{loses both})$$
$$= 1 - \frac{99}{100} \times \frac{99}{100}$$
$$= 1 - \frac{9801}{10\,000}$$
$$= \frac{199}{10\,000}$$

Since $\frac{1}{50} > \frac{199}{10\,000}$

Mary has a better chance of winning.

♦♦ *Mean mark 31%*
MARKER'S COMMENT: Very few students calculated Jane's chance of winning correctly. Note the use of "at least" in the question. Again, finding $1 - P$ (complement) proved the best strategy.

14. Probability, 2UG 2012 HSC 26a

(i) Different postcodes begining with 2

$= 1 \times 10 \times 10 \times 10$

$= 1000$

♦ *Mean marks of 43% and 41% for parts (i) and (ii) respectively.*

(ii) Number of postcodes beginning with 2, 4

$= 1 \times 1 \times 10 \times 10$

$= 100$

$\therefore P\,(\text{Correct}) = \frac{1}{100}$

15. Probability, 2UG 2009 HSC 23b

(i) $\# \text{Combinations} = 10 \times 10 \times 10 \times 10$

$= 10\,000$

♦ *Mean mark 43%*

(ii) $\# \text{Combinations} = 2 \times 10 \times 10 \times 10$

$= 2000$

$$P(\text{Correct PIN}) = \frac{\# \text{ Correct PINS}}{\# \text{ Combinations}}$$

$$= \frac{1}{2000}$$

♦♦♦ *Mean mark 18%*
MARKER'S COMMENT: A common error is finding the number of possible combinations but not then calculating the probability.

16. Probability, 2UG 2010 HSC 26a

♦ *Mean mark 41%*

(i) $\# \text{Combinations} = 10 \times 10 \times 26 \times 26 \times 10 \times 10$

$= 6\,760\,000$

(ii) $\# \text{Possible numberplates}$

$= 10 \times 10 \times 10 \times 10$

$= 10\,000$

♦♦ *Mean mark 30%*
IMPORTANT: Since the middle letters of "JO" can be guaranteed, the focus becomes purely on the 4 surrounding digits.

$\therefore P(30\text{ JO }12) + P(19\text{ JO }92)$

$$= \frac{1}{10\,000} + \frac{1}{10\,000}$$

$$= \frac{1}{5000}$$

17. Probability, 2UG 2013 HSC 26c

(i) The commentator is incorrect. The correct statement is $P(\text{score} \leq 100) = \dfrac{9}{40}$

♦♦♦ *Mean mark 11%*

(ii) $P(\text{score} > 100 \text{ in both}) = \dfrac{31}{40} \times \dfrac{31}{40}$

$$= \frac{961}{1600}$$

♦ *Mean mark 34%*

18. Probability, 2UG 2013 HSC 29c

We need # Combinations to be > 3 million

If we have 3 numerals

$$\begin{aligned} \#\text{ Combinations} &= 26 \times 26 \times 10 \times 10 \times 10 \\ &= 676\,000 < 3000\,000 \end{aligned}$$

$\Rightarrow$ need more numeral(s)

If we have 4 numerals

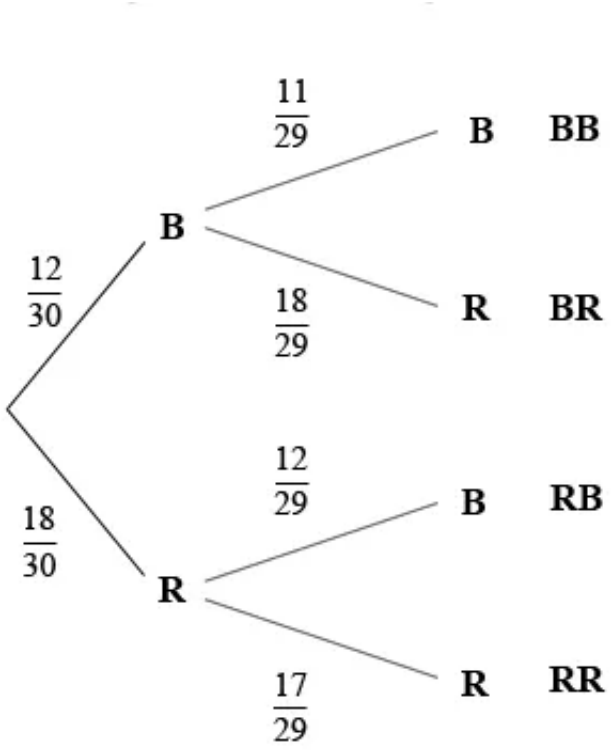
$$\begin{aligned} \#\text{ Combinations} &= 26 \times 26 \times 10 \times 10 \times 10 \times 10 \\ &= 6760\,000 > 3000\,000 \end{aligned}$$

$\therefore$ Minimum number of numerals $= 4$

♦ *Mean mark 34%*
COMMENT: Students can use their rough working to find an appropriate "number of numerals" where their answer should start.

19. Probability, 2UG 2008 HSC 25b

(i)



(ii) $P(\text{same colour})$

$$
\begin{aligned}
&= P(BB) + P(RR) \\
&= \frac{12}{30} \times \frac{11}{29} + \frac{18}{30} \times \frac{17}{29} \\
&= \frac{132}{870} + \frac{306}{870} \\
&= \frac{73}{145}
\end{aligned}
$$

20. Probability, 2UG 2008 HSC 26c

Chance of outcome 4

$$\begin{aligned} &= 100 - (10 + 40 + 30) \\ &= 20\% \end{aligned}$$

Let $X =$ Loss from Outcome 4

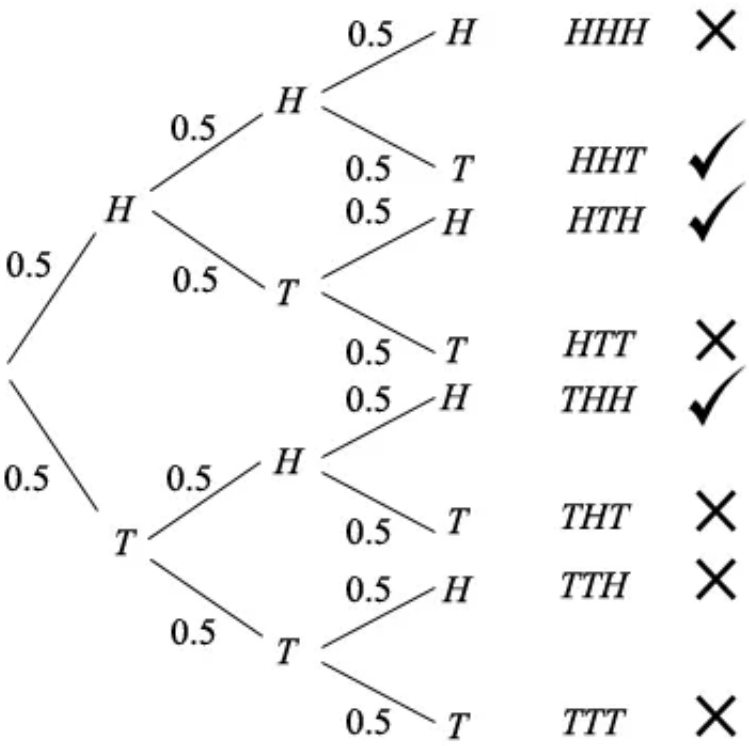
We know Fin Exp $= 0$

$$\Rightarrow 0 = (0.1 \times 12) + (0.4 \times 6) + (0.3 \times 3) - 0.2X$$

$$\begin{aligned} 0.2X &= 1.2 + 2.4 + 0.9 \\ &= 4.5 \\ X &= \$22.5 \end{aligned}$$

$\therefore$ The loss in outcome 4 must be \$22.50.

21. Probability, 2UG 2014 HSC 28c



$P(2 \text{ heads, } 1 \text{ tail})$

$= P(HHT) + P(HTH) + P(THH)$

$= \left(\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}\right) + \left(\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}\right) + \left(\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}\right)$

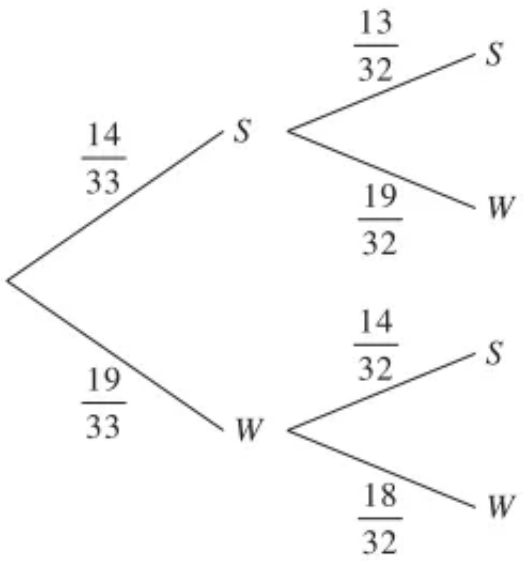
$= \frac{1}{8} + \frac{1}{8} + \frac{1}{8}$

$= \frac{3}{8}$

22. Probability, 2UG 2012 HSC 27e

(i)

♦ *Mean mark 43%*



(ii) $P\left(2 \text{ silk}\right) = P(S_1) \times P(S_2)$

$$= \frac{14}{33} \times \frac{13}{32}$$

$$= \frac{91}{528}$$

(iii) $P\left(\text{diff}\right) = P(S_1, W_2) + P(W_1, S_2)$

$$= \left(\frac{14}{33} \times \frac{19}{32}\right) + \left(\frac{19}{33} \times \frac{14}{32}\right)$$

$$= \frac{532}{1056}$$

$$= \frac{133}{264}$$

♦ *Mean mark 41%*

MARKER'S COMMENT: In better responses, students multiplied along the branches and then added these two results together, as shown in the Worked Solutions.

23. Probability, 2UG 2010 HSC 26c

Financial Expectation

♦♦ *Mean mark 31%*
MARKER'S COMMENT: A common error was not to deduct the chance of losing or the entry fee. *BE CAREFUL!*

$$= \left(\frac{1}{5} \times 10\right) + \left(\frac{1}{2} \times 3\right) - \left(\frac{3}{10} \times 8\right) - 2$$
$$= 2 + 1.5 - 2.4 - 2$$
$$= -0.9$$

$\therefore$ The financial expectation is a loss of \$0.90.

24. Probability, 2UG 2011 HSC 26a

(i) $X = 3 + 2 = 5$

(ii) $P(\text{score} < 4) = \frac{6}{12} = \frac{1}{2}$

(iii) $P(3) = \frac{2}{3}$

(iv) $P(4) = \frac{4}{12} = \frac{1}{3}$

$P(\text{score} < 4) = \frac{6}{12} = \frac{1}{2}$

$P(\text{score} > 4) = \frac{2}{12} = \frac{1}{6}$

♦ *Mean mark 34%*
MARKER'S COMMENT: Better responses remembered to deduct the \$5 cost to play and recognised the negative result as a loss.

Financial Expectation

$$= \left(\frac{1}{3} \times 12\right) + \left(\frac{1}{2} \times 0\right) - \left(\frac{1}{6} \times 3\right) - 5$$
$$= 4 - 0.5 - 5$$
$$= -1.50$$

$\therefore$ Elise should expect a loss of \$1.50

25. Probability, 2UG 2013 HSC 29d

$$P(H,H) = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

$$\begin{aligned} P(H \text{ and } T) &= P(H,T) + P(T,H) \\ &= \left(\frac{1}{2} \times \frac{1}{2}\right) + \left(\frac{1}{2} \times \frac{1}{2}\right) \\ &= \frac{1}{2} \end{aligned}$$

$$P(T,T) = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$$

Financial Expectation

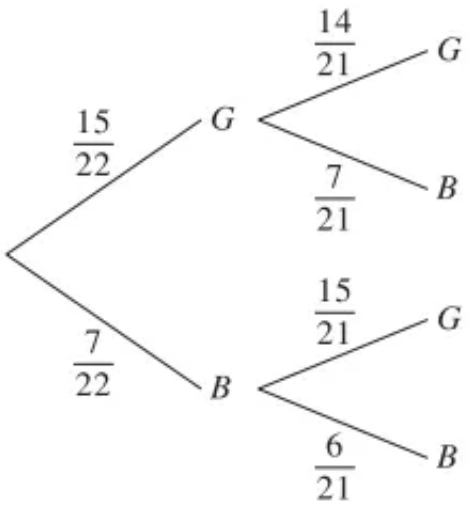
$$\begin{aligned} &= \left(\frac{1}{4} \times 6\right) + \left(\frac{1}{2} \times 1\right) + \left(\frac{1}{4} \times 2\right) - 4 \\ &= 1.50 + 0.5 + 0.5 - 4 \\ &= -1.50 \end{aligned}$$

$\therefore$ Jane should expect a loss of \$1.50.

♦♦ *Mean mark 31%*
MARKER'S COMMENT: Students must be comfortable with how to set out and calculate such financial expectation examples, as well as interpreting their result.

26. Probability, 2UG 2013 HSC 30b

(i)



♦ *Mean mark 40%*

(ii) $P(\text{same gender}) = P(G, G) + P(B, B)$

$$= \left(\frac{15}{22} \times \frac{14}{21}\right) + \left(\frac{7}{22} \times \frac{6}{21}\right)$$

$$= \frac{210}{462} + \frac{42}{462}$$

$$= \frac{252}{462}$$

$$= \frac{6}{11}$$

27. Probability, 2UG 2008 HSC 24b

(i) # Different numbers

$$= 5 \times 4 \times 3$$
$$= 60$$

(ii) The last digit must be one of the 5 numbers, of which 3 are odd

$$\therefore\ P(\text{odd}) = \frac{3}{5}$$

(iii) $P(\text{even}) = 1 - P(\text{odd}) = \dfrac{2}{5}$

$$\therefore \#\text{ Even numbers} = \frac{2}{5} \times 60$$
$$= 24$$

(iv) The numbers that satisfy the criteria:

$432, 431, 421, 321$

$$\therefore\ P(\text{selection}) = \frac{4}{60} = \frac{1}{15}$$

28. Probability, 2UG 2014 HSC 28a

♦ *Mean mark 49%*

$$P(A) = \frac{1}{3}$$

$$P(B \text{ or } C) = \frac{2}{3}$$

Financial expectation

$$= \left(\frac{1}{3} \times 5\right) + \left(\frac{2}{3} \times 0.50\right) - 2$$
$$= \frac{5}{3} + \frac{1}{3} - 2$$
$$= 0$$

$\therefore$ James should expect to breakeven.

29. Probability, 2UG 2009 HSC 28d

Sample space for dice differences

	1	2	3	4	5	6
1	0	1	2	3	4	5
2	1	0	1	2	3	4
3	2	1	0	1	2	3
4	3	2	1	0	1	2
5	4	3	2	1	0	1
6	5	4	3	2	1	0

♦♦♦ *Mean mark 7%. Toughest question in the 2009 exam.*
MARKER'S COMMENT: This question guides students by asking for an explanation using the sample space for the dice differences. This step alone received 2 full marks. Note that instructions to ***explain your answer*** requires mathematical calculations to support an argument.

Differences	*Probabilities*	*Expected frequencies*
0	$\frac{6}{36}$	3
1	$\frac{10}{36}$	5
2	$\frac{8}{36}$	4
3	$\frac{6}{36}$	3
4	$\frac{4}{36}$	2
5	$\frac{2}{36}$	1

Difference from expected frequency	
Experiment 1	*Experiment 2*
0	1
2	1
2	1
1	0
1	0
2	1
8	4

Juan is correct. The table shows Experiment 1 has greater total differences to the expected frequencies than Experiment 2