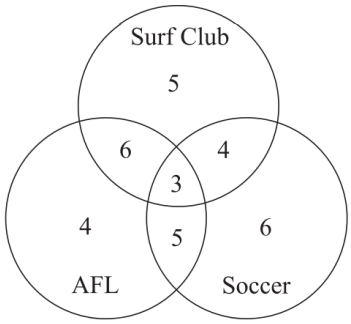
Topic Test: Probability and Discrete Probability Distributions

Marks Available: 20

Section I – Multiple Choice (5)

1. A game is played by tossing an ordinary 6-sided die and an ordinary coin at the same time. The game is won if the uppermost face of the die shows an even number or the uppermost face of the coin shows a tail (or both).
   What is the probability of winning this game?
   A. $\frac{1}{4}$
   B. $\frac{1}{2}$
   C. $\frac{3}{4}$
   D. 1

2. In a classroom, students are asked what sports club they are members of and the results are shown in the Venn diagram.



   A student who is a member of a soccer club is chosen at random. What is the probability that he/she is also a member of a surf club?
   A. $\frac{2}{5}$
   B. $\frac{4}{11}$
   C. $\frac{2}{9}$
   D. $\frac{7}{18}$

3. In an experiment, a standard six-sided die was rolled 72 times. The results are shown in the table.

Number on die	Frequency
1	6
2	12
3	10
4	20
5	9
6	15

Which number on the die was obtained the expected number of times?

A. 1

B. 2

C. 3

D. 6

4. A and B are events from a sample space such that $P(A) = p$, where $p > 0$, $P(B|A) = m$ and $P(B|A') = n$.

A and B are independent events when

A. $m = n$

B. $m = 1 - p$

C. $m + n = 1$

D. $m = p$

5. The number of pets, X, owned by each student in a large school is a random variable with the following discrete probability distribution.

$\boldsymbol{x}$	0	1	2	3
$\boldsymbol{P(X = x)}$	0.5	0.25	0.2	0.05

If two students are selected at random, the probability that they own the same number of pets is

A. 0.3

B. 0.305

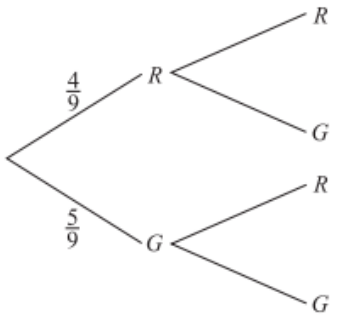
C. 0.355

D. 0.405

Section II – Short Answer (15)

6. In a workplace of 25 employees, each employee speaks either French or German, or both. If 36% of the employees speak German, and 20% speak both French and German.
   i. Calculate the probability one person chosen could speak German if they could speak French. Give your answer to the nearest percent. ***(1 mark)***
   ii. Calculate the probability one person chosen could not speak French if they could speak German. Answer to the nearest percent. ***(1 mark)***

7. One bag contains red and green balls. Kalyn randomly chooses one ball from the bag. Without replacement, he then chooses a second ball from the bag. Complete the tree diagram below and then draw a probability distribution table for the number of red balls that could be drawn out of the bag. ***(2 marks)***



8. A pack of 52 cards consists of four suits with 13 cards in each suit.
   i. One card is drawn from the pack and kept on the table. A second card is drawn and placed beside it on the table. What is the probability that the second card is from a different suit to the rest? ***(1 mark)***
   ii. The two cards are replaced and the pack shuffled. Four cards are chosen from the pack and placed side by side on the table. What is the probability that these four cards are all from different suits? ***(2 marks)***

9. The table shows the probability distribution of a discrete random variable.

x	0	1	2	3	4
$P(X = x)$	0	0.3	0.5	0.1	0.1

i. Show that the expected value $E(X) = 2$. ***(1 mark)***

ii. Calculate the standard deviation, correct to one decimal place. ***(2 marks)***

10. Four Year 12 students want to organise a graduation party.

All four students have the same probability, $P(F)$, of being available next Friday.

All four students have the same probability, $P(S)$, of being available next Saturday.

It is given that $P(F) = \frac{3}{10}$, $P(S|F) = \frac{1}{3}$, and $P(F|S) = \frac{1}{8}$.

Kim is one of the four students.

i. Is Kim's availability next Friday independent from his availability next Saturday? Justify your answer. ***(1 mark)***

ii. Show that the probability that Kim is available next Saturday is $\frac{4}{5}$. ***(2 marks)***

iii. What is the probability that at least one of the four students is NOT available next Saturday? ***(2 marks)***

-END OF TEST-