High School
Mathematics Test 2015

Year 10	*Two and Three Stage Events*	Calculator Allowed

Name_____

Skills and Knowledge Assessed:
- List all outcomes for two - step chance experiments, with and without replacement, using tree diagrams or arrays; assign probabilities to outcomes and determine   probabilities for events. (ACMSP225)
- Describe the results of two- and three-step chance experiments, both with and without replacements, assign probabilities to outcomes and determine probabilities of events. Investigate the concept of independence (ACMSP246)
- Use the language of 'if ....then, 'given', 'of', 'knowing that' to investigate conditional statements and identify common mistakes in interpreting such language (ACMSP247)

Longer Answer Test

Answers should be supported by relevant mathematical reasoning and/or calculations.
Write all working and answers in the spaces provided on this test paper.

Marks

1. Aisha has two sets of envelopes for a competition. One set is coloured green and the other set is yellow.

   Each set has four envelopes labelled A, B, C and D.

   She draws one envelope from each set.

   (a)   Complete the table to show all of the possible pairs of envelopes.   **2**

GREEN / YELLOW	A	B	C	D
A	A A	B A		
B	A B			
C				
D				

   (b)   What is the probability that both envelopes are labelled A?   **1**

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(c) What is the probability that one of the envelopes is labelled A and the other C? **1**

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(d) What is the probability that the two envelopes are labelled with the same letter? **1**

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(e) What is the probability that exactly one of the envelopes is labelled A? **1**

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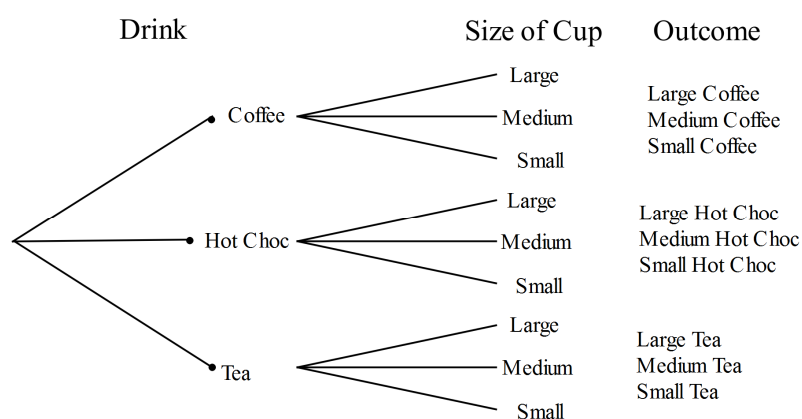
2. A cafe sells hot drinks in three sizes of cup and offers tea, coffee or hot chocolate.
A tree diagram has been drawn to show the different options that can be ordered from the cafe.

Drink	Size of Cup	Outcome
Coffee	Large / Medium / Small	Large Coffee / Medium Coffee / Small Coffee
Hot Choc	Large / Medium / Small	Large Hot Choc / Medium Hot Choc / Small Hot Choc
Tea	Large / Medium / Small	Large Tea / Medium Tea / Small Tea

A person randomly orders a hot drink from the café.

(a) What is the probability that it comes in a large cup? **1**

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Marks

(b)   What is the probability that it is a small or medium coffee?   **1**

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(c)   What is the probability that it is not a small hot chocolate?   **1**

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(d)   What is the probability that it is in a small cup or it is tea or both?   **1**

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3.   Aaron has 4 notes in his wallet, which are $50, $20, $10 and $5.

He draws two notes out to pay for an item without looking.

(a)   Complete the tree diagram to show the possible combined value of the two notes.   **2**

(b)   What is the probability that the combined value of the two notes is $60?   **1**

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Marks

(c)   What is the probability that the value of the two notes is less than $30?   **1**

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(d)   The item he is intending to buy costs $55.   **1**
        What is the probability that the two notes are enough to pay for the item (with change if
        needed)?

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(e)   What is the probability that the two notes include a $5 note, a $10 note or both?   **1**

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4.   (a)   Three racing car drivers; Ian, Jack, and   **2**
               Katie; competed in a race in which they
               were the only competitors.

       Draw a tree diagram to show the possible order
       in which they finished.

       (b)   What is the probability that Ian and Jack fill the first two places?   **1**

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(c)   What is the probability that Katie finishes first or second?   **1**

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(d)   What is the probability that Ian does not come second?   **1**

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(e)   Given that Jack wins, what is the probability that Katie comes second?   **1**

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5.   The two way table illustrates the choices of a compulsory science subject by students in a university course.

	Biology	Chemistry	Totals
Male	9	38	47
Female	21	12	33
Totals	30	50	80

(a)   If a student is chosen at random, what is the probability that they study Chemistry?   **1**

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(b)   If a student is chosen at random, what is the probability that they are a female who studies biology?   **1**

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(c)   If a student is chosen at random, what is the probability that they are either male or they study biology but not both?   **1**

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(d)   If a male student is chosen at random, what is the probability that he studies chemistry?   **1**

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6.   Olwyn has four pups whose names are Petal, Quest, Rebel and Sage.

She washes her pups in a random order, but only has time to do three of them.

(a)   Draw a tree diagram to show the possible order in which they are washed.   **2**

(b)   What is the probability that Sage is washed second or third?   **1**

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(c)   What is the probability that Rebel is not washed at all?   **1**

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(d)   If Sage is washed first, what is the probability that Rebel is not washed at all?   **1**

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(e)   Given that Rebel is not washed at all, what is the probability that Sage is washed   **1**
       second?

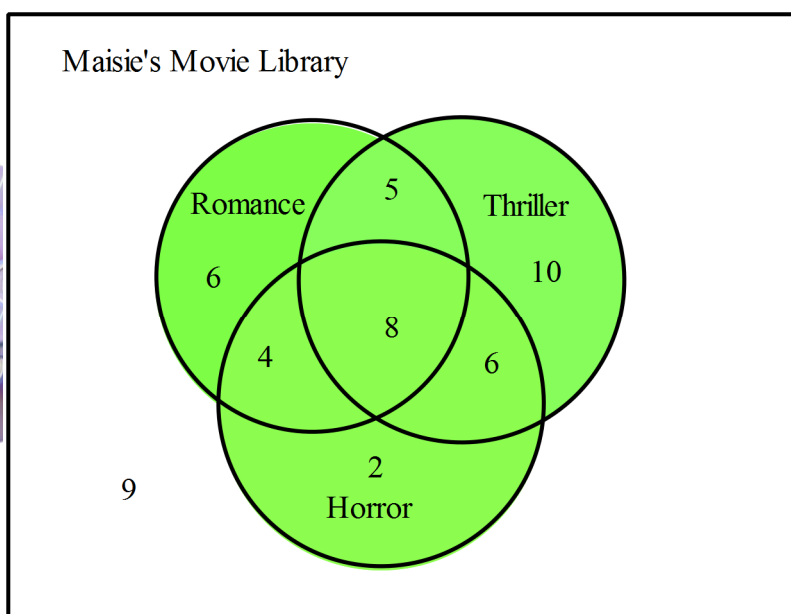………………………………………………………………………………..

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7.   The Venn diagram below summarises the way that the 50 movies in Maisie's library
            were classified according to genre by their producers.

(a)   If Maisie selects one movie at random, what is the probability that it is a Thriller?   **1**

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(b)   If Maisie selects one movie at random, what is the probability that it is not a Horror movie?

1

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(c)   If Maisie selects one movie at random, what is the probability that it is either a Thriller, or a Horror movie or both?

1

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(d)   Maisie's favourite genre is Horror. Given that she selects a movie from this genre, what is the probability that it is also a Romance?

1

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8.   Kevin is playing game A, in which a player has 5 turns and a dice is rolled on each turn.

2

Tim is playing game B, in which a player has 5 turns and a fresh card is drawn without replacement from a pack on each turn.

In which of the games are the events dependant, and on which are they independent. Use the games to illustrate the difference.

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	Longer Answer Test	
	ANSWERS	

Marks

1.   (a)   **2**

GREEN / YELLOW	A	B	C	D
A	A A	*B A*	*C A*	*D A*
B	*A B*	B B	C B	D B
C	*A C*	B C	C C	D C
D	*A D*	B D	C D	D D

(b) $P(\text{A A}) = \dfrac{1}{16}$ **1**

(c) $P(\text{C A or AC}) = \dfrac{2}{16} = \dfrac{1}{8}$ **1**

(d) $P(\text{Same letter}) = \dfrac{4}{16} = \dfrac{1}{4}$ **1**

(e)   There are 6, see those in italics in the table.   **1**
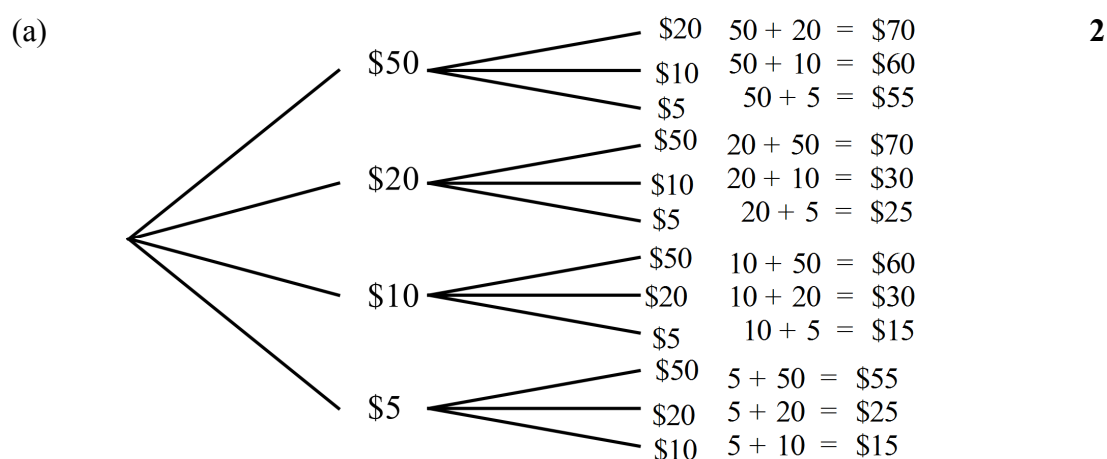 $P(\text{One is A}) = \dfrac{6}{16} = \dfrac{3}{8}$

2.

(a) $P(\text{Large drink}) = \dfrac{3}{9} = \dfrac{1}{3}$ 1

(b) $P(\text{S or M coffee}) = \dfrac{2}{9}$ 1

(c) $P(\text{Not Small Hot Choc}) = \dfrac{8}{9}$ 1

(d) $P(\text{Small or Tea or both}) = \dfrac{5}{9}$ 1

3.

(a)   2

$50	$20	50 + 20 = $70
	$10	50 + 10 = $60
	$5	50 + 5 = $55
$20	$50	20 + 50 = $70
	$10	20 + 10 = $30
	$5	20 + 5 = $25
$10	$50	10 + 50 = $60
	$20	10 + 20 = $30
	$5	10 + 5 = $15
$5	$50	5 + 50 = $55
	$20	5 + 20 = $25
	$10	5 + 10 = $15

(b) $P(\text{Value is \$60}) = \dfrac{2}{12} = \dfrac{1}{6}$ 1

(c) $P(\text{Value} < \$30) = \dfrac{4}{12} = \dfrac{1}{3}$ 1

(d)   To buy the item value must be $55 or more.   1
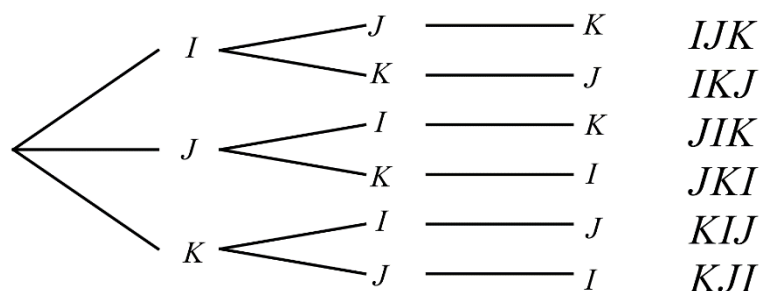
$P(\text{Value} \geq \$55) = \dfrac{6}{12} = \dfrac{1}{2}$

(e) $P(\text{Notes include \$5 or \$10 or both}) = \dfrac{10}{12} = \dfrac{5}{6}$ 1

4.

(a) **2**

OUTCOME

$$I <^{J \longrightarrow K}_{K \longrightarrow J} \quad \begin{matrix} IJK \\ IKJ \end{matrix}$$

$$J <^{I \longrightarrow K}_{K \longrightarrow I} \quad \begin{matrix} JIK \\ JKI \end{matrix}$$

$$K <^{I \longrightarrow J}_{J \longrightarrow I} \quad \begin{matrix} KIJ \\ KJI \end{matrix}$$

(b)　$P(\text{ IJ or JI in first two}) = \dfrac{2}{6} = \dfrac{1}{3}$　**1**

(c)　$P(\text{ Katie in first two}) = \dfrac{4}{6} = \dfrac{2}{3}$　**1**

(d)　$P(\text{ Ian not 2nd }) = 1 - P(\text{ Ian not 2nd }) = 1 - \dfrac{2}{6} = \dfrac{2}{3}$　**1**

(e)　If Jack wins, there are only two possible 2nd place getters.　**1**

$P(\text{ Katie second given Jack wins}) = \dfrac{1}{2}$

5.

	Biology	Chemistry	Totals
Male	9	38	47
Female	21	12	33
Totals	30	50	80

(b)　$P(\text{Studys Chemistry}) = \dfrac{50}{80} = \dfrac{5}{8}$　**1**

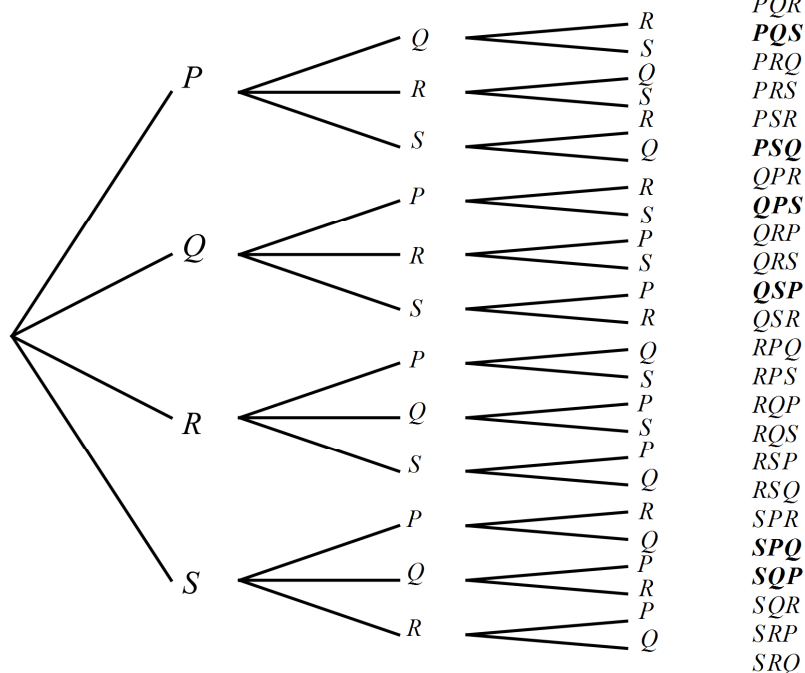(b)　$P(\text{Female studys Biology}) = \dfrac{21}{80}$　**1**

(c)　$P(\text{Male or Biology not both}) = \dfrac{21 + 38}{80} = \dfrac{59}{80}$　**1**

(d) $P(\text{Chemistry given male}) = \dfrac{38}{47}$ **1**

6.   (a)   **2**

	Q	R	PQR
		S	**PQS**
P	R	Q	PRQ
		S	PRS
	S	R	PSR
		Q	**PSQ**
	P	R	QPR
		S	**QPS**
Q	R	P	QRP
		S	QRS
	S	P	**QSP**
		R	QSR
	P	Q	RPQ
		S	RPS
R	Q	P	RQP
		S	RQS
	S	P	RSP
		Q	RSQ
	P	R	SPR
		Q	**SPQ**
S	Q	P	**SQP**
		R	SQR
	R	P	SRP
		Q	SRQ

(b) $P(\text{Sage second or third}) = \dfrac{12}{24} = \dfrac{1}{2}$ **1**

(c) $P(\text{Rebel not washed}) = \dfrac{6}{24} = \dfrac{1}{4}$ **1**

    See **Bold**.

(d) $P(\text{Rebel not washed given Sage first}) = \dfrac{2}{6} = \dfrac{1}{3}$ **1**

(e) $P(\text{Sage second given Rebel not washed}) = \dfrac{2}{6} = \dfrac{1}{3}$ **1**

7.   (a)   Total number of movies = 6+5+4+8+10+6+2+9 = 50   **1**

    $P(\text{Thriller}) = \dfrac{5 + 10 + 8 + 6}{50} = \dfrac{29}{50}$

(b) $P(\text{Not Horrorr}) = \dfrac{9 + 6 + 5 + 10}{50} = \dfrac{30}{50} = \dfrac{3}{5}$ **1**

(c) P(Thriller or Horror or both) $= \dfrac{4 + 8 + 6 + 2 + 10 + 5}{50} = \dfrac{35}{50} = \dfrac{7}{10}$ **1**

(d) P(Romance, given Horror) $= \dfrac{4 + 8}{20} = \dfrac{12}{20} = \dfrac{3}{5}$ **1**

8.

In game A, the roll of the die on each turn is not effected by the previous roll(s), it remain a 1 in 6 chance for each outcome. These are independent events.   **2**

In game B as a fresh card is drawn on each turn, the pack is reduced by one each time, so the probability on the next turn changes depending on the previous card(s) dealt.. These are dependent events.