OCR

Friday 6 June 2014 – Afternoon

AS GCE MATHEMATICS

4732/01 Probability & Statistics 1

QUESTION PAPER

3056785702

Candidates answer on the Printed Answer Book.

OCR supplied materials:
- Printed Answer Book 4732/01
- List of Formulae (MF1)

Other materials required:
- Scientific or graphical calculator

Duration: 1 hour 30 minutes

INSTRUCTIONS TO CANDIDATES

These instructions are the same on the Printed Answer Book and the Question Paper.
- The Question Paper will be found inside the Printed Answer Book.
- Write your name, centre number and candidate number in the spaces provided on the Printed Answer Book. Please write clearly and in capital letters.
- **Write your answer to each question in the space provided in the Printed Answer Book.** Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Do **not** write in the bar codes.
- You are permitted to use a scientific or graphical calculator in this paper.
- Give non-exact numerical answers correct to 3 significant figures unless a different degree of accuracy is specified in the question or is clearly appropriate.

INFORMATION FOR CANDIDATES

This information is the same on the Printed Answer Book and the Question Paper.
- The number of marks is given in brackets **[ ]** at the end of each question or part question on the Question Paper.
- **You are reminded of the need for clear presentation in your answers.**
- The total number of marks for this paper is **72**.
- The Printed Answer Book consists of **12** pages. The Question Paper consists of **8** pages. Any blank pages are indicated.

INSTRUCTION TO EXAMS OFFICER / INVIGILATOR

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1 The stem-and-leaf diagram shows the heights, in metres to the nearest 0.1 m, of a random sample of trees of species *A*.

5	
5	9
6	1 4
6	5 5 9
7	2 3 3 4
7	5 6 6 6 7 8
8	0 3 4
8	5

Key: 6 | 4 means 6.4 m

(i) Find the median and interquartile range of the heights. **[3]**

(ii) The heights, in metres to the nearest 0.1 m, of a random sample of trees of species *B* are given below.

7.6 5.2 8.5 5.2 6.3 6.3 6.8 7.2 6.7 7.3 5.4 7.5 7.4 6.0 6.7

In the answer book, complete the back-to-back stem-and-leaf diagram. **[2]**

(iii) Make two comparisons between the heights of the two species of tree. **[2]**

2 **(a)** The probability distribution of a random variable W is shown in the table.

w	0	2	4
$P(W = w)$	0.3	0.4	0.3

Calculate Var(W). **[3]**

(b) The random variable X has probability distribution given by

$$P(X = x) = k(x + 1) \quad \text{for } x = 1, 2, 3, 4.$$

(i) Show that $k = \frac{1}{14}$. **[1]**

(ii) Calculate E(X). **[3]**

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3 The table shows information about the numbers of people per household in 280 900 households in the north-west of England in 2001.

Number of people	1	2	3	4	5 or more
Number of households	86 900	92 500	45 000	37 100	19 400

(i) Taking '5 or more' to mean '5 or 6', calculate estimates of the mean and standard deviation of the number of people per household. **[5]**

(ii) State the values of the median and upper quartile of the number of people per household. **[2]**

4 Each time Ben attempts to complete a crossword in his daily newspaper, the probability that he succeeds is $\frac{2}{3}$. The random variable X denotes the number of times that Ben succeeds in 9 attempts.

(i) Find

(a) $P(X = 6)$, **[3]**

(b) $P(X < 6)$, **[1]**

(c) $E(X)$ and $\text{Var}(X)$. **[2]**

Ben notes three values, X_1, X_2 and X_3, of X.

(ii) State the total number of attempts to complete a crossword that are needed to obtain three values of X. Hence find $P(X_1 + X_2 + X_3 = 18)$. **[4]**

5 Tariq collected information about typical prices, £y million, of four-bedroomed houses at varying distances, x miles, from a large city. He chose houses at 10-mile intervals from the city. His results are shown below.

x	10	20	30	40	50	60	70	80
y	1.2	1.4	1.2	0.9	0.8	0.5	0.5	0.3

$n = 8$ $\quad \Sigma x = 360$ $\quad \Sigma x^2 = 20\,400$ $\quad \Sigma y = 6.8$ $\quad \Sigma y^2 = 6.88$ $\quad \Sigma xy = 241$

(i) Use an appropriate formula to calculate the product moment correlation coefficient, r, showing that $-1.0 < r < -0.9$. **[3]**

(ii) State what this value of r shows in this context. **[1]**

(iii) Tariq decides to recalculate the value of r with the house prices measured in hundreds of thousands of pounds, instead of millions of pounds. State what effect, if any, this will have on the value of r. **[1]**

(iv) Calculate the equation of the regression line of y on x. **[3]**

(v) Explain why the regression line of y on x, rather than x on y, should be used for estimating a value of x from a given value of y. **[1]**

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6 Fiona and James collected the results for six hockey teams at the end of the season. They then carried out various calculations using Spearman's rank correlation coefficient, r_s.

(i) Fiona calculated the value of r_s between the number of goals scored FOR each team and the number of goals scored AGAINST each team. She found that $r_s = -1$. Complete the table in the answer book showing the ranks.

Team	A	B	C	D	E	F
Number of goals FOR (rank)	1	2	3	4	5	6
Number of goals AGAINST (rank)						

[1]

(ii) James calculated the value of r_s between the number of goals scored and the number of points gained by the 6 teams. He found the value of r_s to be 1. He then decided to include the results of another two teams in the calculation of r_s. The table shows the ranks for these two teams.

Team	G	H
Number of goals scored (rank)	7	8
Number of points gained (rank)	8	7

Calculate the value of r_s for all 8 teams. **[4]**

7 The table shows the numbers of members of a swimming club in certain categories.

	Male	Female
Adults	78	45
Children	52	n

It is given that $\frac{5}{8}$ of the female members are children.

(i) Find the value of n. **[2]**

(ii) Find the probability that a member chosen at random is either female or a child (or both). **[2]**

The table below shows the corresponding numbers for an athletics club.

	Male	Female
Adults	6	4
Children	5	10

(iii) Two members of the athletics club are chosen at random for a photograph.

(a) Find the probability that one of these members is a female child and the other is an adult male. **[2]**

(b) Find the probability that exactly one of these members is female and exactly one is a child. **[2]**

8 A group of 8 people, including Kathy, David and Harpreet, are planning a theatre trip.

(i) Four of the group are chosen at random, without regard to order, to carry the refreshments. Find the probability that these 4 people include Kathy and David but not Harpreet. **[3]**

(ii) The 8 people sit in a row. Kathy and David sit next to each other and Harpreet sits at the left-hand end of the row. How many different arrangements of the 8 people are possible? **[3]**

(iii) The 8 people stand in a line to queue for the exit. Kathy and David stand next to each other and Harpreet stands next to them. How many different arrangements of the 8 people are possible? **[3]**

9 Each day Harry makes repeated attempts to light his gas fire. If the fire lights he makes no more attempts. On each attempt, the probability that the fire will light is 0.3 independent of all other attempts. Find the probability that

(i) the fire lights on the 5th attempt, **[2]**

(ii) Harry needs more than 1 attempt but fewer than 5 attempts to light the fire. **[3]**

If the fire does not light on the 6th attempt, Harry stops and the fire remains unlit.

(iii) Find the probability that, on a particular day, the fire lights. **[3]**

(iv) Harry's week starts on Monday. Find the probability that, during a certain week, the first day on which the fire lights is Wednesday. **[2]**

END OF QUESTION PAPER

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S1 June 2014 Mark Scheme Final (without introduction)

Note: "(3 sfs)" means "answer which rounds to ... to 3 sfs". If correct ans seen to ≥ 3sfs, ISW for later rounding
Penalise over-rounding only once in paper.

Question			Answer	Marks	Guidance	
1	(i)		Median = 7.45 (m)	B1	cao	
			IQR = 7.75 – 6.7	M1	allow 7.775 – 6.6 or 77.5 – 67 or 77.75 – 66 or 7.8 – 6.5 even though this is an incorrect method or 78 – 65	These pairs of values only, and subtract, for M1 eg
			= 1.05 (m) allow 1.175 or 1.18 NOT 1.3	A1	allow 10.5 or 11.75 or 11.8 but only if med = 74.5	7.45, 7.75 – 6.7 = 1.05 B1M1A1 7.45, 7.775 – 6.6 = 1.175 B1M1A1 7.45, 7.8 – 6.5 = 1.3 B1M1A0 7.45, 7.7 – 6.5 = 1.2 B1M0A0 7.45, 77.5 – 67 = 10.5 B1M1A0 74.5, 77.5 – 67 = 10.5 B0M1A1 74.5, 7.75 – 6.7 = 10.5 B0M1A1 74.5, 77.75 – 66 = 11.75 B0M1A1 7.45, 78 – 65 = 13 B1M1A0 74.5, 78 – 65 = 13 B0M1A0 74.5, 77 – 65 = 12 B0M0A0
				[3]		

Question			Answer	Marks	Guidance	
1	(ii)		4 2 2 | 5 5 3 3 0 | 6 8 7 7 | 6 4 3 2 | 7 6 5 | 7 8 5 | 8			Allow a separate diag with leaves to left of stem. If only a separate diag is drawn, with leaves to <u>right</u> of stem: all correct including order, alignment and key: B1
				B1*	correct digits in correct leaves, ignore order, allow one omitted or extra or misplaced or incorrect digit	
			<u>Complete</u> correct diag including order and key and alignment	B1dep	key: eg 8|6|4 means 6.8 (*B*) and 6.4 (*A*) allow just 8 | 6 means 6.8 NOT 8 | 6 means 8.6 Allow 8 | 6 means 68, if consistent with (i)	If <u>all</u> digits are in correct rows and orders, & correct key, award this mark <u>unless</u> EITHER: 1. eg a 2nd digit in one row is <u>clearly</u> aligned with a 3rd digit in another OR 2. 1st, 3rd, 4th & 5th rows are <u>very</u> different lengths, eg because of crossing out and replacement
				[2]		
1	(iii)		One correct comment on size: B1. One correct comment on spread or shape: B1. The following are examples only. Ignore any working; mark the statements only. Allow "First set" or "Right" for A, "Second set" or "Left" for B.			
			A higher <u>overall</u> A has more taller trees or fewer shorter A has higher median (mean, ave, medium)	B1	B shorter <u>overall</u> B has fewer taller trees or more shorter B has lower median (mean, ave, medium)	NOT A higher than B NOT B has shorter trees than A Allow just quoting the two medians, even if wrong, so long as med of A is gter than med of B. Similarly if quote IQRs
			B more evenly spread or distributed B more spread out B has larger range or IQR or sd Ranges of both are similar A is nearer to normal A is negatively skewed A has a (unique) mode, or modal class or peak; (B doesn't)	B1	A less evenly spread or distributed A less spread out A has smaller range or IQR or sd Allow A's heights are more consistent Not other comment about skew Ignore any other reference to mode or most common Ignore all else even if incorrect	NOT any reference to outliers NOT any reference to sample size NOT any reference to indiv trees NOT two comments on size NOT two comments on spread eg highest on both is 8.5 B0

Question			Answer	Marks	Guidance	
2	(a)		$(0^2 \times 0.3) + 2^2 \times 0.4 + 4^2 \times 0.3$ -2^2 or -4 $= 2.4$	M1 M1 A1 **[3]**	last two terms correct. NOT eg ÷ 6 or ÷ 3 allow – (any number)^2, dep +ve result	$2^2\times0.3 + (0) + 2^2\times0.3$ M2 1st or 3rd term correct M1 ÷ 3 M0M0A0
2	(b)	(i)	$2k + 3k + 4k + 5k = 1$ oe $(k = \frac{1}{14}$ **AG)**	B1 **[1]**	or $14k = 1$ oe "= 1" is essential	NOT just $2 + 3 + 4 + 5 = 14$ so $k = \frac{1}{14}$ Allow verification, eg stating that $\frac{2}{14} + \frac{3}{14} + \frac{4}{14} + \frac{5}{14} = 1$
2	(b)	(ii)	$\frac{2}{14}, \frac{3}{14}, \frac{4}{14}, \frac{5}{14}$ or $\frac{2}{14}, \frac{6}{14}, \frac{12}{14}, \frac{20}{14}$ Σxp $= \frac{20}{7}$ or $2\frac{6}{7}$ or 2.86 (3 sf) oe, eg $\frac{40}{14}$	B1 M1 A1 **[3]**	$\geq$ 3 correct $\geq$ 3 correct terms added SC $1 \times \frac{1}{14} + 2 \times \frac{2}{14} + 3 \times \frac{3}{14} + 4 \times \frac{4}{14}$ (=2.143) B0M1A0	$2k, 6k, 12k, 20k$ B1 $2k + 6k + 12k + 20k$ or $40k$ M1 ÷ 4 M0A0

Question			Answer	Marks	Guidance	
3	(i)		Use of 5 or 6 instead of 5.5 for last value of x: all M-marks can be scored, but no A-marks. (ans: 5 gives 2.32 and 1.23; 6 gives 2.39 and 1.40) Use of 5 and 6 instead of 5.5 (probably with freqs 19400/2) could lead to correct mean M1A1, but possibly M1M1A0 for sd.			
			$\frac{\Sigma fx}{\Sigma f}$ attempted $(= \frac{662000}{280900})$	M1	3 terms of Σfx correct.. and $\div \Sigma f$ Allow incorrect Σf NOT Σx	$\div 5$ or $\div 6$ M0A0
			= 2.36 (3 sf)	A1		
			$\frac{\Sigma fx^2}{\Sigma f}$ attempted $(= \frac{2042350}{280900} =$ 7.270737)	M1	3 terms of Σfx^2 correct and $\div \Sigma f$ Allow incorrect Σf NOT Σx	$\frac{\Sigma f(x-\bar{x})^2}{\Sigma f}$ 3 terms of num correct and $\div \Sigma f$ M2 $(86900\times1.36^2 + 92500\times0.36^2 + 45000\times0.64^2 + 37100\times1.64^2 + 19400\times3.1^2)$, $(\frac{482210.64}{280900})$ 2 terms of num correct and $\div \Sigma f$ M1 Allow incorrect Σf but NOT if $\Sigma f = \Sigma x$ NB $\surd$ not requ'd for M1M1
			– "2.36"^{2} (= 1.70 to 1.72, 3 sf)	M1	dep +ve result $\div 5$ or $\div 6$ M0M0A0	
			s.d. = 1.31 or 1.30 (3 sf)	A1	allow 1.3	Correct answer(s) without working score full marks
				[5]		
3	(ii)		2	B1		Ignore working for both, even if Incorrect NB 3, 2 B0B0 unless labelled correctly
			3	B1	allow IQR = 3 – 1 = 2, ie UQ = 3 implied	
				[2]		

Question			Answer	Marks	Guidance	
4	If $\frac{2}{3}$ is interpreted consistently as 0.6 or 0.66 or 0.67 or 0.7, max marks: (i)(a) M1M1A0 (i)(b) B0 (i)(c) B1ft B1ft (ii) B1M1M1A0					
4	(i)	(a)	Binomial seen or implied 0.6228 – 0.3497 = 0.273 (3 sf)	M1 M1 A1 **[3]**	by use of table or ${}^9C_6$ or $(\frac{2}{3})^p(\frac{1}{3})^q$ $(p+q=9)$ ${}^9C_6(\frac{1}{3})^3(\frac{2}{3})^6$ $\frac{1792}{6561}$	Eg 0.6228 seen
4	(i)	(b)	0.3497 or 0.350 (3 sf)	B1 **[1]**	NB 0.3498 (from 0.6228 - 0.273) rounds to 0.350 so B1	
4	(i)	(c)	6 2	B1ft B1ft **[2]**		NB 2, 6 B0B0 unless labelled correctly
4	(ii)		27 seen B(27, $\frac{2}{3}$) seen or implied ${}^{27}C_{18}(\frac{1}{3})^9(\frac{2}{3})^{18}$ = 0.161 (3 sf)	B1 M1 M1 A1 **[4]**	not necessarily in a statement or attempt eg $P(X_1 = 1) \times P(X_2 = 8) \times P(X_3 = 9)$, $P(X_1 = 2) \times P(X_2 = 7) \times P(X_3 = 9)$, $P(X_1 = 3) \times P(X_2 = 6) \times P(X_3 = 9)$, etc $\geq$3 sets with $X_1+X_2+X_3=18$ (not nec'y added) M1	NB $P(X_1 = 6) \times P(X_2 = 6) \times P(X_3 = 6)$ $= 0.273^3 = 0.0203$ M0M0A0 $\frac{55}{729}$ (= 0.0754) M0M0A0

Question			Answer	Marks	Guidance	
5	(i)		$S_{xx} = 20400 - \frac{360^2}{8}$ (= 4200) $S_{yy} = 6.88 - \frac{6.8^2}{8}$ (= 1.1) $S_{xy} = 241 - \frac{360\times6.8}{8}$ (= –65) $r = \frac{"-65"}{\sqrt{"4200"\times"1.1"}}$ = –0.956 (3 sf)	M1 M1 A1 **[3]**	Correct sub in a correct *S* formula Correct sub in 3 correct *S* formulae and a correct *r* formula Correct ans with no working M2A1	Ignore comment about $-1 < r < -0.9$
5	(ii)		eg As you move further away, prices drop	B1 **[1]**	High prices go with short distances oe Allow "Strong (or high or good or equiv) neg corr'n between price and distance"	Both variables must be in context ; miles & £ enough Ignore all else, even if incorrect NOT just neg corr'n between price & dist
5	(iii)		None	B1 **[1]**		Ignore all else, even if incorrect
5	(iv)		$b = \frac{"-65"}{"4200"}$ (= – 0.0154762) $Y - \frac{6.8}{8} =$ "– 0.0154762"$(x - \frac{360}{8})$ oe $y = –0.0155x + 1.55$ (3 sf) oe or $y = \frac{433}{280} - \frac{13}{840}x$ oe	M1 M1 A1 **[3]**	ft their S_{xy} & S_{xx} from (i) for M-marks only or $a = \frac{6.8}{8}$ + "0.0154762" × $\frac{360}{8}$ oe allow $y = –0.015x + 1.5$ (or figs which round to these) (NOT $y = –0.016x + 1.6$ NOT $y = –0.02x + 1.5$) Correct ans with no working M2A1	or fresh start correct method Must have "$y =$ " Allow figures in equn which round to the correct figures to either 3 sf or 2 sf, even if they result from arith errors.
5	(v)		Values of *x* are chosen beforehand or *x* is independent or controlled	B1 **[1]**	*x* is fixed or given or set or predetermined oe	Not "*x* is constant." Not just "*y* depends on *x*" Ignore all other, even if incorrect

Question			Answer	Marks	Guidance	
6	(i)		6 5 4 3 2 1	B1 **[1]**		
6	(ii)		$\Sigma d^2 = 0$ for first 6 teams $\Sigma d^2 = 2$ $1-\frac{6\sum d^2}{8(8^2-1)}$ $= \frac{41}{42}$ or 0.976 (3 sf)	M1 B1 M1 A1 **[4]**	May be implied by use of $\Sigma d^2 = 2$ ft their Σd^2 ($\neq 0$)	using ranks from (i) can score 2nd M1 only
7	(i)		$\frac{n}{n+45} = \frac{5}{8}$ or $n : 45 = 5 : 3$ or $\frac{3}{8} : 45 = \frac{5}{8} : n$ $n = 75$	M1 A1 **[2]**	$\frac{3F}{8}$ =45 & $n = \frac{5}{8}\times F$; $45\times\frac{8}{3}-45$; $45\times\frac{8}{3}\times\frac{5}{8}$	correct first step involving n or complete correct method for finding n
	(ii)		$\frac{45+"75"+52}{45+"75"+52+78}$ alone oe $= \frac{86}{125}$ or $\frac{172}{250}$ or 0.688 (3 sf) oe	M1 A1ft **[2]**	1 - $\frac{78}{45+"75"+52+78}$ oe or $\frac{"250"-78}{"250"}$ oe Completely correct method ft their integer answer to (i) eg if their (i) is 28, ans 0.616 or $\frac{125}{203}$ M1A1ft	$\frac{45+"75"}{"250"}+\frac{52+"75"}{"250"}-\frac{"75"}{"250"}$ or 0.48 + 0.508 – 0.48×0.508
7	(iii)	(a)	$\frac{10}{25}\times\frac{6}{24}$ or $\frac{6}{25}\times\frac{10}{24}$ seen (or $\frac{2}{5}\times\frac{1}{4}$ or $\frac{6}{25}\times\frac{5}{12}$) oe $(\frac{10}{25}\times\frac{6}{24} + \frac{6}{25}\times\frac{10}{24}$ or $\frac{10}{25}\times\frac{6}{24}\times 2)$ $= \frac{1}{5}$	M1 A1 **[2]**	or $\frac{10}{25}\times\frac{6}{25} + \frac{6}{25}\times\frac{10}{25}$ or $\frac{10}{25}\times\frac{6}{25}\times 2$ oe $\frac{{}^{10}C_1\times{}^{6}C_1}{{}^{25}C_2}$ oe or $\frac{10\times 6}{300}$ oe	ie allow M1 if '2×' is omitted **OR** if 25 instead of 24, but not both errors allow M1 for correct num or denom NB long methods may be correct, eg $(\frac{14}{25}\times\frac{10}{14})\times(\frac{11}{24}\times\frac{6}{11})$ same as $\frac{10}{25}\times\frac{6}{24}$

Question			Answer	Marks	Guidance	
7	(iii)	(b)	FA + MC or FC + MA Either $\frac{4}{25}\times\frac{5}{24}\times 2$ or $\frac{10}{25}\times\frac{6}{24}\times 2$ NB ft their (iiia) $(\frac{4}{25}\times\frac{5}{24}\times 2+\frac{10}{25}\times\frac{6}{24}\times 2=\frac{1}{5}+\frac{1}{15})$ $=\frac{4}{15}$ or 0.267 (3 sf)	M1 A1 [2]	Allow $\frac{10}{25}\times\frac{6}{25}\times 2$ or $\frac{4}{25}\times\frac{5}{25}\times 2$ or $\frac{10}{25}\times\frac{6}{24}+\frac{4}{25}\times\frac{5}{24}$ or $\frac{10}{25}\times\frac{6}{25}+\frac{4}{25}\times\frac{5}{25}$ NB ft their (iii)(a) $\frac{{}^{10}C_1\times{}^{6}C_1}{{}^{25}C_2}+\frac{{}^{4}C_1\times{}^{5}C_1}{{}^{25}C_2}$ oe or $\frac{60+20}{300}$ oe cao	ie allow 25 instead of 24 AND allow one case with × 2 or both cases without × 2 ie allow 25 and one of these two errors cf scheme for (iii)(a) allow M1 if one of these fracts correct NB ${}^{25}C_2$ in denom NOT M1 , cf (iii)(a) NB see note on long methods in 7(iiia)
8	(i)		${}^{5}C_2$ oe seen anywhere or num= 10 alone $\frac{{}^{5}C_2}{{}^{8}C_4}$ oe or $\frac{{}^{5}C_2\times 4!}{{}^{8}P_4}$ oe all correct $=\frac{1}{7}$ or 0.143 (3 sf)	M1 M1 A1 [3]	$\frac{1}{8}\times\frac{1}{7}\times\frac{5}{6}\times\frac{4}{5}$ or $\frac{20}{1680}$ or $\frac{1}{84}$ oe seen $\frac{1}{8}\times\frac{1}{7}\times\frac{5}{6}\times\frac{4}{5}\times{}^{4}C_2\times 2$ or $\frac{1}{8}\times\frac{1}{7}\times\frac{5}{6}\times\frac{4}{5}\times 4!\div 2$ oe or $\frac{1}{8}\times\frac{1}{7}\times\frac{5}{6}\times\frac{4}{5}\times 12$ oe all correct Correct ans scores M1M1A1 regardless of method.	alone or ×... eg $\frac{2}{8}\times\frac{1}{7}\times\frac{5}{6}\times\frac{4}{5}$ M1 $\frac{4}{8}\times\frac{3}{7}\times\frac{4}{6}$ oe all correct M2 NB $\frac{\text{incorrect}}{{}^{8}C_4}$ does not score
8	(ii)		6! × 2 alone or 5! × 6 × 2 alone oe = 1440	M2 A1 [3]	M1 for 6! or 5! × 6 or ${}^{6}P_5$ or 720 seen NB 5! scores M0 unless 5! × 6 or 5! × 12	M1 for 7! × 2 alone NB 7! scores M0 unless 7! × 2 alone

Question			Answer	Marks	Guidance	
8	(iii)		6! × 4 alone or 6! × 2 × 2 alone = 2880	M2 A1 **[3]**	M1 for 6! or ${}^6P_5$ or 720 seen or 5! × 6 seen but NOT from 5!×3!	5!: M0 unless 5!×6 or 5!×12 or 5!×24
9	If 0.3 and 0.7 are interchanged consistently through all four parts, all M-marks can be scored, but no A-marks. If 1 – 0.3 is calculated incorrectly (eg 0.6 or 0.66 or $\frac{2}{3}$) consistently, lose the A-mark in (i) but all other marks are available on ft, so long as 0 < ans < 1.					
9	(i)		$0.7^4 \times 0.3$ alone = 0.0720 (3 sf) or $\frac{7203}{100000}$ oe	M1 A1 **[2]**	allow 0.072	
9	(ii)		$(0.7 + 0.7^2 + 0.7^3) \times 0.3$ = 0.4599 or 0.460 (3sf) or $\frac{4599}{10000}$ oe	M2 A1 **[3]**	M1 for 1 term omitted, wrong or extra. must add terms, not mult. Allow 0.46	$(1 – 0.7^4) – 0.3$ or $0.7599 – 0.3$ M2 $(1 – 0.7^4) – ...$ or $1 – 0.3 – ...$ M1 $0.7599 – ...$ or $0.7 – ...$ M1 Just $1 – 0.7^4$ or $1 – 0.3$: M0 $(1+ 0.7 + 0.7^2 + 0.7^3)\times0.3 – 0.3$ M2 1 term omitted, wrong or extra M1
9	(iii)		$1 – 0.7^6$ = 0.882 (3 sf)	M2 A1 **[3]**	M1 for 0.7^6 alone or $1 – 0.7^5$ (= 0.832) or $1 – 0.7^7$ (= 0.918)	$0.3(1+0.7+0.7^2+0.7^3+0.7^4+0.7^5)$ M2 or (ii) + $0.3(1 + 0.7^4 + 0.7^5)$ M2 or (i) + (ii) + $0.3(1 + 0.7^5)$ M2 one term omitted or extra: M1 must add terms, not mult. NB ans 0.832 might be M1M0A0 from omitting last term. Could be, eg, their (ii) + $0.3(1 + 0.7^4)$ correct working, but subtr from 1: M1

Question			Answer	Marks	Guidance	
9	(iv)		$(1 - \text{“}0.882\text{”})^2 \times \text{“}0.882\text{”}$ oe	M1	or $(0.7^6)^2 \times (1 - 0.7^6)$ or $0.1176^2 \times (1 - 0.1176)$ or $(0.7^6)^2 \times$ their "0.882" or $0.3(0.7^{12} + (0.7^{13} + 0.7^{14} + \ldots + 0.7^{17}))$	Not $0.7^2 \times 0.3$ Completely correct method
			= 0.0122 (3 sf)	A1ft **[2]**	allow 0.0123	ft their "0.882" except if 0.3 or 0.7