Oxford Cambridge and RSA Examinations
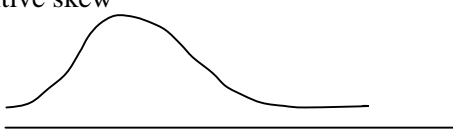
Advanced Subsidiary General Certificate of Education
Advanced General Certificate of Education

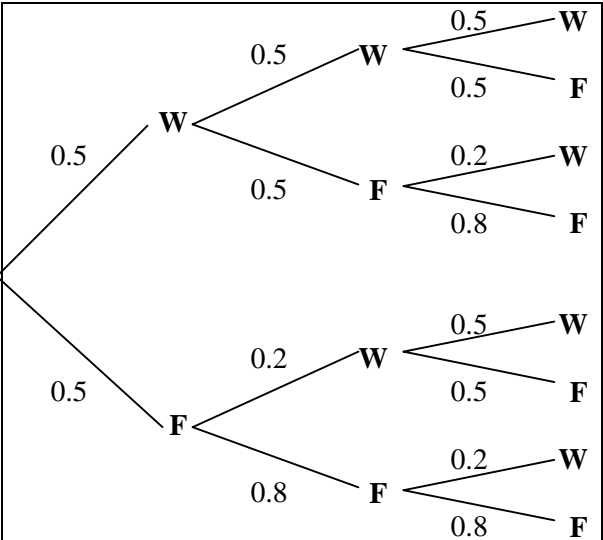**MEI STRUCTURED MATHEMATICS** **4766**
STATISTICS 1, S1

MARK SCHEME

Qu	Answer	Mark	Comment
Section A			
1	$P(A \cup B) = 1 - 0.3 = 0.7$	B1	
	$P(A \cap B) = P(A) + P(B) - P(A \cup B)$	M1	
	$= 0.5 + 0.35 - 0.7$		
	$= 0.15$	A1 **[3]**	

2(i)

Length	Frequency	Mark	Comment
602 to 607	5	B1	For 5 and 10
607 to 609	6	B1	For 6 and 12
609 to 610	22		
610 to 611	25		
611 to 613	12		
613 to 618	<u>10</u>		
Total	**80**	B1 **[3]**	For figures with total 80

Qu	Answer	Mark	Comment
2(ii)	The range lies between 6 and 16.	B1 **[1]**	
2(iii)	Mean is estimated as		
	$$\sum \frac{(\text{Mid-point} \times \text{Frequency})}{\text{Total}}$$	B1	Allow 1 mark for each of two Sensible statements
	The intervals are symmetrically placed either side of 410 but in each case the frequency on the right is greater	B1 **[2]**	
3(i)	Number of ways 4 may be chosen from 36	M1	$^{36}C_4$ term
	$= {}^{36}C_4 = 58905$	A1 **[2]**	
3(ii)	P(All of same sex) = P(All male) + P(All female)	M1	
	$= \frac{16}{36} \times \frac{15}{35} \times \frac{14}{34} \times \frac{13}{33} + \frac{20}{36} \times \frac{19}{35} \times \frac{18}{34} \times \frac{17}{33}$	M1	Attempt at correct numbers
	$= 0.113 \ (3 \text{ s.f.})$	A1 **[3]**	cao

Qu	Answer	Mark	Comment
Section A (continued)			
4(i)	Median = 34 Upper quartile = 56 Lower quartile = 26	B1 B1 **[2]**	Median Quartiles
4(ii)	 20 28 34 56 90	B1 B1 **[2]**	Box Whiskers
4(iii)	Positive skew 	B1 B1 B1 **[3]**	1 mark for skew 1 mark for positive Sketch
5(i)(A)	$\bar{x} = \dfrac{50}{10} = 5$	B1	
5(i)(B)	$\sum (x - \bar{x})^2 = 858 \Rightarrow rmsd = \sqrt{\dfrac{858}{10}} = 9.26$	B1 B1	For 858 seen cao
5(i)(C)	$s = \sqrt{\dfrac{858}{9}} = 9.76$	B1 **[4]**	For division by 9
5(ii)	$\bar{x} + 2s = 5 + 2 \times 9.76 = 24.52$ Since $32 > 24.52$, 32 may be classified as an outlier.	M1 E1 **[2]**	
5(iii)	Without the 32, $\bar{x} = \dfrac{18}{9} = 2, \ s = \sqrt{\dfrac{48}{8}} = 2.45$ Both the mean and standard deviation are much reduced	B1 B1 **[2]**	One mark both

Qu	Answer	Mark	Comment
Section A (continued)			

6(i)

r	1	2	3	4
$P(X=r)$	k	$\frac{1}{2}k$	$\frac{1}{3}k$	$\frac{1}{4}k$

M1 — Tabulation (SO1)

Now $k + \frac{1}{2}k + \frac{1}{3}k + \frac{1}{4}k = 1$ — M1

$\Rightarrow k = \dfrac{12}{25} = 0.48$ — A1 — Value of k

[3]

6(ii)

$E(X) = 1 \times 0.48 + 2 \times 0.24 + 3 \times 0.16 + 4 \times 0.12$
$= 1.92$

B1 — $E(X)$ (provided $\sum p = 1$)

$E(X^2) = 1 \times 0.48 + 4 \times 0.24 + 9 \times 0.16 + 16 \times 0.12$

M1 — $E(X^2)$ ($\sum p = 1$)

Hence $Var(X) = E(X^2) - [E(X)]^2$

M1 — Positive variance

$= 4.8 - 1.92^2$
$= 4.8 - 3.6864$
$= 1.1136 \; or \; 1.11 \text{ (to 3 s.f.)}$

A1 — cao

[4]

Section A Total: 36

Qu	Answer	Mark	Comment
Section B			

7(i)

		Mark	Comment
		B1	Overall shape
		B1	1st pair branches
		B1	2nd set branches
		B1	3rd set branches
		[4]	

7(ii) P(same weather on Tuesday, Wednesday, and Thursday)

$= 0.5^3 + 0.5 \times 0.8^2 = 0.445$

	Mark	Comment
	M1	2 triple products
	M1	Sum of products
	A1	cao
	[3]	

7(iii) P(wet Thursday)

$= 0.5^3 + 0.5^2 \times 0.2 + 0.5^2 \times 0.2 + 0.5 \times 0.8 \times 0.2$
$= 0.305$

	Mark	Comment
	M1	4 triples
	A1	Correct triples
	M1	Sum of products
	A1	cao
	[4]	

7(iv) P(fine Tuesday and wet Thursday)
$= 0.5 \times 0.2 \times 0.5 + 0.5 \times 0.8 \times 0.2$
$= 0.13$

	Mark	Comment
	M1	2 triples
	A1	
	A1	
	[3]	

7(v) P(fine Tuesday | wet Thursday)

Use of $P(A|B) = \dfrac{P(A \cap B)}{P(B)}$

$= \dfrac{0.13}{0.305}$

$= 0.426$ (3 s.f.) *or* $\dfrac{26}{61}$

	Mark	Comment
	M1	
	A1	Numerator and denominator
	A1	cao
	[3]	

Qu	Answer	Mark	Comment
Section B (continued)			
8(i)(A)	P(no lorries have defective tyres)	M1	
	$= 0.83^6 = 0.327$ (3 s.f.) $= 0.33$ (2 s.f.)	A1 **[2]**	cao
8(i)(B)	P(exactly 2 lorries have defective tyres)	M1	For $0.17^2 \times 0.83^4$
	$= {}^6C_2 \times 0.17^2 \times 0.83^4$	M1	For ${}^6C_2 \times \ldots$
	$= 0.206$ (to 3 s.f.) $= 0.21$ (2 s.f.)	A1 **[3]**	cao
8(i)(C)	P(1 lorry has defective tyres)		
	$= {}^6C_1 \times 0.17 \times 0.83^5$		
	$= 0.402$ (to 3 s.f.)	B1	
	P(more than 2 lorries have defective tyres)		
	$= 1 - (0.327 + 0.402 + 0.206)$	M1	
	$= 0.065(5)$	A1 **[3]**	
8(ii)	$H_0 : P = 0.2$	B1	Null hypothesis
	$H_1 : P < 0.2$	B1	Alternative hyp.
	H_1 takes this form because we are looking for a *reduction* in the proportion of defective tyres.	E1 **[3]**	Explanations
8(iii)	Let $X \sim B(18, 0.2)$		
	$P(X \le 1) = 0.0991$	B1	Tail probablity
	Since $0.0991 > 0.05$, do not reject H_0		
	(*or* accept H_0)	M1	Comparison
	There is not enough evidence to suggest that there has been a (significant) reduction in the proportion of defective tyres *or* 'campaign appears to have been successful'	A1 **[4]**	Conclusion in words
8(iv)	The critical value for the test is 0,	B1	Critical value
	since $P(X \le 0)$ $[= 0.018] < 0.05$	B1 **[2]**	Reason
8(v)	The opposite conclusion would be reached provided the significance level was above 9.91%, e.g. 10%	B1 E1 **[2]**	Suitable percentage Explicit comparison with 9.91%
		Section B Total: 36	
		Total: 72	

AO	Range	Total	Question Number							
			1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	14-22	19	1	1	2	2	1	4	4	4
2	14-22	18	1	2	1	3	1	3	4	3
3	18-26	21	-	-	2	-	2	-	8	9
4	7-15	8	-	3	-	2	2	-	-	1
5	3-11	6	1	-	-	-	2	-	1	2
Totals		**72**	3	6	5	7	8	7	17	19