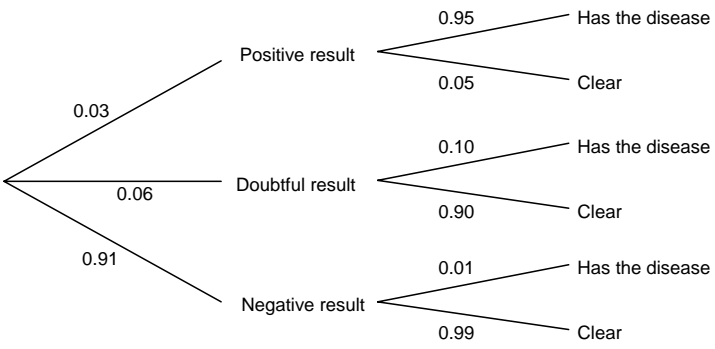


Mark Scheme 4766
June 2007

Q1 (i)	$\binom{8}{4}$ ways to select = 70	M1 for $\binom{8}{4}$ A1 CAO	2										
(ii)	$4! = 24$	B1 CAO	1										
		TOTAL	3										
Q2 (i)	<table border="1"> <thead> <tr> <th>Amount</th> <th>0- <20</th> <th>20- <50</th> <th>50- <100</th> <th>100- <200</th> </tr> </thead> <tbody> <tr> <td>Frequency</td> <td>800</td> <td>480</td> <td>400</td> <td>200</td> </tr> </tbody> </table>	Amount	0- <20	20- <50	50- <100	100- <200	Frequency	800	480	400	200	B1 for amounts B1 for frequencies	2
Amount	0- <20	20- <50	50- <100	100- <200									
Frequency	800	480	400	200									
(ii)	Total \approx $10 \times 800 + 35 \times 480 + 75 \times 400 + 150 \times 200 = \text{£}84800$	M1 for their midpoints \times their frequencies A1 CAO	2										
		TOTAL	4										
Q3 (i)	Mean = $\frac{3026}{56} = 54.0$ $S_{xx} = 178890 - \frac{3026^2}{56} = 15378$ $s = \sqrt{\frac{15378}{55}} = 16.7$	B1 for mean M1 for attempt at S_{xx} A1 CAO	3										
(ii)	$\bar{x} + 2s = 54.0 + 2 \times 16.7 = 87.4$ So 93 is an outlier	M1 for their $\bar{x} + 2 \times$ their s A1 FT for 87.4 and comment	2										
(iii)	New mean = $1.2 \times 54.0 - 10 = 54.8$ New $s = 1.2 \times 16.7 = 20.1$	B1 FT M1A1 FT	3										
		TOTAL	8										
Q4 (i)	(A) $P(\text{at least one}) = \frac{36}{50} = \frac{18}{25} = 0.72$ (B) $P(\text{exactly one}) = \frac{9+6+5}{50} = \frac{20}{50} = \frac{2}{5} = 0.4$	B1 aef M1 for $(9+6+5)/50$ A1 aef	3										
(ii)	$P(\text{not paper} \mid \text{aluminium}) = \frac{13}{24}$	M1 for denominator 24 or $24/50$ or 0.48 A1 CAO	2										
(iii)	$P(\text{one kitchen waste}) = 2 \times \frac{18}{50} \times \frac{32}{49} = \frac{576}{1225} = 0.470$	M1 for both fractions M1 for $2 \times$ product of both, or sum of 2 pairs A1	3										
		TOTAL	8										

Q5 (i)	11 th value is 4, 12 th value is 4 so median is 4 Interquartile range = 5 – 2 = 3	B1 M1 for either quartile A1 CAO	3
(ii)	No, not valid any two valid reasons such as : <ul style="list-style-type: none"> the sample is only for two years, which may not be representative the data only refer to the local area, not the whole of Britain even if decreasing it may have nothing to do with global warming more days with rain does not imply more total rainfall a five year timescale may not be enough to show a long term trend 	B1 E1 E1	3
		TOTAL	6
Q6 (i)	Either $P(\text{all 4 correct}) = \frac{4}{7} \times \frac{3}{6} \times \frac{2}{5} \times \frac{1}{4} = \frac{1}{35}$ or $P(\text{all 4 correct}) = \frac{1}{{}^7C_4} = \frac{1}{35}$	M1 for fractions, or 7C_4 seen A1 NB answer given	2
(ii)	$E(X) = 1 \times \frac{4}{35} + 2 \times \frac{18}{35} + 3 \times \frac{12}{35} + 4 \times \frac{1}{35} = \frac{80}{35} = 2\frac{2}{7} = 2.29$ $E(X^2) = 1 \times \frac{4}{35} + 4 \times \frac{18}{35} + 9 \times \frac{12}{35} + 16 \times \frac{1}{35} = \frac{200}{35} = 5.714$ $\text{Var}(X) = \frac{200}{35} - \left(\frac{80}{35}\right)^2 = \frac{24}{49} = 0.490$ (to 3 s.f.)	M1 for $\sum rp$ (at least 3 terms correct) A1 CAO M1 for $\sum x^2 p$ (at least 3 terms correct) M1dep for – their $E(X)^2$ A1 FT their $E(X)$ provided $\text{Var}(X) > 0$	5
		TOTAL	7

Section B			
Q7 (i)		<p>G1 probabilities of result</p> <p>G1 probabilities of disease</p> <p>G1 probabilities of clear</p> <p>G1 labels</p>	4
(ii)	$P(\text{negative and clear}) = 0.91 \times 0.99$ $= 0.9009$	<p>M1 for their 0.91×0.99</p> <p>A1 CAO</p>	2
(iii)	$P(\text{has disease}) = 0.03 \times 0.95 + 0.06 \times 0.10 + 0.91 \times 0.01$ $= 0.0285 + 0.006 + 0.0091$ $= 0.0436$	<p>M1 three products</p> <p>M1 <i>dep</i> sum of three products</p> <p>A1 FT their tree</p>	3
(iv)	$P(\text{negative} \mid \text{has disease})$ $= \frac{P(\text{negative and has disease})}{P(\text{has disease})} = \frac{0.0091}{0.0436} = 0.2087$	<p>M1 for their 0.01×0.91 or 0.0091 on its own or as numerator M1 <i>indep</i> for their 0.0436 as denominator</p> <p>A1 FT their tree</p>	3
(v)	<p>Thus the test result is not very reliable.</p> <p>A relatively large proportion of people who have the disease will test negative.</p>	<p>E1 FT for idea of 'not reliable' or 'could be improved', etc</p> <p>E1 FT</p>	2
(vi)	$P(\text{negative or doubtful and declared clear})$ $= 0.91 + 0.06 \times 0.10 \times 0.02 + 0.06 \times 0.90 \times 1$ $= 0.91 + 0.00012 + 0.054 = 0.96412$	<p>M1 for their $0.91 +$</p> <p>M1 for either triplet</p> <p>M1 for second triplet</p> <p>A1 CAO</p>	4
TOTAL			18

Q8	$X \sim B(17, 0.2)$		
(i)	$P(X \geq 4) = 1 - P(X \leq 3)$ $= 1 - 0.5489 = 0.4511$	B1 for 0.5489 M1 for 1 – their 0.5489 A1 CAO	3
(ii)	$E(X) = np = 17 \times 0.2 = 3.4$	M1 for product A1 CAO	2
(iii)	$P(X = 2) = 0.3096 - 0.1182 = 0.1914$ $P(X = 3) = 0.5489 - 0.3096 = 0.2393$ $P(X = 4) = 0.7582 - 0.5489 = 0.2093$ So 3 applicants is most likely	B1 for 0.2393 B1 for 0.2093 A1 CAO <i>dep</i> on both B1s	3
(iv)	(A) Let p = probability of a randomly selected maths graduate applicant being successful (for population) $H_0: p = 0.2$ $H_1: p > 0.2$ (B) H_1 has this form as the suggestion is that mathematics graduates are <u>more</u> likely to be successful.	B1 for definition of p in context B1 for H_0 B1 for H_1 E1	4
(v)	Let $X \sim B(17, 0.2)$ $P(X \geq 6) = 1 - P(X \leq 5) = 1 - 0.8943 = 0.1057 > 5\%$ $P(X \geq 7) = 1 - P(X \leq 6) = 1 - 0.9623 = 0.0377 < 5\%$ So critical region is $\{7,8,9,10,11,12,13,14,15,16,17\}$	B1 for 0.1057 B1 for 0.0377 M1 for at least one comparison with 5% A1 CAO for critical region <i>dep</i> on M1 and at least one B1	4
(vi)	Because $P(X \geq 6) = 0.1057 > 10\%$ Either: comment that 6 is still outside the critical region Or comparison $P(X \geq 7) = 0.0377 < 10\%$	E1 E1	2
		TOTAL	18