

CAMBRIDGE
INTERNATIONAL EXAMINATIONS

June 2003

GCE A AND AS LEVEL
AICE

MARK SCHEME

MAXIMUM MARK: 50

SYLLABUS/COMPONENT: 9709/06, 0390/06

MATHEMATICS
Paper 6 (Probability and Statistics 1)



Page 1	Mark Scheme	Syllabus	Paper
	A AND AS LEVEL – JUNE 2003	9709/0390	6

1	(i)	False zero	B1	1	Or any sensible answer																								
	(ii)	<table border="1"> <tr> <td>(a)</td> <td>Stem</td> <td>Leaf</td> </tr> <tr> <td></td> <td>3</td> <td>45</td> </tr> <tr> <td></td> <td>4</td> <td>145</td> </tr> <tr> <td></td> <td>5</td> <td>02</td> </tr> <tr> <td></td> <td>6</td> <td>2</td> </tr> <tr> <td></td> <td>7</td> <td>339</td> </tr> <tr> <td></td> <td>8</td> <td>344556679</td> </tr> <tr> <td></td> <td>9</td> <td>1</td> </tr> </table> <p>Key 3 4 rep 34, or stem width = 10</p>	(a)	Stem	Leaf		3	45		4	145		5	02		6	2		7	339		8	344556679		9	1	B1 B1		For correct stem, i.e. not 30, 40, 50 etc. For correct leaf, must be sorted
(a)	Stem	Leaf																											
	3	45																											
	4	145																											
	5	02																											
	6	2																											
	7	339																											
	8	344556679																											
	9	1																											
			B1	3	For key, NB 30 4 rep 34 gets B1 here																								
		(b) 79	B1 ft	1	For correct answer, only ft from a sorted stem and leaf diagram																								
2	(i)	$P(N, \bar{N}) = \frac{3}{10} \times \frac{7}{9}$ <p>Mult. By 2 = 7/15 AG</p> <p>OR Total ways ${}_{10}C_2 (= 45)$ Total 1 of each ${}_{7}C_1 \times {}_{3}C_1 (= 21)$ Prob = $21/45 = 7/15$ AG</p>	M1 A1	2	For multiplying 2 relevant possibilities For obtaining given answer legitimately																								
			M1		For both totals																								
			A1	2	For obtaining correct answer																								
	(ii)	$P(N, N) = 3/10 \times 2/9 (= 1/15)$ $P(\bar{N}, \bar{N}) = 7/10 \times 6/9 (= 7/15)$ <table border="1"> <tr> <td>x</td> <td>0</td> <td>1</td> <td>2</td> </tr> <tr> <td>P(X=x)</td> <td>7/15</td> <td>7/15</td> <td>7/15</td> </tr> </table>	x	0	1	2	P(X=x)	7/15	7/15	7/15	M1 M1		For 2 correct numbers multiplied together, can be implied For 2 correct numbers multiplied together or subtracting from 1																
x	0	1	2																										
P(X=x)	7/15	7/15	7/15																										
			B1	3	All correct. Table correct and no working gets 3/3																								
	(iii)	$E(X) = 1 \times 7/15 + 2 \times 1/15 = 3/5$	B1 ft	1	For correct answer or equivalent. Only ft if $\sum p = 1$																								
3	(i)	$P(X > 120)$ $= 1 - \Phi\left(\frac{120 - 112}{17.2}\right)$ $= 1 - \Phi(0.4651)$ $= 1 - 0.6790 = 0.321$	M1 M1		For standardising with or without the $\sqrt{\quad}$, 17.2^2 , but no cc. For finding the correct area, 1 – their $\Phi(z)$, NOT $\Phi(1 - \text{their } z(0.4651))$																								
			A1	3	For correct answer																								

Page 2	Mark Scheme	Syllabus	Paper
	A AND AS LEVEL – JUNE 2003	9709/0390	6

	(ii)	$z = -0.842$ $-0.842 = \frac{103 - 115}{\sigma}$ $\sigma = 14.3$	B1 M1 A1	3	For z , ± 0.842 or ± 0.84 For solving an equation involving their z or $z = 0.7881$ or 0.5793 only, 103, 115 and σ or $\sqrt{\sigma}$ or σ^2 , i.e. must have used tables For correct answer
4	(i)	$(0.7)^{24} \times (0.3)^6 \times {}_{30}C_{24}$ $= 0.0829$ OR normal approx. $P(24) = \Phi((24.5 - 21)/\sqrt{6.3})$ $- \Phi((23.5 - 21)/\sqrt{6.3})$ $= 0.9183 - 0.8404 = 0.0779$	M1 A1 M1 A1	2 2	For relevant binomial calculation For correct answer For subtracting the 2 phi values as written For correct answer
	(ii)	$\mu = 30 \times 0.7 = 21,$ $\sigma^2 = 30 \times 0.7 \times 0.3 = 6.3$ $P(< 20) = \Phi\left(\frac{19.5 - 21}{\sqrt{6.3}}\right) =$ $\Phi(-0.5976)$ $= 1 - 0.7251 = 0.275$	B1 M1 M1 M1 A1	5	For 21 and 6.3 seen For standardising process, must have $\sqrt{\quad}$, can be + or - For continuity correction 19.5 or 20.5 For using 1 - some area found from tables For correct answer
5	(i)	${}_6C_3 \times {}_4C_2 = 120$	M1 A1	2	For multiplying 2 combinations together, not adding, no perms, ${}_{10}C_3 \times {}_{10}C_2$ or ${}_5C_3 \times {}_5C_2$ would get M1 For answer 120
	(ii)	${}_6C_4 \times {}_4C_1 (= 60)$ ${}_6C_5 \times {}_4C_0 (= 6)$ Answer = 186	M1 M1 A1	3	For reasonable attempt on option 4M 1W, or 5M, 0W, can have + here and perms For other option attempt For correct answer
	(iii)	Man and woman both on ${}_5C_2 \times {}_3C_1 (= 30)$ $120 - 30 = 90$	M1 M1 A1	3	For finding number of ways of the man and woman being on together, need not be evaluated but must be multiplied For subtracting a relevant number from their (i) For correct answer

Page 3	Mark Scheme	Syllabus	Paper
	A AND AS LEVEL – JUNE 2003	9709/0390	6

	<p>OR ${}_5C_2 \times {}_3C_2 (= 30)$ ${}_3C_1 \times {}_5C_3 (= 30)$ ${}_5C_3 \times {}_3C_2 (= 30)$ $\Sigma = 90$</p> <p>OR ${}_3C_1 \times {}_5C_3 (= 30)$ ${}_3C_2 \times {}_6C_3 (= 60)$ $\Sigma = 90$</p> <p>OR ${}_5C_2 \times {}_3C_2 (= 30)$ ${}_5C_3 \times {}_4C_2 (= 60)$ $\Sigma = 90$</p>	<p>M1 M1 A1</p> <p>M1 M1 A1</p> <p>M1 M1 A1</p>	<p>3</p> <p>3</p> <p>3</p>	<p>Any 2 of man in, woman out Woman in, man out Neither in</p> <p>Woman in, man out Woman out, any man For correct answer</p> <p>Man in, woman out Man out, any woman For correct answer</p>	
6	(i)	<p>P(G) = number of g'parents/total people</p> <p>= $6/16 = 3/8$</p>	<p>M1 A1</p>	<p>2</p>	<p>For appreciating total g'parents/total people, can be implied</p> <p>For correct answer</p>
	(ii)	<p>$P(H1, G) + P(H2, G) + P(H3, G)$</p> $= \frac{1}{3} \times \frac{2}{7} + \frac{1}{3} \times \frac{3}{7} + \frac{1}{3} \times \frac{1}{2} = \frac{17}{42}$ <p>(= 0.405)</p>	<p>B1 M1 A1</p>	<p>3</p>	<p>For any correct 2-factor product, need not be evaluated</p> <p>For addition of 3 relevant 2-factor products For correct answer or equivalent</p>
	(iii)	<p>$P(H1 G) + P(H2 G)$</p> $= \frac{2/21}{17/42} + \frac{3/21}{17/42} = \frac{10}{17}$ <p>OR $P(H3 G) = 7/17$ Answer = $1 - 7/17$ = $10/17$</p>	<p>M1 M1 A1 A1 M1 M1 A2</p>	<p>4</p>	<p>For summing exactly 2 probability options</p> <p>For dividing by answer to (ii), only if not multiplied as well, and p must be < 1 For one correct probability For correct answer or equivalent</p> <p>For finding prob. options no parents For sub. from 1 For correct answer</p>
7	(i)	<p>Mean =</p> $(2.5 \times 11 + 7.5 \times 20 + 15 \times 32 + 25 \times 18 + 35 \times 10 + 55 \times 6) / 97 = 18.4$	<p>M1 M1 A1</p>	<p>3</p>	<p>For using their mid-intervals (not end points or class widths)</p> <p>For using $\frac{\sum fx^2}{\sum f}$ any x</p> <p>For correct answer, cwo, 18.4 no wkg 3/3</p>

Page 4	Mark Scheme	Syllabus	Paper
	A AND AS LEVEL – JUNE 2003	9709/0390	6

	<p>sd =</p> $\sqrt{(2.5^2 \times 11 + 7.5^2 \times 20 + 15^2 \times 32 + 25^2 \times 18 + 35^2 \times 10 + 55^2 \times 6) / 97 - \text{mean}^2} = 13.3$	M1		For using $\frac{\sum fx^2}{\sum f} - (\text{their mean})^2$ or equivalent, no $\sqrt{\quad}$ needed, not $(\sum fx)^2 / \sum f$
		A1	5	For correct answer
(ii)	<p>Freq. densities: 2.2, 4.0, 3.2, 1.8, 1.0, 0.2</p>	M1		For attempting a frequency density of some sort (or scaled frequency), can be upside down but not multiplied
		A1		For correct heights on the graph
		B1		For correct bars on uniform horiz. scale, i.e. from 0 to 5 etc.
		B1	4	Freq. density or scaled freq. labelled on vertical axis, time or mins on horiz., 'class width' is not enough