CAMBRIDGE
INTERNATIONAL EXAMINATIONS

June 2003

GCE A AND AS LEVEL
AICE

MARK SCHEME

MAXIMUM MARK: 50

SYLLABUS/COMPONENT: 9709/06, 0390/06

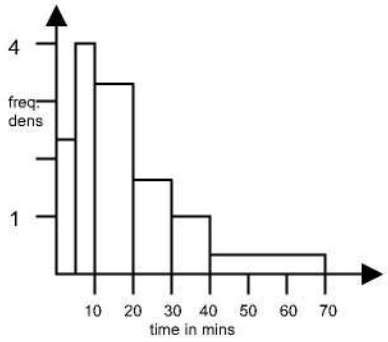
MATHEMATICS
Paper 6 (Probability and Statistics 1)

UNIVERSITY of CAMBRIDGE
Local Examinations Syndicate

1	(i)	False zero	B1	1	Or any sensible answer
	(ii)	**(a)** Stem | Leaf 3 | 45 4 | 145 5 | 02 6 | 2 7 | 339 8 | 344556679 9 | 1 Key 3 | 4 rep 34, or stem width = 10	B1 B1 B1	 3	For correct stem, i.e. not 30, 40, 50 etc. For correct leaf, must be sorted 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, $\overline{N}$) = $\frac{3}{10}\times\frac{7}{9}$ Mult. By 2 = 7/15 **AG**	M1 A1	 2	For multiplying 2 relevant possibilities For obtaining given answer legitimately
		OR Total ways $_{10}C_2$ (= 45) Total 1 of each $_7C_1 \times {}_3C_1$ (= 21) Prob = 21/45 = 7/15 **AG**	M1 A1	 2	For both totals For obtaining correct answer
	(ii)	P (N, N) – 3/10 x 2/9 (= 1/15) P($\overline{N}$, $\overline{N}$) = 7/10 x 6/9 (= 7/15) x | 0 1 2 P (X=x) | 7/15 7/15 7/15	M1 M1 B1	 3	For 2 correct numbers multiplied together, can be implied For 2 correct numbers multiplied together or subtracting from 1 All correct. Table correct and no working gets 3/3
	(iii)	E(X) = 1 x 7/15 + 2 x 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 - Φ (0.4651) = 1 - 0.6790 = 0.321	 M1 M1 A1	 3	 For standardising with or without the $\sqrt{}$, 17.2^2, but no cc. For finding the correct area, 1 – their Φ (z), NOT Φ (1 – their z(0.4651)) For correct answer

	(ii)	$z = -0.842$ $-0.842 = \frac{103-115}{\sigma}$	B1 M1		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
		$\sigma = 14.3$	A1	3	For correct answer
4	(i)	$(0.7)^{24} \times (0.3)^6 \times {}_{30}C_{24}$	M1		For relevant binomial calculation
		$= 0.0829$	A1	2	For correct answer
		OR normal approx. $P(24) = \Phi((24.5 - 21)/\sqrt{6.3}))$ $- \Phi((23.5 - 21)/\sqrt{6.3}))$	M1		For subtracting the 2 phi values as written
		$= 0.9183 - 0.8404 = 0.0779$	A1	2	For correct answer
	(ii)	$\mu = 30 \times 0.7 = 21$, $\sigma^2 = 30 \times 0.7 \times 0.3 = 6.3$	B1		For 21 and 6.3 seen
		$P(< 20) = \Phi\left(\frac{19.5-21}{\sqrt{6.3}}\right) =$	M1		For standardising process, must have $\sqrt{}$, can be + or –
		$\Phi(-0.5976)$	M1		For continuity correction 19.5 or 20.5
			M1		For using 1 - some area found from tables
		$= 1 - 0.7251 = 0.275$	A1	5	For correct answer
5	(i)	${}_6C_3 \times {}_4C_2 = 120$	M1		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
			A1	2	For answer 120
	(ii)	${}_6C_4 \times {}_4C_1$ (= 60)	M1		For reasonable attempt on option 4M 1W, or 5M, 0W, can have + here and perms
		${}_6C_5 \times {}_4C_0$ (= 6)	M1		For other option attempt
		Answer = 186	A1	3	For correct answer
	(iii)	Man and woman both on ${}_5C_2 \times {}_3C_1$ (= 30)	M1		For finding number of ways of the man and woman being on together, need not be evaluated but must be multiplied
		120 - 30 = 90	M1		For subtracting a relevant number from their **(i)**
			A1	3	For correct answer

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

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