

JUNE 2002

**GCE Advanced Subsidiary Level
Advanced International Certificate of Education**

MARK SCHEME

MAXIMUM MARK : 50

SYLLABUS/COMPONENT :9709 /6, 0390 /6

**MATHEMATICS
(Probability and Statistics 1)**



Page 1	Mark Scheme	Syllabus	Paper
	AS Level & AICE Examinations – June 2002	9709, 0390	6

1 (i) not independent $P(A) \times P(B) \neq P(A \text{ and } B)$	B1 B1dep 2	
(ii) not mutually exclusive $P(A \text{ and } B) \neq 0$	B1 B1 2	Can be stated in words
2 both axes correct points median IQ range	B1 M1 A1 B1ft M1 A1ft 6	For correct scales and labels on at least one axis For points at upper bounds or 15.5 or 14.5 All correct and smooth curve or straight lines On mid-points or upper bounds For evaluating their UQ – theirLQ For correct answer, ft on correct upper bounds only
3 (i) a 1 4 9 16 $P(A = a)$ $\frac{1}{2}$ $\frac{1}{6}$ $\frac{1}{6}$ $\frac{1}{6}$	M1 A1 A1 3	For $A = 1, 4, 9, 16$, or 1,1,1,4,9,16 Any three correct probabilities for 3 different vals of A All correct
(ii) $E(A) = 1 \times \frac{1}{2} + 4 \times \frac{1}{6} + 9 \times \frac{1}{6} + 16 \times \frac{1}{6}$ $= 5.33$ $\text{Var}(A) = 1^2 \times \frac{1}{2} + 4^2 \times \frac{1}{6} + \dots - (5.33)^2$ $= 30.9$	M1 A1 M1 A1 4	For calculation of $\sum xp$ where $\sum p$ must be 1 For correct answer For calculation of $\sum x^2 p - (\text{their } E(A))^2 \sum p$ need not be 1 For correct answer
4 (i) $-47.2/30 = -1.573$ OR $\sum x - \Sigma 110 = -47.2$ and $\Sigma 110 = 3300$ $\bar{x} = 110 - 1.573 = 108.427$ standard deviation = $\sqrt{\frac{5460}{30} - (-1.573)^2}$ $= 13.4$	B1 B1 M1 A1 4	For correct answer For $\frac{5460}{30} - (\text{their coded mean})^2$ For correct answer
(ii) $z = \frac{110 - 107.6}{13.8} = 0.174$ $P(X > 110) = 1 - \Phi(0.174)$ $= 1 - 0.5691$ $= 0.431$	M1 M1 A1 3	For standardising, can have $\sqrt{13.8}$ on denom not 13.8^2 For using tables correctly and finding a correct area from their z . For correct answer

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5 (i) $\frac{7!}{2!} = 2520$	M1 A1 2	For dividing by 2 or 2! For correct answer
(ii) $\frac{5!}{2!} \times 3! = 360$	B1 M1 A1 3	For 5! or equivalent For multiplying by 3! or dividing by 2! or both For correct answer
(iii) $4/7$ of 2520 = 1440 OR $6! + \frac{6!}{2!} + \frac{6!}{2!} = 1440$	M2 A1 M1 A1 A1 3	For 4/7 of their (i) For correct answer For summing options for ending in 2, 6, 8 For correct options For correct answer
(ii) (i) $\mu = 3.6$ $\frac{2.8 - \text{their } \mu}{\sigma} = -0.4$ $\sigma = 2$	B1 M1 M1 A1 4	Stated or can be calculated later on For equation relating μ or 3.6 and σ . Must be standardised, can have ± 0.4 Solving the correct equation or with a second correct equation relating μ and σ For correct answer
(ii) $(0.6554)^2 \times (0.3446)^2 \times {}_4C_2$ $+ (0.6554)^3 \times (0.3446) \times {}_4C_3 + (0.6554)^4$ $= 0.879$ $(= 0.3061 + 0.3881 + 0.1845)$ OR $1 - (0.3446)^4 - (0.6554)^1 \times (0.3446)^3 \times {}_4C_3$ $(= 1 - 0.0141 - 0.1072)$ $= 0.879$	M1 B1 A1 A1 M1 B1 A1 A1 4	For attempted binomial calculation of any 2 or 3 of P(2), P(3), P(4), needs 0.6554 in For correct numerical expression for P(2) or P(3) All in correct form For correct answer For calculation of i – any 2 or 3 of P(0), P(1), P(2) For correct numerical expression for P(1) or P(2) All in correct form For correct answer
7 (i) (a) $np = 11$ $np(1 - p) = 4.95$ $n = 20$ ($p = 0.55$)	B1 B1 M1 A1 4	For solving, need to find a value for n For correct answer
(b) $P(X = 12) = (0.55)^{12} \times (0.45)^8 \times {}_{20}C_{12}$ $= 0.162$	M1 A1 2	For $(\text{their } p)^{12} \times (\text{their } q)^{n-12} \times k \neq 1$ For correct answer
(ii) $\mu = 100 \times 0.3 = 30$, $\sigma^2 = 100 \times 0.3 \times 0.7$ $P(X < 35) = \Phi\left(\frac{34.5 - 30}{\sqrt{21}}\right)$ $= \Phi(0.9820)$ $= 0.837$ (exact)	B1 M1 M1 A1 4	For both mean and variance correct, allow $\sigma = 21$ For standardising with or without cc, allow their 21 or their $\sqrt{21}$ in denom For use of any continuity correction 34.5 or 35.5 For correct answer