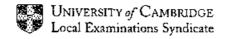# CAMBRIDGE
INTERNATIONAL EXAMINATIONS

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)

| | | | |
|---|---|---|---|
| **1** (i) not independent<br>$P(A) \times P(B) \neq P(A \text{ and } B)$ | B1<br>B1dep | 2 | |
| (ii) not mutually exclusive<br>$P(A \text{ and } B) \neq 0$ | B1<br>B1 | 2 | Can be stated in words |
| **2** both axes correct | B1 | | For correct scales and labels on at least one axis |
| points | M1<br>A1 | | For points at upper bounds or 15.5 or 14.5<br>All correct and smooth curve or straight lines |
| median<br>IQ range | B1ft<br>M1<br><br>A1ft | <br><br><br>6 | On mid-points or upper bounds<br>For evaluating their UQ – theirLQ<br><br>For correct answer, ft on correct upper bounds only |
| **3** (i)    $a$    1   4   9   16<br>     $P(A = a)$   $\frac{1}{2}$   $\frac{1}{6}$   $\frac{1}{6}$   $\frac{1}{6}$ | M1<br>A1<br><br>A1 | <br><br><br>3 | For $A = 1, 4, 9, 16,$ or $1,1,1,4,9,16$<br>Any three correct probabilities for 3 different vals of A<br>All correct |
| (ii)   $E(A) = 1 \times 1/2 + 4 \times 1/6 + 9 \times 1/6 +$<br>     $16 \times 1/6$<br>     $= 5.33$<br>  Var $(A) = 1^2 \times \frac{1}{2} + 4^2 \times 1/6 + \ldots - (5.33)^2$<br>     $= 30.9$ | M1<br>A1<br>M1<br><br>A1 | <br><br><br><br>4 | For calculation of $\Sigma xp$ where $\Sigma p$ must be 1<br>For correct answer<br>For calculation of $\Sigma x^2 p$ – (their $E(A))^2$ $\Sigma p$ need not be 1<br>For correct answer |
| **4** (i) $-47.2/30 = -1.573$<br>   OR $\Sigma x - \Sigma 110 = -47.2$ and $\Sigma 110 = 3300$<br><br>   $\bar{x} = 110 - 1.573 = 108 \ (108.4)$<br>   standard deviation $= \sqrt{\dfrac{5460}{30} - (-1.573)^2}$<br>     $= 13.4$ | B1<br><br><br>B1<br><br>M1<br>A1 | <br><br><br><br><br><br>4 | <br><br><br>For correct answer<br><br>For $\dfrac{5460}{30} - (their\ coded\ mean)^2$<br>For correct answer |
| (ii) $z = \dfrac{110 - 107.6}{13.8} = 0.174$<br>   $P(X > 110) = 1 - \Phi(0.174)$<br>     $= 1 - 0.5691$<br>     $= 0.431$ | M1<br><br>M1<br><br><br>A1 | <br><br><br><br><br>3 | For standardising, can have $\sqrt{13.8}$ on denom not $13.8^2$<br>For using tables correctly and finding a correct area from their z.<br>For correct answer |

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