**June 2004**

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 2004** | **9709/0390** | **6** |

| | | | |
|---|---|---|---|
| **1 (i)** $\bar{x}_A = 139$ (138.75) <br> $\sigma_A = 83.1$ | B1 <br> B1 <br><br> **2** | For the mean <br> For the sd | |
| **(ii)** team B <br> smaller standard deviation | B1 <br> B1 dep <br><br> **2** | Independent mark <br> Need the idea of spread <br> SR If team A has a smaller sd then award <br> B1only for 'teamA, smaller sd' | |
| **2 (i)** axes and labels <br> points <br><br><br> (3,0) (15,160) (20,320) (35,480) <br> (60,640) | B1 <br><br><br><br> B1 <br> B1 <br><br> **3** | For correct uniform scales and labels on <br> both axes, accept Frequency, %CF, <br> Number of people, allow axes reversed, <br> allow halves <br> For 3 correct points <br> All points correct and reasonable graph incl <br> straight lines | |
| **(ii)** accept 60 – 70 for straight lines <br> 40 – 70 for curve | M1 <br><br> A1 <br> **2** | For subtracting from 640 can be implied <br><br> For correct answer, reasonably compatible <br> with graph | |

**3 (i)**

| $x$ | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| P($X = x$) | $\frac{11}{36}$ | $\frac{9}{36}$ | $\frac{7}{36}$ | $\frac{5}{36}$ | $\frac{3}{36}$ | $\frac{1}{36}$ |

| | | | |
|---|---|---|---|
| | M1 <br><br><br> A1 <br> A1 <br> **3** | For 36 in the uncancelled denominator <br> somewhere, accept decimals eg 0.305 <br> recurring or 0.306 etc <br> For 3 correct probabilities <br> All correct | |
| **(ii)** E($X$) = $1 \times \frac{11}{36} + 2 \times \frac{9}{36} + 3 \times \frac{7}{36} +$ <br> $4 \times \frac{5}{36} + 5 \times \frac{3}{36} + 6 \times \frac{1}{36} = \frac{91}{36}$ | M1 <br><br> A1 <br> **2** | For calculation of $\sum xp$ where all probs < 1 | |
| **4 (i)** $z = \dfrac{350 - 450}{120}$ <br> $= -0.833$ <br> % small = 1 – 0.7975 = 0.2025 or <br> 20.25% | M1 <br> A1 <br> A1 <br><br> **3** | For standardising accept 120 or √120, no cc <br> For correct $z$ value, + or -, accept 0.83 <br> For answer rounding to 0.202 or 0.203 | |
| **(ii)** 0.7975 ÷ 2 = 0.39875 each <br> $\Phi z_2$ = 0.60125 <br><br> $z_2$ = 0.257 <br><br> $x$ = 120 × 0.257 + 450 <br> = 481 | M1 <br> M1dep <br><br> M1 <br><br> M1dep <br> A1 <br> **5** | For dividing their remainder by 2 <br> For adding their above two probs together <br> or subt from 1 <br> For finding the $z$ corresponding to their <br> probability <br> For converting to $x$ from a $z$ value <br> For answer, rounding to 481 | |

| Page 2 | Mark Scheme | Syllabus | Paper |
|---|---|---|---|
| | A AND AS LEVEL – JUNE 2004 | 9709/0390 | 6 |

| 5 (a) (i) $3 \times 5 \times 3 \times 2$ or $_3C_1 \times {}_5C_1 \times {}_3C_1 \times 2$ $= 90$ | M1 A1    2 | For multiplying $3 \times 5 \times 3$ For correct answer |
|---|---|---|
| (ii) $(3 \times 5 \times 2) + (3 \times 3) + (5 \times 2 \times 3)$ $= 69$ | M1 M1 A1    3 | For summing options that show S&M,S&D,M&D $3 \times 5 \times a + 3 \times 3 \times b + 5 \times 3 \times c$ seen for integers a,b,c For correct answer |
| (b) $_{14}C_5 \times {}_9C_5 \times {}_4C_4$ or equivalent $= 252252$ | M1 M1 A1    3 | For using combinations not all $_{14}C\ldots$ For multiplying choices for two or three groups For correct answer NB 14!/5!5!4! scores M2 and A1 if correct answer |
| 6 (i)  | B1 B1 B1 B1    4 | For top branches correct (0.65, 0.9, 0.1) For bottom branches correct (0.35, 0.8, 0.2) For win/lose option after $2^{nd}$ in (0.6, 0.4) For all labels including final lose at end of bottom branch |
| (ii) $0.65 \times 0.1 + 0.35 \times 0.8 \times 0.4 + 0.35 \times 2$ $= 0.247$ | M1 M1 A1    3 | For evaluating $1^{st}$ in and lose seen For $1^{st}$ out $2^{nd}$ in lose, or $1^{st}$ out $2^{nd}$ out lose For correct answer |
| (iii) $\dfrac{0.65 \times 0.1}{0.247}$ $= 0.263 \quad (= 5/19)$ | M1 A1ft    2 | For dividing their $1^{st}$ in and lose by their answer to (ii) For correct answer, ft only on $0.65 \times 0.1$/their (ii) |

| Page 3 | Mark Scheme | Syllabus | Paper |
|--------|-------------|----------|-------|
| | A AND AS LEVEL – JUNE 2004 | 9709/0390 | 6 |

| | | | |
|---|---|---|---|
| **7 (i)** $P(0) = (0.8)^{15}$ (= 0.03518)<br>$P(1) = {}_{15}C_1 \times (0.2) \times (0.8)^{14}$<br>(= 0.1319)<br>$P(2) = {}_{15}C_2 \times (0.2)^2 \times (0.8)^{13}$<br>(= 0.2309)<br><br>$P(X \leq 2) = 0.398$ | B1<br><br><br><br>B1<br><br>B1<br><br>**3** | For correct numerical expression for P(0)<br><br><br>For correct numerical expression for P(1) or P(2)<br>For answer rounding to 0.398 | |
| **(ii)** $1 - (0.8)^n \geq 0.85$<br>$0.15 \geq (0.8)^n$<br><br>n = 9 | M1<br><br>M1 dep<br><br>A1<br>**3** | For an equality/inequality involving 0.8, *n*, 0.85<br>For solving attempt (could be trial and error or lg)<br>For correct answer | |
| **(iii)** $\mu = 1600 \times 0.2 = 320$,<br>$\sigma^2 = 1600 \times 0.2 \times 0.8 = 256$<br>$P(X \geq 290)$  or $P(X<350)$<br><br>= $1 - \Phi\left(\dfrac{289.5 - 320}{\sqrt{256}}\right) = 1 - \Phi(-1.906)$<br><br>= $\Phi(1.906) = 0.972$ | B1<br>M1<br><br><br>M1<br><br><br>M1<br><br>A1<br>**5** | For both mean and variance correct<br>For standardising, with or without cc, must have $\sqrt{\phantom{x}}$ on denom<br>For use of continuity correction 289.5 or 290.5<br><br>For finding an area > 0.5 from their *z*<br><br>For answer rounding to 0.972 | |

© University of Cambridge International Examinations 2004