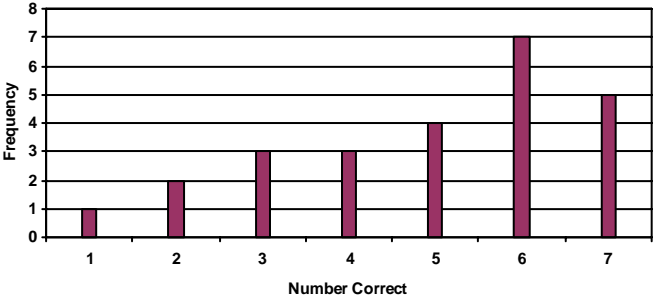
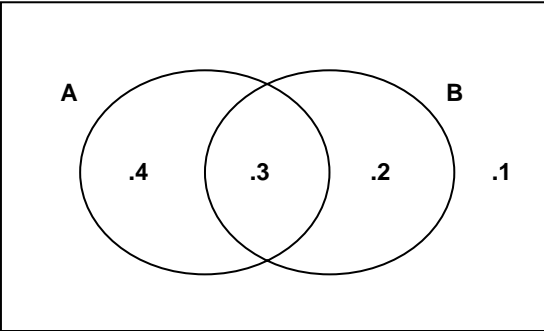
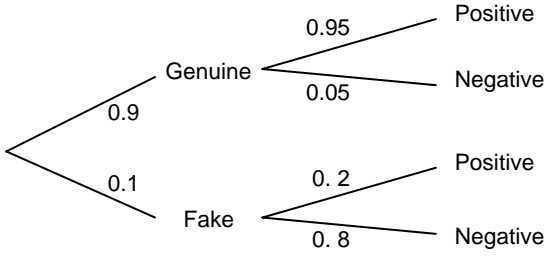


Mark Scheme 4766
June 2006

Q1 (i)		G1 Labelled linear scales G1 Height of lines	2
(ii)	Negative (skewness)	B1	1
(iii)	$\Sigma fx = 123$ so mean = $123/25 = 4.92$ o.e. $S_{xx} = 681 - \frac{123^2}{25} = 75.84$ M.s.d = $\frac{75.84}{25} = 3.034$	B1 M1 for S_{xx} attempted A1 FT their 4.92	3
(iv)	Total for 25 days is 123 and totals for 31 days is 155. Hence total for next 6 days is 32 and so mean = 5.33	M1 $31 \times 5 - 25 \times$ their 4.92 A1 FT their 123	2
		TOTAL	8
Q2 (i)	$P(A \cap B) = P(A)P(B A) = \frac{7}{10} \times \frac{3}{7}$ $\rightarrow P(A \cap B) = 0.3$ o.e.	M1 Product of these fractions A1	2
(ii)		B1FT either 0.4 or 0.2 in correct place B1FT all correct and labelled	2
(iii)	$P(B A) \neq P(B)$, $3/7 \neq 0.5$ Unequal so not independent	E1 Correct comparison E1dep for 'not independent'	2
(iv)	$3/7 < 0.5$ so Isobel is less likely to score when her parents attend	E1 for comparison E1dep	2
		TOTAL	8

Q3 (i)	$P(X = 1) = 7k, P(X = 2) = 12k, P(X = 3) = 15k, P(X = 4) = 16k$ $50k = 1$ so $k = 1/50$	M1 for addition of four multiples of k A1 ANSWER GIVEN	2
(ii)	$E(X) = 1 \times 7k + 2 \times 12k + 3 \times 15k + 4 \times 16k = 140k = 2.8$ OR $E(X) = 1 \times 7/50 + 2 \times 12/50 + 3 \times 15/50 + 4 \times 16/50 = 140/50 = 2.8$ oe $\text{Var}(X) = 1 \times 7k + 4 \times 12k + 9 \times 15k + 16 \times 16k - 7.84 = 1.08$ OR $\text{Var}(X) = 1 \times 7/50 + 4 \times 12/50 + 9 \times 15/50 + 16 \times 16/50 - 7.84$ $= 8.92 - 7.84 = 1.08$	M1 for $\sum xp$ (at least 3 terms correct) A1 CAO M1 $\sum x^2p$ (at least 3 terms correct) M1 <i>dep</i> for $-$ their $E(X)^2$ NB provided $\text{Var}(X) > 0$ A1 FT their $E(X)$	5
		TOTAL	7
Q4 (i)	$4 \times 5 \times 3 = 60$	M1 for $4 \times 5 \times 3$ A1 CAO	2
(ii)	(A) $\binom{4}{2} = 6$ (B) $\binom{4}{2} \binom{5}{2} \binom{3}{2} = 180$	B1 ANSWER GIVEN B1 CAO	2
(iii)	(A) $1/5$ (B) $\frac{3}{4} \times \frac{4}{5} \times \frac{2}{3} = \frac{2}{5}$	B1 CAO M1 for $\frac{3}{4} \times \frac{4}{5} \times \frac{2}{3}$ A1	3
		TOTAL	7
Q5 (i)	$P(X = 2) = \binom{3}{2} \times 0.87^2 \times 0.13 = 0.2952$	M1 $0.87^2 \times 0.13$ M1 $\binom{3}{2} \times p^2q$ with $p+q=1$ A1 CAO	3
(ii)	In 50 throws expect 50 $(0.2952) = 14.76$ times	B1 FT	1
(iii)	$P(\text{two } 20\text{'s twice}) = \binom{4}{2} \times 0.2952^2 \times 0.7048^2 = 0.2597$	M1 $0.2952^2 \times 0.7048^2$ A1 FT their 0.2952	2
		TOTAL	6

Q6 (i)		G1 for left hand set of branches fully correct including labels and probabilities G1 for right hand set of branches fully correct	2
(ii)	$P(\text{test is positive}) = (0.9)(0.95) + (0.1)(0.2) = 0.875$	M1 Two correct pairs added A1 CAO	2
(iii)	$P(\text{test is correct}) = (0.9)(0.95) + (0.1)(0.8) = 0.935$	M1 Two correct pairs added A1 CAO	2
(iv)	$P(\text{Genuine} \text{Positive})$ $= 0.855/0.875$ $= 0.977$	M1 Numerator M1 Denominator A1 CAO	3
(v)	$P(\text{Fake} \text{Negative}) = 0.08/0.125 = 0.64$	M1 Numerator M1 Denominator A1 CAO	3
(vi)	<p>EITHER: A positive test means that the painting is almost certain to be genuine so no need for a further test.</p> <p>However, more than a third of those paintings with a negative result are genuine so a further test is needed.</p> <p>NOTE: Allow sensible alternative answers</p>	E1FT E1FT	2
(vii)	$P(\text{all 3 genuine}) = (0.9 \times 0.05 \times 0.96)^3$ $= (0.045 \times 0.96)^3$ $= (0.0432)^3$ $= 0.0000806$	M1 for 0.9×0.05 (=0.045) M1 for complete correct triple product M1 <i>indep</i> for cubing A1 CAO	4
		TOTAL	18

<p>Q7 (i)</p>	<p>$X \sim B(20, 0.1)$</p> <p>(A) $P(X = 1) = \binom{20}{1} \times 0.1 \times 0.9^{19} = 0.2702$</p> <p>OR from tables $0.3917 - 0.1216 = 0.2701$</p> <p>(B) $P(X \geq 1) = 1 - 0.1216 = 0.8784$</p>	<p>M1 0.1×0.9^{19}</p> <p>M1 $\binom{20}{1} \times pq^{19}$</p> <p>A1 CAO</p> <p>OR: M2 for $0.3917 - 0.1216$ A1 CAO</p> <p>M1 $P(X=0)$ provided that $P(X \geq 1) = 1 - P(X \leq 1)$ not seen</p> <p>M1 $1 - P(X=0)$</p> <p>A1 CAO</p>	<p>3</p> <p>3</p>
<p>(ii)</p>	<p>EITHER: $1 - 0.9^n \geq 0.8$ $0.9^n \leq 0.2$ Minimum $n = 16$</p> <p>OR (using trial and improvement): Trial with 0.9^{15} or 0.9^{16} or 0.9^{17} $1 - 0.9^{15} = 0.7941 < 0.8$ and $1 - 0.9^{16} = 0.8147 > 0.8$ Minimum $n = 16$</p> <p>NOTE: $n = 16$ unsupported scores SC1 only</p>	<p>M1 for 0.9^n</p> <p>M1 for inequality</p> <p>A1 CAO</p> <p>M1</p> <p>M1</p> <p>A1 CAO</p>	<p>3</p>
<p>(iii)</p>	<p>(A) Let p = probability of a randomly selected rock containing a fossil (for population) $H_0: p = 0.1$ $H_1: p < 0.1$</p> <p>(B) Let $X \sim B(30, 0.1)$ $P(X \leq 0) = 0.0424 < 5\%$ $P(X \leq 1) = 0.0424 + 0.1413 = 0.1837 > 5\%$</p> <p>So critical region consists only of 0.</p> <p>(C) 2 does not lie in the critical region.</p> <p>So there is insufficient evidence to reject the null hypothesis and we conclude that it seems that 10% of rocks in this area contain fossils.</p>	<p>B1 for definition of p</p> <p>B1 for H_0</p> <p>B1 for H_1</p> <p>M1 for attempt to find $P(X \leq 0)$ or $P(X \leq 1)$ using binomial</p> <p>M1 for both attempted</p> <p>M1 for comparison of either of the above with 5%</p> <p>A1 for critical region dep on both comparisons (NB Answer given)</p> <p>M1 for comparison</p> <p>A1 for conclusion in context</p>	<p>3</p> <p>4</p> <p>2</p>
		<p>TOTAL</p>	<p>18</p>