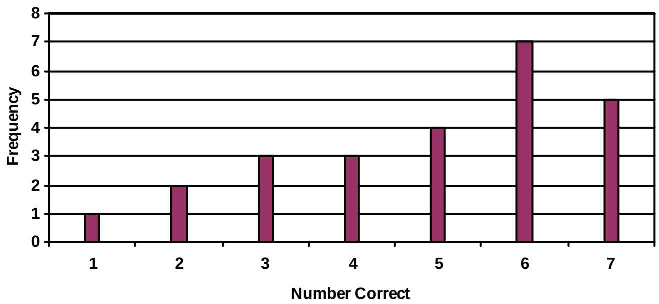
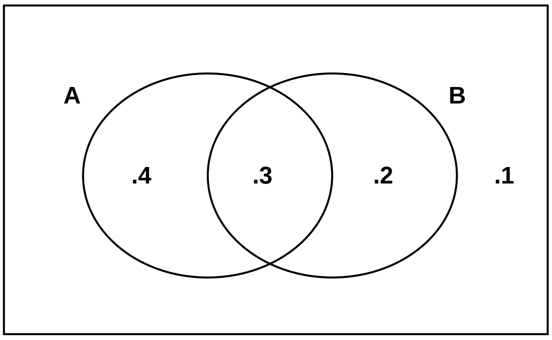
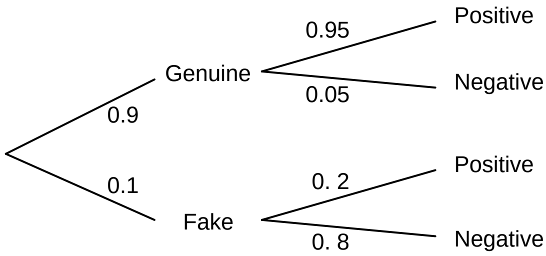
Mark Scheme 4766
June 2006

Q1 **(i)**		G1 Labelled linear scales G1 Height of lines	**2**
(ii)	Negative (skewness)	B1	**1**
(iii)	Σfx = 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 x 5 – 25xtheir 4.92 A1 FT their 123	**2**
		TOTAL	**8**
Q2 **(i)**	$\mathrm{P}(A \cap B) = \mathrm{P}(A)\mathrm{P}(B \mid A) = \frac{7}{10} \times \frac{3}{7}$ $\rightarrow \mathrm{P}(A \cap B) = 0.3$ 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*) ≠ P(*B*), 3/7 ≠ 0.5 Unequal so not independent	E1 Correct comparison E1*dep* for 'not independent'	**2**
(iv)	3/7 < 0.5 so Isobel is less likely to score when her parents attend	E1 for comparison E1*dep*	**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 x 7k + 2 x 12k + 3 x 15k + 4 x 16k = 140k = 2.8 OR E(X) = 1 x $^7/_{50}$ + 2 x $^{12}/_{50}$ + 3 x $^{15}/_{50}$ + 4 x $^{16}/_{50}$ = $^{140}/_{50}$ = 2.8 oe Var(X) = 1 x 7k + 4 x 12k + 9 x 15k + 16 x 16k -7.84 = 1.08 OR Var(X) = 1 x $^7/_{50}$ + 4 x $^{12}/_{50}$ + 9 x $^{15}/_{50}$ + 16 x $^{16}/_{50}$ -7.84 = 8.92 – 7.84 = 1.08	M1 for Σxp (at least 3 terms correct) A1 CAO M1 $\Sigma x^2 p$ (at least 3 terms correct) M1*dep* for – their E(X)² NB provided Var(X) > 0 A1 FT their E(X)	**5**
		TOTAL	**7**
Q4 (i)	4 x 5 x 3 = 60	M1 for 4 x 5 x 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)	$\mathrm{P}(X=2)=\binom{3}{2}\times 0.87^2\times 0.13=0.2952$	M1 0.87^2 x 0.13 M1 $\binom{3}{2}$ x 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 (two 20'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 (test is positive) = (0.9)(0.95) + (0.1)(0.2) = 0.875	M1 Two correct pairs added A1 CAO	**2**
(iii)	P (test is correct) = (0.9)(0.95) + (0.1)(0.8) = 0.935	M1 Two correct pairs added A1 CAO	**2**
(iv)	P (Genuine|Positive) = 0.855/0.875 = 0.977	M1 Numerator M1 Denominator A1 CAO	**3**
(v)	P (Fake|Negative) = 0.08/0.125 = 0.64	M1 Numerator M1 Denominator A1 CAO	**3**
(vi)	EITHER: A positive test means that the painting is almost certain to be genuine so no need for a further test. However, more than a third of those paintings with a negative result are genuine so a further test is needed. NOTE: Allow sensible alternative answers	E1FT E1FT	**2**
(vii)	P (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 x 0.05 (=0.045) M1 for complete correct triple product M1*indep* for cubing A1 CAO	**4**
		TOTAL	**18**

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