



Binomial Distribution - Edexcel Past Exam Questions MARK SCHEME

Question 1 : Jan 06 Q1

Question Number	Scheme	Marks
(a)	<p>Let X be the random variable the number of heads.</p> <p>$X \sim \text{Bin}(4, 0.5)$</p> <p>$P(X = 2) = C_2^4 0.5^2 0.5^2$</p> <p style="padding-left: 40px;">$= 0.375$</p>	<p>Use of Binomial including ${}^n C_r$</p> <p>or equivalent</p> <p>M1</p> <p>A1</p> <p>(2)</p>
(b)	<p>$P(X = 4)$ or $P(X = 0)$</p> <p style="padding-left: 40px;">$= 2 \times 0.5^4$</p> <p style="padding-left: 40px;">$= 0.125$</p>	<p>B1</p> <p>$(0.5)^4$</p> <p>M1</p> <p>or equivalent</p> <p>A1</p> <p>(3)</p>
(c)	<p>$P(\text{HHT}) = 0.5^3$</p> <p style="padding-left: 40px;">$= 0.125$</p> <p>or</p> <p>$P(\text{HHTT}) + P(\text{HHTH})$</p> <p style="padding-left: 40px;">$= 2 \times 0.5^4$</p> <p style="padding-left: 40px;">$= 0.125$</p>	<p>no ${}^n C_r$</p> <p>or equivalent</p> <p>M1</p> <p>A1</p> <p>(2)</p>
Total 7 marks		



Question 2 : Jan 07 Q3

Question Number	Scheme	Marks
(a)	<p>Let W represent the number of white plants. $W \sim B(12, 0.45)$ $P(W = 5) = P(W \leq 5) - P(W \leq 4)$ $= 0.5269 - 0.3044$ $= 0.2225$</p>	<p>B1 M1 A1 (3)</p>
(b)	<p>$P(W \geq 7) = 1 - P(W \leq 6)$ $= 1 - 0.7393$ $= 0.2607$</p>	<p>use of ${}^{12}C_5 0.45^5 0.55^7$ or equivalent award B1M1 values from correct table implies B awrt 0.222(5) or $= 1 - P(W < 7)$ implies method awrt 0.261 M1 A1 (2)</p>
(c)	<p>$P(3 \text{ contain more white than coloured}) = \frac{10!}{3!7!} (0.2607)^3 (1 - 0.2607)^7$ $= 0.256654\dots$</p>	<p>use of B, n=10 awrt 0.257 M1A1 A1 (3)</p>



Question 3 : Jan 08 Q2

<p>(a)</p>	<p>Let X be the random variable the number of faulty bolts</p> $P(X \leq 2) - P(X \leq 1) = 0.0355 - 0.0076 \quad \text{or} \quad (0.3)^2 (0.7)^{18} \frac{20!}{18!2!}$ $= 0.0279 \qquad \qquad \qquad = 0.0278$	<p>M1 A1 (2) M1 A1 (2)</p>
<p>(b)</p>	<p>$1 - P(X \leq 3) = 1 - 0.1071$ $= 0.8929$</p> <p>or $1 - (0.3)^3 (0.7)^{17} \frac{20!}{17!3!} - (0.3)^2 (0.7)^{18} \frac{20!}{18!2!} - (0.3)(0.7)^{19} \frac{20!}{19!1!} - (0.7)^{20}$</p>	<p>M1A1√A1 (3)</p>
<p>(c)</p>	<p>$\frac{10!}{4!6!} (0.8929)^6 (0.1071)^4 = 0.0140.$</p>	<p>(3)</p>
<p>Notes:</p>		
<p>(a)</p>	<p>M1 Either attempting to use $P(X \leq 2) - P(X \leq 1)$ or attempt to use binomial and find $p(X=2)$. Must have $(p)^2 (1-p)^{18} \frac{20!}{18!2!}$, with a value of p</p> <p>A1 awrt 0.0278 or 0.0279.</p>	
<p>(b)</p>	<p>M1 Attempting to find $1 - P(X \leq 3)$</p> <p>A1 awrt 0.893</p>	
<p>(c)</p>	<p>M1 for $k (p)^k (1-p)^{n-k}$. They may use any value for p and k can be any number or ${}^n C_k p^k (1-p)^{n-k}$</p> <p>A1√ $\frac{10!}{4!6!} (their\ part\ b)^6 (1 - their\ part\ b)^4$ may write ${}^{10} C_6$ or ${}^{10} C_4$</p> <p>A1 awrt 0.014</p>	<p>B1 B1 (2)</p>



Question 4 : Jan 09 Q5

Question Number	Scheme	Marks
(a)	X represents the number of defective components. $P(X = 1) = (0.99)^9 (0.01) \times 10 = 0.0914$	M1A1 (2)
(b)	$P(X \geq 2) = 1 - P(X \leq 1)$ $= 1 - (p)^{10} - (a)$ $= 0.0043$	M1 A1 A1 (3)

Question 5 : Jan 10 Q1

Question Number	Scheme	Marks
(a)	$X \sim B(20, 0.05)$	B1 B1 (2)
(b)	$P(X = 0) = 0.95^{20} = 0.3584859\dots$ or 0.3585 using tables .	M1 A1 (2)
(c)	$P(X > 4) = 1 - P(X \leq 4)$ $= 1 - 0.9974$ $= 0.0026$	M1 A1 (2)
	Notes	
(a)	1 st B1 for binomial 2 nd B1 for 20 and 0.05 o.e These must be in part (a)	
(b)	M1 for finding $(p)^{20}$ $0 < p < 1$ this working needs to be seen if answer incorrect to gain the M1 A1 awrt 0.358 or 0.359.	
(c)	M1 for writing $1 - P(X \leq 4)$ or $1 - [P(X = 0) + P(X = 1) + P(X = 2) + P(X = 3) + P(X = 4)]$ or $1 - 0.9974$ or $1 - 0.9568$ A1 awrt 0.0026 or 2.6×10^{-3} , do not accept a fraction e.g. 26/10000	



Question 6 : June 10 Q2

Question Number	Scheme	Marks
(a)	<p>Let X be the random variable the number of games Bhim loses. $X \sim B(9, 0.2)$</p> $P(X \leq 3) - P(X \leq 2) = 0.9144 - 0.7382 \quad \text{or} \quad (0.2)^3 (0.8)^6 \frac{9!}{3!6!}$ $= 0.1762 \qquad \qquad \qquad = 0.1762 \qquad \qquad \qquad \text{awrt } 0.176$	<p>B1</p> <p>M1</p> <p>A1 (3)</p>
(b)	$P(X \leq 4) = 0.9804$	<p>awrt 0.98</p> <p>M1A1 (2)</p>
<p>Notes</p> <p>(a) B1 – writing or use of $B(9, 0.2)$ M1 for writing/ using $P(X \leq 3) - P(X \leq 2)$ or $(p)^3 (1-p)^6 \frac{9!}{3!6!}$ A1 awrt 0.176</p> <p>(b) M1 for writing or using $P(X \leq 4)$ A1 awrt 0.98</p>		

Question 7 : Jan 11 Q1

Question Number	Scheme	Marks
(a)	<p>Occurrences of the disease are independent The probability of catching the disease remains constant.</p>	<p>B1</p> <p>B1</p> <p>(2)</p>
(b)	$X \sim \text{Bin}(10, 0.03)$ $P(X = 2) = \frac{10 \times 9}{2} (0.03)^2 (0.97)^8 = 0.0317$	<p>B1</p> <p>M1A1</p> <p>(3)</p>
<p style="text-align: center;">Notes</p>		
(a)	<p>B1 independent B1 <u>probability</u> remains <u>constant</u>. One of these must have the context of disease. No context only one correct B0B0 If only one mark awarded give the first B1 SC if they are both correct without context award B1B0</p>	
(b)	<p>B1 for writing or using $B(10, 0.03)$</p> <p>M1 for writing or using $(p)^2 (1-p)^8 \frac{10!}{2!8!}$ allow ${}^{10}C_2 \binom{10}{2}$ etc</p> <p>Allow $P(X \leq 2) - P(X \leq 1)$ A1 awrt 0.0317</p>	