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<p>1 $X \sim B(19, 0.12)$ $P(X < 4) = P(0, 1, 2, 3)$ $= (0.88)^{19} + {}^{19}C_1(0.12)^1(0.88)^{18} +$ ${}^{19}C_2(0.12)^2(0.88)^{17} + {}^{19}C_3(0.12)^3(0.88)^{16}$ $= 0.813$</p>	<p>M1 M1 M1 A1</p>	<p>Any binomial term ${}^{19}C_x p^x (1-p)^{19-x}$, $0 < p < 1$ Any binomial term ${}^n C_x (0.12 \text{ or } 0.88)^x (0.88 \text{ or } 0.12)^{n-x}$ $P(0, 1, 2, 3)$ binomial expr with at least 2 consistent terms Correct answer</p>										
<p>2 Y1(7) Y2(2) Y3(2) $1 \quad 2 \quad 2 = 7 \times 1 \times 1 = 7$ $2 \quad 1 \quad 2 = {}^7C_2 \times {}^2C_1 \times 1 = 42$ $2 \quad 2 \quad 1 = {}^7C_2 \times 1 \times {}^2C_1 = 42$ $3 \quad 1 \quad 1 = {}^7C_3 \times {}^2C_1 \times {}^2C_1 = 140$ Total = 231</p>	<p>B1 B1 M1 A1</p>	<p>One unsimplified correct 3-factor product of combinations A second unsimplified correct 3-factor product of combinations Summing 3 or 4 options allow perms, wrong combs but second numbers must sum to 5 etc. Correct answer</p>										
<p>3 (i) $P(RR) = 0.6 \times 0.7 = 0.42$ $P(AA) = 0.4 \times 0.75 = 0.3$ $P(2 \text{ sets in match}) = 0.72$</p> <hr/> <p>(ii) $\frac{P(A \text{ wins and 2 sets})}{P(2 \text{ sets})} = \frac{P(AA)}{P(2 \text{ sets})}$ $= \frac{0.3}{0.72} = \frac{5}{12} (0.417)$</p>	<p>B1 B1 B1^{ft} B1^{ft} B1^{ft}</p>	<p>Only 2 factors Only 2 factors ft previous answers Correct num or correct denom of a fraction ft their (i) Correct answer ft their or recovered AA/their or recovered (i)</p>										
<p>4 (i) A: $P(H) = 2/3$, $P(T) = 1/3$ B: $P(H) = 1/4$, $P(T) = 3/4$ $P(1H) = P(HTT) + P(THT) + P(TTH)$ $= (2/3 \times 1/3 \times 3/4) + (1/3 \times 2/3 \times 3/4)$ $+ (1/3 \times 1/3 \times 1/4) = 13/36$ AG</p> <hr/> <p>(ii)</p> <table border="1" data-bbox="245 1352 679 1487"> <tr> <td>x</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> </tr> <tr> <td>P</td> <td>3/36</td> <td>13/36</td> <td>16/36</td> <td>4/36</td> </tr> </table> <p>$P(0H) = P(TTT) = 1/3 \times 1/3 \times 3/4 = 1/12$ $P(2H) = P(HHT) + P(HTH) + P(THH)$ $= (2/3 \times 2/3 \times 3/4) + (2/3 \times 1/3 \times 1/4)$ $+ (1/3 \times 2/3 \times 1/4) = 4/9$ not $2/3 \times 2/3$ $P(3H) = P(HHH) = 2/3 \times 2/3 \times 1/4 = 1/9$</p>	x	0	1	2	3	P	3/36	13/36	16/36	4/36	<p>M1 M1 A1 B1 B1 B1^{ft}</p>	<p>Using some of $2/3$, $1/3$, $1/4$ or $3/4$ in a calculation involving prod of 3 probs Summing 3 options not all the same Correct answer 0, 1, 2, 3 seen for table no probs needed, table not absolutely necessary if calcs shown One prob correct other than (i) condone 0.083 for 0.0833 A second prob correct need 3 factors can be implied A third prob correct ft $23/36 - \Sigma$ their 2 probs</p>
x	0	1	2	3								
P	3/36	13/36	16/36	4/36								
<p>(iii) $E(X) = 13/36 + 32/36 + 12/36$ $= 57/36 (19/12) (1.58)$</p>	<p>M1 A1</p>	<p>Attempt to evaluate Σxp at least 3 vals of x in table Correct answer</p>										

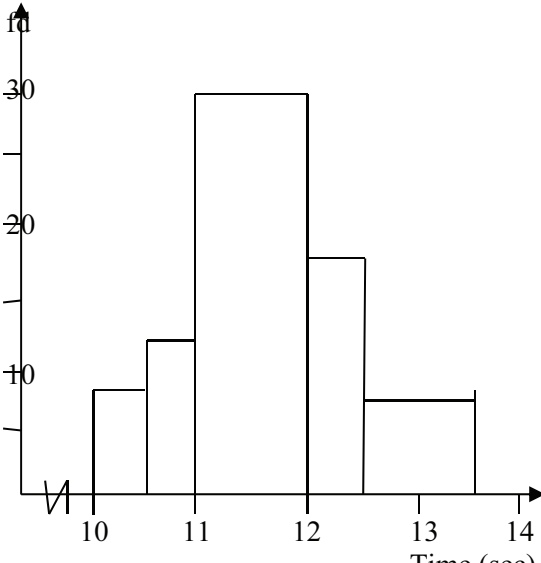
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5 (i) $5! \times 3!$ or $6!$ $= 720$	B1	5! or 3! or 6! oe seen mult or alone
	B1	2 Correct final answer

(ii) $3^{**}4, 3^{**}8, 4^{**}8$ $= 5 \times 4 + 5 \times 4 + 5 \times 4 = 60$	M1	considering at least 2 types of 4-figure options ending with 4 or 8 and starting with 3 or 4
	B1	One option correct unsimplified can be implied
	A1	3 Correct final answer

(iii) $5, *5, **5,$ $= 1 + 7 + 7^2$ $= 57$	M1	Appreciating that the number must end in 5 (can be implied)
	M1	summing numbers ending in 5 with at least 2 different numbers of digits
	A1	3 Correct final answer

6 (i) 6	B1	1 Must see in (i)

(ii) freqs 4 6 30 9 8 fd 8 12 30 18 8 	M1	Attempt at scaled freq or fd (must be f/cw) at least three f/cw
	A1	Correct heights seen on graph
	B1	Correct-looking widths from 10, 10.5 etc. no gaps no extra lines
	B1	4 Labels and linear axes or squiggle need time or secs, fd,

(iii) $E(X) = (10.25 \times 4 + 10.75 \times 6 + 11.5 \times 30 + 12.25 \times 9 + 13 \times 8) / 57$ $= 11.7(11.662)$ $\text{Var}(X) = (10.25^2 \times 4 + 10.75^2 \times 6 + 11.5^2 \times 30 + 12.25^2 \times 9 + 13^2 \times 8) / 57 - (11.662\dots)^2$ $= 0.547$	M1	Using mid-point attempt (not end points) with their freq or cf at least 2 sensible ones
	A1	Correct mean
	M1	numerical attempt at correct variance formula with mean ² subt ft their "midpoints" i.e. ucb, cw, etc.
	A1	4 accept answers between 0.547 and 0.610 condone 0.6, 0.60

