Question	Scheme	Marks
7. (a)	$Y \sim B(20, p)$ p = P(sample contains counter with a 9 on it)	
	$p = \left(1 - \frac{9}{10} \times \frac{8}{9} \times \frac{7}{8}\right)$ oe **or** $\left(\frac{1}{10} \times \frac{9}{9} \times \frac{8}{8} \times 3\right)$ oe **or** $\left(\frac{6}{10} \times \frac{5}{9} \times \frac{1}{8} \times 3 + \frac{6}{10} \times \frac{3}{9} \times \frac{1}{8} \times 6 + \frac{3}{10} \times \frac{2}{9} \times \frac{1}{8} \times 3\right)$ oe $\left[= \frac{3}{10}\right]$	M1A1
(i)	$E(Y) = 20 \times "\frac{3}{10}" \left[= 6\right]$	B1
(ii)	$Var(Y) = 20 \times "\frac{3}{10}" \times (1 - "\frac{3}{10}") = 4.2$	M1A1
		(5)
(b)	(7,7,7) (7,7,8), [(7,8,7), (8,7,7)] (7,7,9), [(7,9,7), (9,7,7)]	B2
		(2)
(c)	m | 7 | 8 $P(M = m)$ | $\frac{6}{10} \times \frac{5}{9} \times \frac{4}{8} + 3 \times \frac{6}{10} \times \frac{5}{9} \times \frac{3}{8} + 3 \times \frac{6}{10} \times \frac{5}{9} \times \frac{1}{8}$ $= \frac{2}{3}$ | $1 - P(M = 1)$ $= \frac{1}{3}$	B1 M1 M1 A1 A1
		(5)
	Notes	**[Total 12]**
(a)	1st M1 For all methods condone missing ×3 and /or ×6 Allow $\frac{{}^{1}C_{1} \, {}^{9}C_{2}}{{}^{10}C_{3}}$ oe	
	Condone with replacement - condone missing ×3 and /or ×6 $1 - \left(\frac{9}{10}\right)^3$ **or** $\left(\frac{6}{10}\right)^2 \times \frac{1}{10} \times 3 + \frac{6}{10} \times \frac{3}{10} \times \frac{1}{10} \times 6 + \left(\frac{3}{10}\right)^2 \times \frac{1}{10} \times 3 + \ldots$ [=0.271]	
	1st A1 A fully correct expression without replacement or 0.3 NB $E(Y) = 6$ implies the 1st M1 1st A1	
(i)	B1 for 20 × probability – no need to calculate	
and (ii)	2nd M1 Use of $np(1-p)$ or $np\left(1 - \frac{np}{20}\right)$	
	2nd A1 variance = 4.2	
(b)	B1B1 all 3 correct (with none incorrect – ignore arrangements of the correct numbers) (B1B0 any one correct and no incorrect **or** 2 or 3 correct and only one incorrect)These can be awarded in part (c) provided that they are clearly identified as having a median of 7 More than one incorrect is B0B0	
(c)	B1 for identifying that the only possible medians are 7 and 8. Allow 9 if it has a probability of 0	
	1st M1 correct expression for P(M = 7) Implied by 2/3 **or** P(M = 8) Implied by 1/3 P (M = 8) = $\frac{3}{10} \times \frac{2}{9} \times \frac{1}{8} + 3 \times \frac{6}{10} \times \frac{3}{9} \times \frac{2}{8} + 3 \times \frac{3}{10} \times \frac{2}{9} \times \frac{1}{8} + 6 \times \frac{6}{10} \times \frac{3}{9} \times \frac{1}{8}$	
	Condone with replacement P(M = 7) = $\left(\frac{6}{10}\right)^3 + 3 \times \left(\frac{6}{10}\right)^2 \times \frac{3}{10} + 3 \times \left(\frac{6}{10}\right)^2 \times \frac{1}{10} \left[= \frac{81}{125} = 0.648\right]$ or P (M = 8) = $\left(\frac{3}{10}\right)^3 + 3 \times \frac{6}{10} \times \left(\frac{3}{10}\right)^2 + 3 \times \left(\frac{3}{10}\right)^2 \times \frac{1}{10} + 6 \times \frac{6}{10} \times \frac{3}{10} \times \frac{1}{10} \left[= \frac{81}{250} = 0.324\right]$	
	2nd M1 Total of the 2 probabilities for 7 and 8 =1 or a correct expression without replacement for both P(M = 7) and P(M = 8) condone with replacement	
	1st A1 $P(M = 7) = \frac{2}{3}$ oe 2nd A1 $P(M = 8) = \frac{1}{3}$ oe	

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