

Question			Answer	Mks	AO	Guidance	
13			DR				
13	(i)		$N(450 \times 0.15, 450 \times 0.15 \times 0.85)$ or $N(67.5, 57.375)$ oe $P(Y > \mu + \sigma) \approx \frac{1}{6}$ or $\Phi^{-1}(\frac{1}{6}) = 0.9674$ '67.5' + $\sqrt{57.375}$ or '67.5' + $0.9674 \times \sqrt{57.375}$ = 74 or 75 or 76	M1 M1 A1	3.1b 1.2 1.1	seen or implied $P(Y < a) = \frac{5}{6}$ or 74.83 seen; ft their μ & σ for M1 only Integer. No ft Dep M1M1 Correct ans, inadequate wking: M0M0A0 NB 450/6 = 75 M0M0A0	$B(450, 0.15)$ <u>with</u> T & I method using $\geq$ one of 74, 75, 76, 61, 60, 59 $P(X > 74) = 0.177$ $P(X > 75) = 0.145$ both $a = 74$ or 75 or 76
				[3]			
13	(ii)		$\frac{50!}{r!(50-r)!} \times 0.15^r \times 0.85^{50-r}$ $\frac{50!}{(r+1)!(50-(r+1))!} \times 0.15^{r+1} \times 0.85^{50-(r+1)}$ oe eg $\frac{\frac{1}{50-r} \times 0.85}{\frac{1}{r+1} \times 0.15}$ or $\frac{0.85}{50-r} \times \frac{r+1}{0.15}$ oe = $\frac{17(r+1)}{3(50-r)}$ AG	M1 A1 A1	1.1a 2.1 1.1	$\frac{50C_r \times 0.15^r \times 0.85^{50-r}}{50C_{r+1} \times 0.15^{r+1} \times 0.85^{50-(r+1)}}$ Any correct simplification without factorials OR without indices Any correct simplification without factorials AND without indices and correctly obtain result	Fully correct or $\frac{17}{20} \times \frac{20}{3} \times \frac{r+1}{50-r}$
				[3]			
13	(iii)	(a)	$\frac{17(r+1)}{3(50-r)} \leq 1$ oe $17r + 17 \leq 150 - 3r$ $20r \leq 133$ oe $r \leq 6.65$ r is an integer so $r \leq 6$	M1 A1 A1 A1	3.1b 1.1 1.1 1.1	$\frac{1}{50-r} \times 0.85 \leq \frac{1}{r+1} \times 0.15$ oe M1 $0.85(r+1) \leq 0.15(50-r)$ $r \leq 50 \times 0.15 - 0.85$ A1 SC: $P(X=6)=0.142, P(X=7)=0.157, P(X=8)=0.149$ B1 (must be these three) hence $r \leq 6$ B1dep	No factorials or indices Correct, in form $ar \leq b$ or $r <$ correct expr'n No wking B0B0
				[4]			

Question			Answer	Mks	AO	Guidance	
13	(iii)	(b)	$P(X = r) \leq P(X = r + 1)$ for $r \leq 6$ Hence most likely value is r is 6 or 7 $\frac{P(X=6)}{P(X=7)} = \frac{17(6+1)}{3(50-6)} = 0.902 < 1$ Most likely value is 7	B1 B1 [2]	2.1 3.2a	or $P(X = 6) = 0.142$ & $P(X = 7) = 0.157$ indep, but dep on some reasonable explanation	NOT 6.65 rounds to 7 B0B0 No expl'n: B0B0
				100			