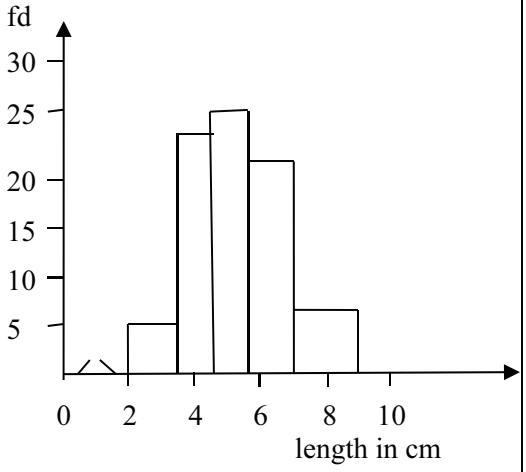
1	$P(x < 3.273) = 0.5 - 0.475 = 0.025$ $z = -1.96$ $\frac{3.2 - \mu}{0.714} = -1.96$ $\mu = 4.60$s	**M1** **A1** **M1** **A1 [4]**	Attempt to find z-value using tables in reverse ±1.96 seen Solving their standardised equation z-value not nec Correct ans accept 4.6
2 (i)	UQ 5.5 – 7.0 cm	**B1 [1]**	
(ii)	fd 5.33, 25, 28, 20.7, 6,  	**M1** **A1** **B1** **B1 [4]**	Attempt at fd or scaled freq [fr/cw] Correct heights seen on graph Correct bar widths no gaps Labels (fd and length/cm) and correct bar ends
3 (i)	$P(A) = \frac{1}{3} \times \frac{2}{3} + \frac{2}{3} \times \frac{1}{3} = \frac{4}{9}$ $P(B) = \frac{27}{36} = \frac{3}{4}$ $P(A \cap B) = \frac{12}{36} = \frac{1}{3}$ $P(A) \times P(B) = \frac{4}{9} \times \frac{3}{4} = \frac{1}{3}$ Independent as $P(A \cap B) = P(A) \times P(B)$	**M1** **M1** **B1** **M1** **A1 [5]**	Sensible attempt at $P(A)$ Sensible attempt at $P(B)$ correct $P(A \cap B)$ Cf $P(A \cap B)$ with $P(A) \times P(B)$ need at least 1 correct Correct conclusion following all correct working
(ii)	Not mutually exclusive because $P(A \cap B) \neq 0$ Or give counter example e.g. 1 and 6	**B1√ [1]**	ft their $P(A \cap B)$
4 (i)	$(1 - x)0.9 + x \times 0.24 = 0.801$ $x = 0.15$	**M1** **A1** **A1 [3]**	Eqn with sum of two 2-factor probs = 0.801 Correct equation Correct answer

(ii)	P(≥100 times given ≤ 3 views) $\frac{P(\geqslant 100 \text{ times} \cap \geqslant 3 \text{ views})}{P(\geqslant 3 \text{ views})} =$ $\frac{0.85\times 0.1}{0.85\times 0.1+0.15\times 0.76 \text{ or } 1-0.801}$ $= 0.427$	**B1** **M1** **A1** **A1 [4]**	0.85×0.1 seen on its own as num or denom of a fraction Attempt at P(≥ 3 views) either $(0.85\times p_1 + 0.15\times p_2)$ or $1 - 0.801$ seen anywhere Correct unsimplified P(≥ 3 views) as num or denom of a fraction Correct answer
5 (i)	new mean $= \frac{9\times 7.1+18\times 5.2}{27}$ $= 5.83$	**M1** **A1 [2]**	Mult by 9 and 18 and dividing by 27 correct answer
(ii)	$1.45^2 =$ so $\frac{\Sigma x_t^2}{9} = 472.6125$ mm $0.96^2 = \frac{\Sigma x_g^2}{18} - 5.2^2$ so $\Sigma x_g^2 = 503.3088$ New sd^2 $\frac{472.6\ldots^2 + 503.3\ldots^2}{27} - 5.83\ldots^2 = 2.117$ New sd = 1.46	**M1** **A1** **A1** **M1** **A1 [5]**	subst in a correct variance formula sq rt or not correct Σx_t^2 (rounding to 470) correct Σx_g^2 (rounding to 500) using $\Sigma x_t^2 + \Sigma x_g^2$, dividing by 27 and subt comb mean^2 correct answer
6 (i)	P(5, 6, 7) = $^8C_5(0.68)^5(0.32)^3 +$ $^8C_6(0.68)^6(0.32)^2 + {}^8C_7(0.68)^7(0.32)$ $= 0.722$	M1 M1 A1 A1 [4]	Binomial term $^8C_x\, p^x(1-p)^{8-x}$ seen $0 < p < 1$ Summing 3 binomial terms Correct unsimplified answer Correct answer
(ii)	$np = 340$, $npq = 108.8$ $P(x > 337) = P\left(z > \frac{337.5-340}{\sqrt{108.8}}\right)$ $= P(z > -0.2396)$ $= 0.595$	B1 M1 M1 M1 A1 [5]	Correct (unsimplified) mean and var standardising with sq rt must have used 500 cc either 337.5 or 336.5 correct area (> 0.5) must have used 500 correct answer
(iii)	np (340) > 5 and nq(160) > 5	B1 [1]	must have both or at least the smaller, need numerical justification
7 (a) (i)	$\frac{9!}{2!2!3!}$ = 15120 ways	B1 B1 [2]	Dividing by 2!2!3! Correct answer

(ii)	********3 in $\frac{8!}{2!2!3!}$ = 1680 ways	B1	Correct ways end in 3
	********7 in $\frac{8!}{2!3!}$ = 3360 ways	B1	Correct ways end in 7
	Total even = 15120 – 1680 – 3360	M1	Finding odd and subt from 15120 or their **(i)**
	= 10080 ways	A1 [**4**]	Correct answer
	OR		
	********2 in 8!/2!3! = 3360 ways	B1	One correct way end in even
	********6 in 8!/2!2!3! = 1680 ways	B1	correct way end in another even
	********8 in 8!/2!2!2! = 5040ways	M1	Summing 2 or 3 ways
	Total = 10080 ways	A1	Correct answer
	OR		
	"15120" ×6/9 = 10080	M2	Mult their **(i)** by 2/3 oe
		A2	Correct answer
(b)	T(3) S(6) G(14)		
	1 1 3 in $3\times6\times{}^{14}C_3 = 6552$	M1	Mult 3 (combinations) together assume $6 = {}^{6}C_1$etc
	1 3 1 in $3\times{}^{6}C_3\times14 = 840$		
	3 1 1 in $1\times6\times14 = 84$	M1	Listing at least 4 different options
	2 2 1 in $^{3}C_2\times{}^{6}C_2\times14 = 630$	M1	Summing at least 4 different options
	2 1 2 in $^{3}C_2\times6\times{}^{14}C_2 = 1638$		
	1 2 2 in $3\times{}^{6}C_2\times{}^{14}C_2 = 4095$	B1	At least 3 correct numerical options
	Total ways = 13839 (13800)	A1 [**5**]	Correct answer