1	$z = 0.674$ $0.674 = \frac{k-20}{7}$ $k = 24.7$	**M1** **M1** **A1**	[3]	±0.674 seen Standardising no cc, no sq, no sq rt
2	diff: 0, 1, 2, 3, 4, 5 prob: 6/36, 10/36, 8/36, 6/36, 4/36, 2/36 Expectation = (0+10+16+18+16+10)/36 = 70/36 = 1.94	**B1** **M1** **A1** **M1** **A1**	[5]	0, 1, 2, 3, 4, 5 seen in table heading or considering all different differences Attempt at finding prob of any difference 1 correct prob Probs summing to 1
3 (i)	$0.9 \times 0.95 \times 0.85 \times 0.1 = 0.0727$	**B1**	[1]	
(ii)	P(0, 1, 2) $= (0.9)^{12} + {}^{12}C_1\,(0.1)(0.9)^{11} + {}^{12}C_2\,(0.1)^2(0.9)^{10}$ = 0.889	**M1** **M1** **A1**	[3]	Bin term ${}^{12}C_x\,(p)^x(1-p)^{12-x}$ $p < 1$, $x \neq 0$ Bin expression $p = 0.1$ or 0.9, $n = 12$, 2 or 3 terms
(iii)	$X \sim B(50, 0.85)$ Expectation = 50 × 0.85 (= 42.5) Var = 50 × 0.85 × 0.15 (= 6.375)	**M1** **A1**	[2]	50 × 0.85 seen oe can be implied Correct unsimplified mean and var
4 (i)	$P(< 1) = P\left(z < \frac{1-1.04}{0.017}\right) = P(z < -2.353)$ = 1 – 0.9907 = 0.0093	**M1** **M1** **A1**	[3]	Standardising no cc, no √ or sq 1 – Φ (final process)
(ii)	expected number 1000 ÷ 1.04 = 961 or 962	**B1**	[1]	Or anything in between
(iii)	$z = -1.765$ $-1.765 = \frac{1-\mu}{0.017}$ =1.03	**B1** **M1** **A1**	[3]	± 1.76 to 1.77 Standardising must have a z-value, allow √ or sq
(iv)	expected number = 1000 ÷ 1.03 = 971 or 970	**B1**√	[1]	Or anything in between, ft their (iii)

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5 (a)	e.g. P*N*P*P*L	**M1**		Mult by 5! in num
	$= \frac{5!}{3!} \times \frac{^6P_4}{2!}$	**M1** **M1**		Dividing by 3! or 2! Mult by $^6P_4$ oe
	$= 3600$	**A1**	[4]	
(b) (i)	$^7C_5 \times {}^5C_4 \times {}^2C_1 \times {}^2C_1$	**M1**		Mult 4 combs of which three are correct
	$= 420$	**A1**	[2]	
(ii)	both in team	**M1**		Evaluating both in team and subtracting from (i)
	$^6C_4 \times {}^4C_3 \times 2 \times 2 = 240$	**M1**		240 seen can be unsimplified ft their 420, their 240
	$420 - 240 = 180$ ways	**A1**		
	OR			
	Bat in bowl out + bowl in bat out + both out	**M1**		summing 2 or 3 options not both in team
	$= {}^6C_4 \times {}^4C_3 \times 2 \times 2 + {}^6C_5 \times {}^4C_3 \times 2 \times 2 + {}^6C_5 \times {}^4C_4 \times 2 \times 2$	**A1**		2 or 3 options correct unsimplified
	$= 60 + 96 + 24 = 180$ ways	**A1**		Correct ans from correct working
	OR			
	Bat in bowl out + bat out	**M1**		As above, or bowl in bat out + bowl out
	$= 60 + {}^6C_5 \times {}^5C_4 \times 2 \times 2 = 60 + 120 = 180$ ways	**A1 A1**	[3]	
6 (i)	P(B, B) = 1/4 ×2/5	**M1**		Multiplying two different probs
	= 1/10	**A1**	[2]	
(ii)	$P(X = 1) = P(R,R) + P(B,B)$	**M1**		Finding P(R, R) (=3/5)
	$= 3/4 \times 4/5 + 1/10$	**M1**		Summing two options
	= 14/20 (7/10)	**A1**	[3]	
(iii)	$P(B \mid B)$	**M1**		their (i) seen as num or denom of a fraction
	$= \frac{P(B \cap B)}{P(B)} = \frac{1/10}{3/4 \times 1/5 + 1/4 \times 2/5}$	**M1**		¾ × p_1 + ¼ × p_2 seen anywhere
		A1		1/4 (unsimplified) seen as num or denom of a fraction, www
	= 2/5	**A1**	[4]	

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7 (i)	Factory *A* | Factory *B* 3 | 1 5 8 9 | 4 | 2 4 7 8 9 9 8 8 7 4 3 0 | 5 | 1 4 6 8 5 3 1 1 1 | 6 | 4 Key: 9 | 4 | 2 represents 0.049g for factory *A* and 0.042 g for factory *B*	**M1** **B1** **B1** **B1** **B1**	[5]	Attempt at ordering factory *B* Correct stem Correct leaves factory *A* Correct leaves factory *B* Correct key need factory *A* and factory *B* and units
(ii)	median factory *B* = 0.048 g IQR = UQ – LQ = 0.055 – 0.04 = 0.015	**B1** **M1** **A1**	[3]	using their key i.e. 48, 0.48 etc or correct Subt their LQ from their UQ for factory *B*
(iii)	generally heavier in factory *A* Masses more spread out in factory *B*	**B1** **B1**	[2]	oe must refer to context, e.g. mass

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