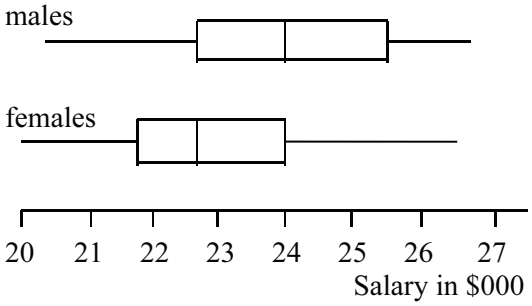
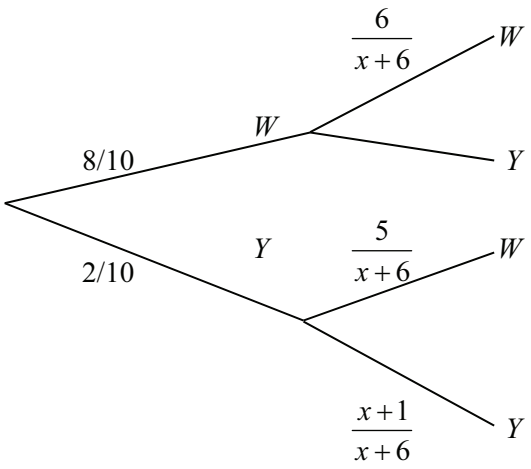
1	**(i)**	$sd^2 = 1957.5/30 - (234/30)^2$ $sd = 2.1$	M1 A1	**[2]**	Subst in formula or expand Accept 2.10
	(ii)	$86 = 234/30 + c$ $c = 78.2$	M1 A1	**[2]**	234/30 seen
2		$np = 350 \times 1/7$ (= 50) $npq = 350 \times 1/7 \times 6/7$ (= 42.857) $P(x \quad 47) = P\left(z > \frac{46.5-50}{\sqrt{42.857}}\right) =$ $P(z > -0.5346)$ = 0.704	B1 M1 M1 M1 A1	**[5]**	Correct unsimplified *np* and *npq* standardising, with or without cc, must have sq rt continuity correction 46.5 or 47.5 correct area ie > 0.5 must be a Φ correct answer
3	**(i)**	females: med \$22 700 LQ \$21700 UQ \$24 000	B1 B1	**[2]**	Any 2 correct All correct
	(ii)	males  females 20 21 22 23 24 25 26 27 Salary in \$000	B1 B1 B1	**[3]**	Uniform scale and labels must see Salary, \$000 Correct graph for females ft their quartiles. Line not through box Correct graph for males
4	**(a)**	$P(y < 0) = P\left(z < \frac{0-\mu}{\mu/2}\right)$ $= P(z < -2)$ $= 1 - 0.9772 = 0.0228$	M1 A1 A1	**[3]**	Standardising containing 0 (can be implied) and μ only $z < -2$ seen Correct answer
	(b)	$P(x > 2.1) = 253/8000 = 0.031625$ $P(x < 2.1) = 0.968375 = \Phi(z)$ $z = 1.857$ or 1.858 or 1.859 $= \frac{2.1-2.04}{\sigma}$ $\sigma = 0.0323$	M1 A1 M1 A1	**[4]**	1 – their 253/8000 used to obtain a *z*-value Rounded to 1.86 seen Solving for σ using their *z* val must be a *z* val Correct answer
5	**(i)**	$X \sim$ Bin (12, 0.2)	B1 B1 B1	**[3]**	Bin or B 12 0.2 or 1/5
	(ii)	$P(X = 3, 4, 5) = 0.2^3 0.8^9 {}_{12}C_3 + 0.2^4 0.8^8 {}_{12}C_4 + 0.2^5 0.8^7 {}_{12}C_5$ = 0.23622 + 0.13287 + 0.05315 = 0.422	M1 A1ft A1	**[3]**	Bin exprerssion with any p Correct unsimplified expression, their p Correct answer

	(iii)	P ($X = 0$) < 0.01 $0.8^n < 0.01$ $n = 21$	M1 M1 A1	**[3]**	Statement involving P(X = 0) and 0.01 can be implied Equn involving '0.8', 0.01 or 0.99 Correct answer
6	**(i)**	4! × 3! × 5! × 2! × 4! = 829440	B1 B1 B1	**[3]**	4!, 3!, 5!, 2 seen multiplied 1, not in denominator Mult by 4! Correct answer
	(ii)	8! × 9 × 8 × 7 × 6 × 5 × 4 = 2438553600 (2.44×10^9)	B1 B1 B1	**[3]**	8! seen multiplied 1 Mult by ${}_9P_6$ Correct answer
	(iii)	8C3 × 5C3 × 2C2 = 560	B1 B1 B1	**[3]**	8C3 seen mult 5C3 seen mult Correct answer
7	**(i)**	number of balls in B is $5+ x + 1 = x + 6$ P(Y) = $x/(x + 6)$ **AG**	B1	**[1]**	Sensible reason
	(ii)	box A box B  	B1 B1 B1 B1	**[4]**	both correct for box A 1 correct 1 correct 1 correct
	(iii)	P(W_B) = $\frac{6}{x+6} = \frac{1}{3}$ $x = 12$ **AG**	M1 A1	**[2]**	their $\frac{6}{x+6}$ = 1/3 or x/x+6 = 2/3 Verification or solving legit

(iv)	$P(Y) = \frac{8}{10} \times \frac{12}{18} + \frac{2}{10} \times \frac{13}{18}$	M1		Attempt at P(,Y) involving 2 two-factor fractions, seen anywhere.
	$= \frac{61}{90}$	A1		Correct P(Y) seen as num or denom of a fraction
	$P(= (AY \mid BY) = \frac{P(AY \cap BY)}{P(Y)}$	B1		(2/10) × (13/18) seen as num or denom of a fraction
	$= \frac{2}{10} \times \frac{13}{18} / \frac{61}{90}$			
	$= \frac{13}{61} (0.213)$	A1	**[4]**	Correct answer