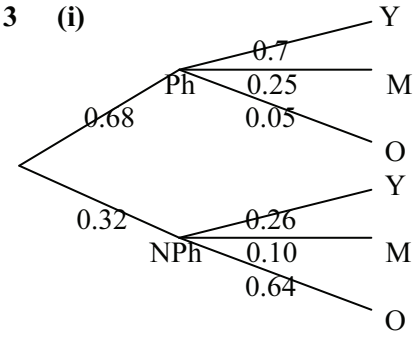
1	Normal mean 60 kg, variance 90 kg^2	B1 B1 [2]	Any sensible values (mean 40–80 kg, variance 16–225 kg^2), could give s.d. 4–15 kg
2	**(i)** x | 1 | 2 | 3 | 4 | 5 Prob | k | $2k$ | $3k$ | $4k$ | $5k$ $15k = 1$ $k = 1/15$ (0.0667)	M1 M1 A1 [3]	1, 2, 3, 4, 5 seen, together with some probabilities involving k but not x summing probs involving k to 1 correct answer
	(ii) E(X) $= k + 4k + 9k + 16k + 25k$ $= 55k = 11/3$ (3.67)	M1 A1ft [2]	using Σpx no dividing correct answer, ft on $55k$, $0 < k < 1$
3	**(i)**  	M1 A1 [2]	Y = young, M = middle-aged, O = old Correct shape with Ph, NPh first All probabilities and correct
	(ii) $P(Ph \mid M) = \dfrac{0.68 \times 0.25}{0.68 \times 0.25 + 0.32 \times 0.1}$ $= 0.842$ (170/202)	B1 M1 A1 [3]	For correct numerator using cond prob formula with numerator < denominator For attempt at P(35 – 60 years old), involving the sum of two 2-factor probs, seen anywhere Correct answer
4	**(i)** $\bar{x} = 60 + 245/70$ $= 63.5$	M1 A1 [2]	245/70 seen Correct answer
	(ii) $\Sigma(x - 50) = \Sigma x - \Sigma 50$ $= 245 + 70 \times 60 - 70 \times 50$ $= 945$	M1 A1 [2]	Any valid method, involving 70 Correct answer
	(iii) coded mean = 945/70 = 13.5 $\dfrac{\Sigma(x-50)^2}{70} - \left(\dfrac{945}{70}\right)^2 = 10.6^2$ $\Sigma(x - 50)^2 = 20623$ (20600)	M1 A1 [2]	Using variance formula with coded mean Correct answer

5	**(i)**	<table><tr><td>2 to 4</td><td>4 to 6</td><td>6 to 7</td><td>7 to 8</td><td>8 to 10</td><td>10 to 16</td></tr><tr><td>20</td><td>44</td><td>34</td><td>30</td><td>30</td><td>36</td></tr></table>	M1 A1 A1 [3]	Using fd to evaluate freqs Any four correct All correct
	(ii)	mid-points 3, 5, 6.5, 7.5, 9, 13 E(X) = (3 × 20 + 5 × 44 + 6.5 × 34 + 7.5 × 30 + 9 × 30 + 13 × 36) / 194 = 1464/194 = 7.55	M1 A1ft [2]	5 or 6 correct mid-points Correct answer, ft on 6 correct mid-points and the frequencies in their table
	(iii)	p = 60/194 (0.309) P(1) = 2 × (60/194)(134/193) = 8040/18721 (0.429)	B1ft M1 A1 [3]	60/194 seen, ft on (their 30 + their 30) / their total multiplying a probability by 2 Correct answer
6	**(i)**	$^{14}P_{12}$ = 4.36×10^{10}	M1 A1 [2]	$^{14}P_{12}$ seen oe Correct answer
	(ii)	business people 3! = 6 students 5! = 120 married couples $^{3}P_{2} \times 2 \times 2 = 24$ total ways = 17280	B1 B1 B1 B1 [4]	3! oe seen, not in denominator 5! oe seen, not in denominator 24 oe seen, not in denominator correct final answer
	(iii)	Mrs Brown 3 Mrs Lin 10 Student 5 Prob = 3 × 10 × 5 × $^{11}P_{9}$ / **(i)** = 0.0687 OR$_1$ 3/14 × 10/13 × 5/12 = 150/2184 (0.0687) OR$_2$ 1 − 3/14 = 11/14 1 − 11/14 × 5/13 = 127/182 8/14(4/13 × 12/12 + 9/13 × 7/12) + 3/14(3/13 × 12/12 + 10/13 × 7/12) = 1206/2184 1 − (1524 + 1716 − 1206)/2184 = 150/2184	B1 B1 M1 A1 [4] B1 B1 M1 A1 B1 B1 M1 A1	any 2 of 3, 10, 5 oe seen, not in denominator $^{11}P_{9}$ seen multiplied dividing by their **(i)** correct answer any 2 of numerators 3, 10, 5 oe seen denominators 14, 13, 12 of 3 fractions multiplying 3 separate fractions correct answer 1 − 3/14 seen 1 − 11/14 × 5/13 seen attempt to find P(Mrs Lin not behind a student and Mrs Brown not in front row), involving 8/14 × prob + 3/14 × prob correct answer

7	**(i)** $z = 0.807$	B1	0.807 seen
	$0.807 = \dfrac{10 - 8.2}{\sigma}$	M1	standardising, must have σ, no sq rt, no cc and a z-value
	$s = 2.23$	A1 [3]	correct answer
	(ii) P(> 1 min from mean) = P(mod $z >$ $\dfrac{1}{2.23}$)	M1	standardising, their sd, no cc and adding two areas
	$= P(\lvert z \rvert > 0.4484)$	M1	using $1 - \Phi(z)$
	$= (1 - 0.6729) \times 2$		
	$= 0.654$	A1 [3]	correct answer
	(iii) P(> 2 longer) = 1 – P(0, 1, 2 longer)	M1	binomial term ${}^6C_x p^x (1-p)^{6-x}$
	$= 1 - \{(0.79)^6 + {}^6C_1(0.21)(0.79)^5 + {}^6C_2(0.21)^2(0.79)^4\}$	A1	correct unsimplified answer
	$= 0.112$	A1 [3]	correct answer
	(iv) $\mu = 35 \times 0.5 = 17.5$ $\sigma^2 = 35 \times 0.5 \times 0.5 = 8.75$	B1	17.5 and 8.75 or $\sqrt{8.75}$ seen
	$P(X < 16) = \Phi\left(\dfrac{15.5 - 17.5}{\sqrt{8.75}}\right)$	M1	standardising, with or without cc, must have sd in denom
		M1	continuity correction 15.5 or 16.5 only, seen
	$= 1 - \Phi(0.676)$	M1	using $1 - \Phi(z)$
	$= 1 - 0.7505$		
	$= 0.2495$ (0.249 or 0.250)	A1 [5]	correct answer
	OR ${}^{35}C_0 0.5^0 0.5^{35} + {}^{35}C_1 0.5^1 0.5^{34} + {}^{35}C_2 0.5^2 0.5^{33} + \ldots$	M1	binomial term ${}^{35}C_x 0.5^x 0.5^{35-x}$
	$= 8582372584/2^{35} = 0.250$	A1	at least 2 correct terms ($x \neq 0$) seen
		M1	summing 16 or 17 terms
		A1	correct expression
		A1	correct answer