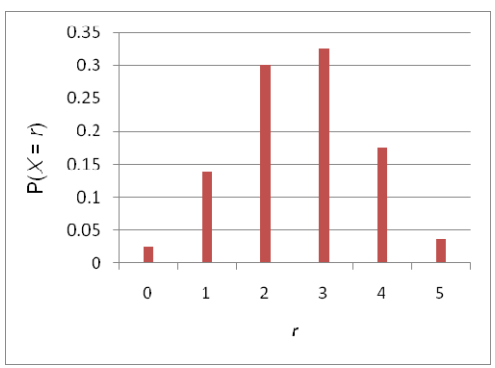
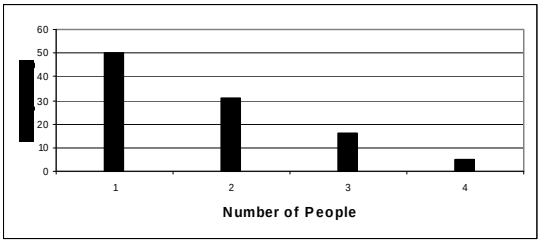
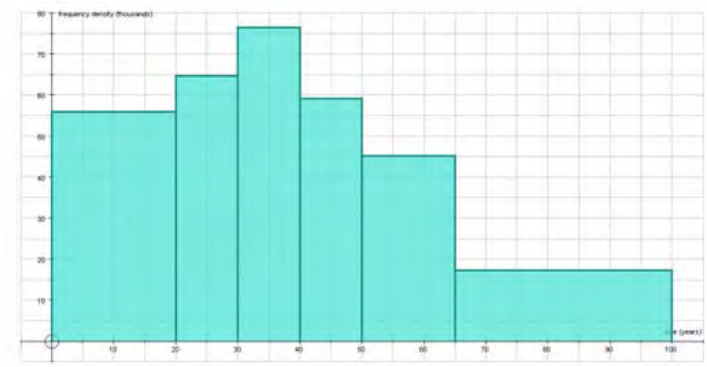
Question			Answer	Marks	Guidance
1	(i)		$P(X = 0) = 0.4 \times 0.5^4 = 0.025$ **NB ANSWER GIVEN**	M1 A1 **[2]**	For 0.5^4
	(ii)		$P(X = 1) = (0.6 \times 0.5^4) + (4 \times 0.4 \times 0.5 \times 0.5^3)$ $= 0.0375 + 0.1 = 0.1375$ **NB ANSWER GIVEN**	M1* M1* M1* dep A1 **[4]**	For 0.6×0.5^4 seen as a single term (not multiplied or divided by anything) For $4 \times 0.4 \times 0.5^4$ Allow 4×0.025 Watch out for incorrect methods such as (0.4/4) 0.1 **MUST** be justified For sum of both , dep on both M1's
	(iii)			G1 G1 **[2]**	For labelled linear scales on both axes Dep on attempt at vertical line chart. Accept P on vertical axis For heights – visual check only but last bar taller than first and fifth taller than second and fourth taller than third. Lines must be thin (gap width > line width). All correct. Zero if vertical scale not linear Everything correct but joined up tops G0G1 MAX Everything correct but f poly G0G1 MAX Everything correct but bar chart G0G1 MAX Curve only (no vertical lines) gets G0G0 Best fit line G0G0 Allow transposed diagram

Question			Answer	Marks	Guidance
1	(iv)		'Negative' or 'very slight negative'	E1 **[1]**	E0 for symmetrical but E1 for (very slight) negative skewness even if also mention symmetrical Ignore any reference to unimodal
	(v)		$E(X) = (0\times0.025) + (1\times0.1375) + (2\times0.3) + (3\times0.325) + (4\times0.175) + (5\times0.0375)$ $= 2.6$ $E(X^2) = (0\times0.025) + (1\times0.1375) + (4\times0.3) + (9\times0.325) + 16\times0.175) + (25\times0.0\ \ 75) = 0 + 0.1375 + 1.2 + 2.925 + 2.8 + 0.9375 = 8$ $\text{Var}(X) = 8 - 2.6^2$ $= 1.24$	M1 A1 M1* M1* dep A1 **[5]**	For Σrp (at least 3 terms correct) CAO For $\Sigma r^2 p$ (at least 3 terms correct) for – their $E(X)^2$ FT their E(X) provided $\text{Var}(X) > 0$ USE of $E(X-\mu)^2$ gets M1 for attempt at $(x-\mu)^2$ should see $(-2.6)^2$, $(-1.6)^2$, $(-0.6)^2$, 0.4^2, 1.4^2, 2.4^2 (if $E(X)$ correct but FT their $E(X)$) (all 5 correct for M1), then M1 for $\Sigma p(x-\mu)^2$ (at least 3 terms correct) Division by 5 or other spurious value at end gives max M1A1M1M1A0, or M1A0M1M1A0 if $E(X)$ also divided by 5. Unsupported correct answers get 5 marks.
	(vi)		$P(\text{Total of 3}) = (3\times0.325\times0.025^2) + (6\times0.3\times0.1375\times0.025) + 0.1375^3 = 3\times0.000203 + 6\times0.001031 + 0.002600 =$ $0.000609 + 0.006188 + 0.002600 = 0.00940$ $(= 3\times13/64000 + 6\times33/32000 + 1331/512000)$	M1 M1 M1 A1 **[4]**	For decimal part of first term 0.325×0.025^2 For decimal part of second term $0.3\times0.1375\times0.025$ For third term – ignore extra coefficient All M marks above depend on triple probability products CAO: AWRT 0.0094. Allow 0.009 with working.

2 (i)	Median = 2 Mode = 1	B1 CAO B1 CAO	**2**
(ii)		S1 labelled linear scales on both axes H1 heights	**2**
(iii)	Positive	B1	**1**
		TOTAL	**5**

3 (i)	Positive	B1	**1**
(ii)	Number of people = 20×33 (000) + 5×58 (000) = 660 (000) + 290 (000) = 950 000	M1 first term M1(indep) second term A1 cao NB answer of 950 scores M2A0	**3**
(iii)	(*A*) *a* = 1810 + 340 = 2150 (*B*) Median = age of 1 385 (000^{th}) person or 1385.5 (000) Age 30, cf = 1 240 (000); age 40, cf = 1 810 (000) Estimate median = (30) + $\frac{145}{570} \times 10$ Median = 32.5 years (32.54...) If no working shown then 32.54 or better is needed to gain the M1A1. If 32.5 seen with **no previous working** allow SC1	M1 for sum A1 cao 2150 or 2150 thousand but not 215000 B1 for 1 385 (000) or 1385.5 M1 for attempt to interpolate $\frac{145k}{570k} \times 10$ (2.54 or better suggests this) A1 cao min 1dp	**2** **3**
(iv)	Frequency densities: 56, 65, 77, 59, 45, 17 *(accept 45.33 and 17.43 for 45 and 17)* 	B1 for any one correct B1 for all correct (soi by listing or from histogram) **Note: all G marks below *dep* on attempt at frequency density, NOT frequency** G1 Linear scales on both axes (no inequalities) G1 Heights FT their listed fds or all must be correct. **Also widths. All blocks joined** G1 Appropriate label for vertical scale eg 'Frequency density (thousands)', 'frequency (thousands) per 10 years', 'thousands of people per 10 years'. (allow key). **OR f.d.**	**5**

(v)	Any two suitable comments such as: Outer London has a greater proportion (or %) of people under 20 (or almost equal proportion) The modal group in Inner London is 20-30 but in Outer London it is 30-40 Outer London has a greater proportion (14%) of aged 65+ **<u>All</u>** populations in **<u>each</u>** age group are higher in Outer London Outer London has a more evenly spread distribution or balanced distribution (ages) o.e.	E1 E1	**2**
(vi)	Mean increase ↑ median unchanged (-) midrange increase ↑ standard deviation increase ↑ interquartile range unchanged. (-)	Any one correct B1 Any two correct B2 Any three correct B3 All **five** correct B4	**4**
		TOTAL	**20**