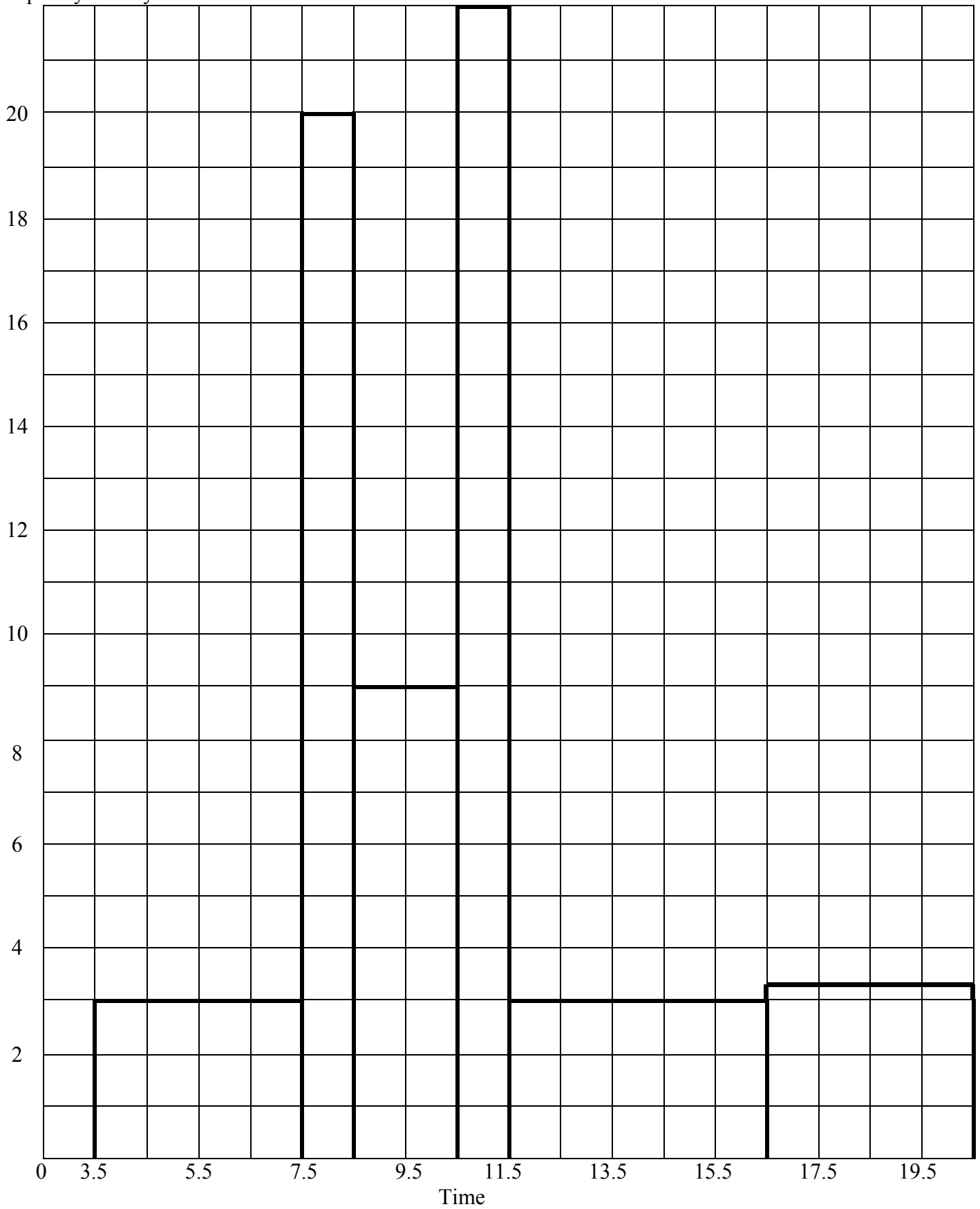
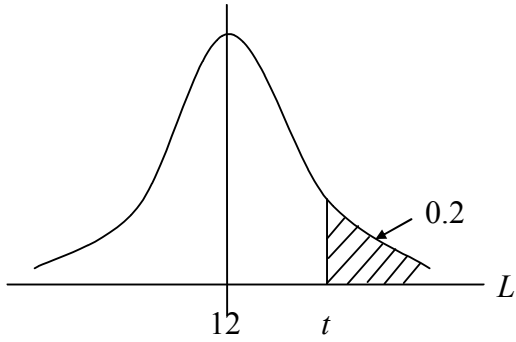


| Question Number | Scheme | Marks |
|-----------------|--|--|
| 1. | Frequency densities: 3.0, 20.0, 9.0, 22.0, 3.0, 3.25 Graph (see page 2) | Can be implied from graph Scales and labels Bases Heights (5 marks) |

1.

Frequency density



| Question Number | Scheme | Marks |
|-----------------|---|---|
| 2. |  <p>Let L represent lifetimes $\therefore L \sim N(12, 3^2)$ $P(L > t) = 0.2$ $\therefore \frac{t - 12}{3} = 0.8416$ $\therefore t = 14.5248$</p> | <p>M1 M1 B1 A1 M1 A1 (6) (6 marks)</p> |
| Alt | <p>$P(L > t) = 0.2$ $\therefore P(L \leq t) = 0.8$ $\therefore \frac{t - 12}{3} = 0.84(16)$ $\therefore t = 14.52(54)$</p> | <p>M1 M1 B1 A1 M1 A1 (6)</p> |
| 3. | <p>(a) $S_{xy} = 204.95 - \frac{48.1 \times 52.8}{7} = -157.86142$ (awrt -157.9) $S_{xx} = 155.92428$ (awrt 155.9) $S_{yy} = 214.95714$ (awrt 215.0)</p> <p>(b) $r = \frac{-157.86142}{\sqrt{155.92428 \times 214.95714}}$ $= -0.862269$ (awrt -0.862)</p> <p>(c)(i) -0.862 (ii) As sales at on petrol station increases, the other decreases; limited pool of customers; close one garage</p> | <p>M1 A1 A1 A1 (4) M1 A1ft A1 (3) B1 B1 (2) (9 marks)</p> |

(ft = follow through mark; awrt = anything which rounds to)

| Question Number | Scheme | Marks | | | | | | | | |
|---|---|--|-----------------|---|---|----------|----------------|-----------------|-----------------|--|
| <p>4. (a)</p> <p>(b)</p> <p>(c)</p> | $k(16 - 9) + k(25 - 9) + k(36 - 9) = 1$ $\therefore 7k + 16k + 27k = 1 \Rightarrow k = \frac{1}{50}$ <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="padding: 5px;">x</td> <td style="padding: 5px; width: 20px;">4</td> <td style="padding: 5px; width: 20px;">5</td> <td style="padding: 5px; width: 20px;">6</td> </tr> <tr> <td style="padding: 5px;">$P(X=x)$</td> <td style="padding: 5px; text-align: center;">$\frac{7}{50}$</td> <td style="padding: 5px; text-align: center;">$\frac{16}{50}$</td> <td style="padding: 5px; text-align: center;">$\frac{27}{50}$</td> </tr> </table> $E(X) = (4 \times \frac{7}{50}) + (5 \times \frac{16}{50}) + (6 \times \frac{27}{50}) = \frac{270}{50} = 5.4$ $E(X^2) = (4^2 \times \frac{7}{50}) + (5^2 \times \frac{16}{50}) + (6^2 \times \frac{27}{50}) = \frac{1484}{50} = 29.68$ $\therefore \text{Var}(X) = 29.68 - 5.4^2$ $\text{Var}(2X - 3) = 2^2 \text{Var}(X)$ $= 4 \times 0.52 = 2.08$ | x | 4 | 5 | 6 | $P(X=x)$ | $\frac{7}{50}$ | $\frac{16}{50}$ | $\frac{27}{50}$ | <p>M1 A1</p> <p>A1 (3)</p> <p>M1 A1</p> <p>M1 A1</p> <p>M1 A1 (6)</p> <p>M1</p> <p>A1 (2)</p> <p>(11 marks)</p> |
| x | 4 | 5 | 6 | | | | | | | |
| $P(X=x)$ | $\frac{7}{50}$ | $\frac{16}{50}$ | $\frac{27}{50}$ | | | | | | | |
| <p>5. (a)</p> <p>(b)</p> <p>(c)</p> <p>(d)</p> <p>(e)</p> | <p>Discrete uniform</p> $P(X=x) = \frac{1}{6}, x = 1, 2, \dots, 6$ $\therefore E(X) = \sum x P(X=x) = \frac{1}{6} + \frac{2}{6} + \dots + \frac{6}{6} = \frac{21}{6} = 3.5$ $\text{Var}(X) = \sum x^2 P(X=x) - \{E(X)\}^2$ $= \frac{1}{6} + \frac{4}{6} + \dots + \frac{36}{6} - (\frac{21}{6})^2 = 2.91666\dots$ $P(\text{three 6s}) = (\frac{1}{6})^3 = \frac{1}{216}$ $16 \Rightarrow (6, 5, 5); (5, 6, 5); (5, 5, 6)$ $(6, 6, 4); (6, 4, 6); (4, 6, 6)$ $P(16) = \frac{6}{216} = \frac{1}{36}$ | <p>B1 (1)</p> <p>B1</p> <p>M1</p> <p>A1 (3)</p> <p>M1 A1 (2)</p> <p>B1 B1</p> <p>B1 B1 (4)</p> <p>M1 A1 (2)</p> <p>(12 marks)</p> | | | | | | | | |

| Question Number | Scheme | Marks | | | | | | | | | | | | | | | | | | | | | | | | |
|-----------------|--|-----------------------------------|--------|------------|--------|---|---|--|-----|---|-----------|--|-----|---|-------|--|-----|---|-------|--|-----|---|-----|--|-----|---|
| 6. (a) | $\bar{x} = \frac{20 + 15 + \dots + 17}{14} = \frac{312}{14} = 22.2857\dots$ | (awrt 22.3) M1 A1 (2) | | | | | | | | | | | | | | | | | | | | | | | | |
| 6. (b) | <table style="margin-left: 40px; border-collapse: collapse;"> <thead> <tr> <th style="border-right: 1px solid black; padding: 2px;">Bags of crisps</th> <th style="padding: 2px;">1</th> <th style="padding: 2px;">0 means 10</th> <th style="padding: 2px;">Totals</th> </tr> </thead> <tbody> <tr> <td style="border-right: 1px solid black; padding: 2px;">0</td> <td style="padding: 2px;">5</td> <td style="padding: 2px;"></td> <td style="padding: 2px;">(1)</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 2px;">1</td> <td style="padding: 2px;">0 1 3 5 7</td> <td style="padding: 2px;"></td> <td style="padding: 2px;">(5)</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 2px;">2</td> <td style="padding: 2px;">0 0 5</td> <td style="padding: 2px;"></td> <td style="padding: 2px;">(3)</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 2px;">3</td> <td style="padding: 2px;">0 1 3</td> <td style="padding: 2px;"></td> <td style="padding: 2px;">(3)</td> </tr> <tr> <td style="border-right: 1px solid black; padding: 2px;">4</td> <td style="padding: 2px;">0 2</td> <td style="padding: 2px;"></td> <td style="padding: 2px;">(2)</td> </tr> </tbody> </table> | Bags of crisps | 1 | 0 means 10 | Totals | 0 | 5 | | (1) | 1 | 0 1 3 5 7 | | (5) | 2 | 0 0 5 | | (3) | 3 | 0 1 3 | | (3) | 4 | 0 2 | | (2) | Label and key B1 2 correct rows B1 All correct B1 (3) |
| Bags of crisps | 1 | 0 means 10 | Totals | | | | | | | | | | | | | | | | | | | | | | | |
| 0 | 5 | | (1) | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | 0 1 3 5 7 | | (5) | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | 0 0 5 | | (3) | | | | | | | | | | | | | | | | | | | | | | | |
| 3 | 0 1 3 | | (3) | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | 0 2 | | (2) | | | | | | | | | | | | | | | | | | | | | | | |
| 6. (c) | $Q_2 = 20; Q_1 = 13; Q_3 = 31$ | B1; B1; B1 (3) | | | | | | | | | | | | | | | | | | | | | | | | |
| 6. (d) | $1.5 \times \text{IQR} = 1.5 \times (31 - 13) = 27$ $31 + 27 = 58; 13 - 27 = -14$ No outliers | B1 both M1 A1 (3) | | | | | | | | | | | | | | | | | | | | | | | | |
| 6. (e) | scale and label $Q_1 = 13, Q_2 = 20, Q_3 = 31$ Whiskers 5, 42; | B1 B1 ft B1 | | | | | | | | | | | | | | | | | | | | | | | | |
| 6. (f) | $Q_2 - Q_1 = 7; Q_3 - Q_2 = 11; Q_3 - Q_2 > Q_2 - Q_1$ Postive skew | M1 A1 (2) (13 marks) | | | | | | | | | | | | | | | | | | | | | | | | |

| Question Number | Scheme | Marks |
|-------------------|--|-------------------|
| 7. (a) | m is explanatory variable | B1 (1) |
| (b) | scales and labels | B1 |
| (c) | points (7, 19), (8, 10), (9, 11), (10, 15), (13, 21), (14, 23), (17, 26), (20, 31) | B2 (3) |
| (c) | $\Sigma m = 98$; $\Sigma p = 156$; $\Sigma m^2 = 1348$; $\Sigma mp = 2119$ | |
| | $S_{mp} = 2119 - \frac{98 \times 156}{8} = 208$ | M1 A1 |
| | $S_{mm} = 1348 - \frac{98^2}{8} = 147.5$ | A1 |
| | $\therefore b = \frac{S_{mp}}{S_{mm}} = \frac{208}{147.5} = 1.410169$ | (awrt 1.41) M1 A1 |
| | $a = \frac{156}{8} - (1.410169...) \times \frac{98}{8} = 2.225429$ | (awrt 2.23) M1 A1 |
| (d) | $\therefore p = 2.23 + 1.41m$ | A1 ft (8) |
| (d) | Line on graph | M1 A1 (2) |
| (e) | $p = 2.23 + 1.41 \times 15 = 23.38$ | M1 A1 (2) |
| (14 marks) | | |

(ft = follow through mark; -1 eeo = minus one mark for each error or omission)