

Stats 1 - January 2010

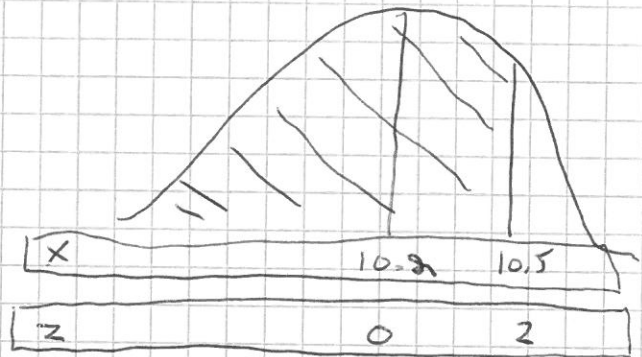
① $X \sim N(10.2, 0.15^2)$

a) i) $P(X < 10.5)$

$$= P\left(Z < \frac{10.5 - 10.2}{0.15}\right)$$

$$= P(Z < 2)$$

$$= 0.97725$$



a) ii) $P(10.0 < X < 10.5)$

$$= P\left(\frac{10.0 - 10.2}{0.15} < Z < \frac{10.5 - 10.2}{0.15}\right)$$

$$= P(-1.33 < Z < 2)$$

$$= P(Z < 2) - P(Z < -1.33)$$

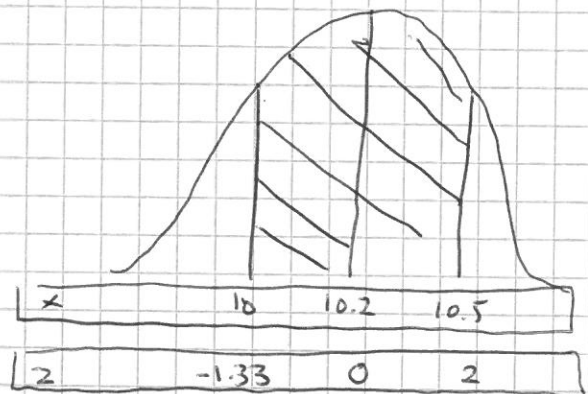
↓

$$= 0.97725$$

$$= P(Z > 1.33)$$

$$= 1 - P(Z < 1.33)$$

$$= 1 - 0.90824 = 0.09176$$



$$= 0.97725 - 0.09176 = 0.88549$$

b) $P(X > 10) = 0.90824$ from a ii)

$$P(6 \text{ rolls}) = (0.90824)^6 = 0.561311...$$

② a) a 14 15 18 20 25 25 26 27 29 32 34 37 37 b

$$\text{Median} = \frac{15 + 1}{2} = 8^{\text{th}} = 26$$

$$LQ = \frac{15 + 1}{4} = 4^{\text{th}} = 18$$

$$UQ = \frac{3(15 + 1)}{4} = 12^{\text{th}} = 34$$

$$IGR = 34 - 18 = 16$$

b) Mode - No unique value, $\therefore$ 2 modes of 25 & 37

Standard Deviation - we don't know the values of a and b

c) From calculator: $\sum x = 390$ $\sum x^2 = 11472$

$$\text{Mean } (\bar{x}) = 26$$

$$\text{Sample SD } (s) = 9.7541...$$

(3) a) From calculator: $\sum x = 1351$

$$a = 2501.091046... \quad (\text{intercept})$$

$$b = 7.05134... \quad (\text{gradient})$$

$$\rightarrow y = 2501.1 + 7.051x$$

$$\begin{aligned} \text{b) } x &= 200 \rightarrow y = 2501.1 + 7.051(200) \\ &= 3911 \text{ litres} \end{aligned}$$

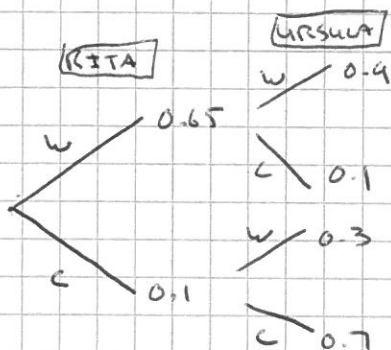
c) Residuals are only approximately 10% of the y values,
 $\therefore$ not too bad an estimate
(fairly reliable).

$$\text{(4) a) i) } P(R_w, S_w, T_w) = 0.65 \times 0.4 \times 0.25 = 0.065$$

$$\text{ii) } P(R_b, S_b, T_b) = 0.25 \times 0.85 \times 0.8 = 0.17$$

$$\begin{aligned} \text{iii) } P(R_c, S_c, T_c) &= 0.1 \times 0.45 \times 0.55 = 0.02475 \\ P(R_c, S_c, T_c) &= 0.1 \times 0.45 \times 0.45 = 0.02025 \\ P(R_c, S_c, T_c) &= 0.1 \times 0.55 \times 0.55 = 0.03025 \\ P(R_c, S_c, T_c) &= 0.9 \times 0.45 \times 0.55 = 0.22275 \end{aligned} \quad \left. \vphantom{\begin{aligned} P(R_c, S_c, T_c) \\ P(R_c, S_c, T_c) \\ P(R_c, S_c, T_c) \\ P(R_c, S_c, T_c) \end{aligned}} \right\} +$$
$$\underline{\underline{0.298}}$$

b)



$$\begin{aligned} \text{i) } P(\text{same}) &= P(w, w) + P(c, c) \\ &= 0.65 \times 0.9 + 0.1 \times 0.7 \\ &= 0.655 \end{aligned}$$

$$\begin{aligned} P(\text{different}) &= 1 - 0.655 \\ &= 0.345 \end{aligned}$$

⑤ a) i) From calculator:

$$\bar{x} = 1010 \quad \sigma = 10.5 \quad n = 12$$

$$98\% \text{ multiplier for } Z \text{ (2 tailed)} = 2.3263$$

$$\begin{aligned} 98\% \text{ CI for } \mu &= \bar{x} \pm Z \times \frac{\sigma}{\sqrt{n}} \\ &= 1010 \pm 2.3263 \times \frac{10.5}{\sqrt{12}} \\ &= 1010 \pm 7.05122 \dots \\ &= (1003, 1017) \quad (4 \text{ s.f. } 0.31) \end{aligned}$$

ii) The population is normally distributed

iii) About 30

b) **CI** 1kg is outside the confidence interval. It is lower than the lower bound of 1003

SAMPLE $\frac{3}{12}$ or 25% of weights below 1kg
 $\therefore$ Likely to be involved labelling.

$$c) 2\% \quad (100 - 98)$$

⑥ Let X = number of nights out

$$a) X \sim B(14, 0.35)$$

$$i) P(X \leq 7) = 0.9267 \quad (\text{table})$$

$$\begin{aligned} ii) P(X \geq 11) &= 1 - P(X \leq 10) \\ &= 1 - 0.9989 = 0.0011 \end{aligned}$$

$$iii) P(5 < X < 10)$$

$$\text{CAN BE: } 6, 7, \dots, 9$$

$$= P(X \leq 9) - P(X \leq 5)$$

$$= 0.9960 - 0.6405 = 0.3535$$

$$b) 3 \text{ weeks} = 21 \text{ days} \rightarrow X \sim B(21, 0.35)$$

$$\begin{aligned} P(X = 4) &= {}^{21}C_4 \times 0.35^4 \times 0.65^{17} \\ &= 0.05927 \dots \end{aligned}$$

$$c) S \sim B(7, 5/7)$$

$$i) \text{MEAN} = np = 7 \times 5/7 = 5$$

$$\text{VARIANCE} = np(1-p) = 7 \times 5/7 \times 2/7 = 10/7 \text{ or } 1.43...$$

ii) Mean is the same and variance is similar.

$\therefore$ Barry's claim seems valid.

$$(7) a) \text{ From calculator: } S_{xx} = 636$$

$$r = -0.03546...$$

b) Virtually no linear correlation between purchase price and auction price.

c) i) See Mark Scheme

ii) Positive linear correlation between most of the data
But

Two outliers: J and L

$$d) i) r = \frac{S_{xy}}{\sqrt{S_{xx} \times S_{yy}}} = \frac{4268.8}{\sqrt{4854.4 \times 4216.1}}$$

$$= 0.943588...$$

ii) Strong, positive, linear correlation between purchase price & auction price.