Stats 1 - January 2009

① a) From calculator: $\Sigma(x) = 247 \rightarrow$ mean $(\bar{x}) = 4.75$

Median $= \dfrac{52+1}{2} = 26.5$th value $= 5$

Mode $=$ 4 and 6

b) Mode, as more than 1 value

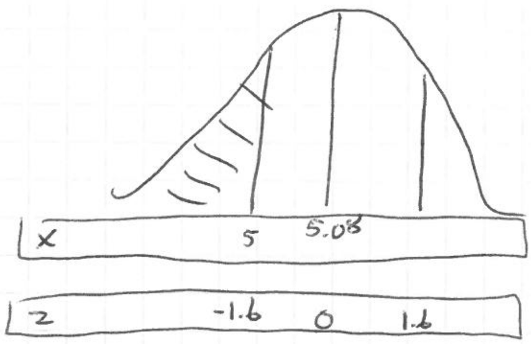
② a) i) From Calculator: $\Sigma x^2 = 1619.36$ $\quad r = 0.022557...$

ii) Virtually no linear correlation between length and diameter of carrots.

b) Geri is likely to be wrong.

We would expect a positive r value as there is a positive association between length and weight.

③ $X \sim N(5.08, 0.05^2)$



a) i) $P(X < 5)$

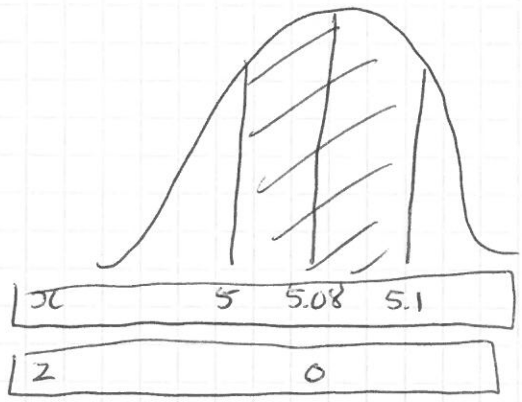
$= P\left(Z < \dfrac{5 - 5.08}{0.05}\right)$

$= P(Z < -1.6)$

$= P(Z > 1.6)$

$= 1 - P(Z < 1.6)$

$= 1 - 0.94520 = 0.0548$



ii) $P(5 < X < 5.1)$

$= P\left(\dfrac{5-5.08}{0.05} < Z < \dfrac{5.1-5.08}{0.05}\right)$

$= P(-1.6 < Z < 0.4)$

$= P(Z < 0.4) - P(Z < -1.6)$

$= 0.65542 - 0.0548 = 0.60062$

b) i) $\bar{X} \sim N(5.08, \ 0.05^2/4)$

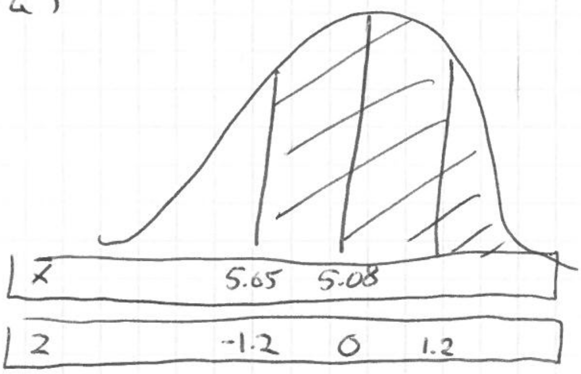
$P(\bar{X} > 5.05)$

$= P\left(Z > \dfrac{5.05 - 5.08}{0.05/\sqrt{4}}\right)$

$= P(Z > -1.2)$

$= P(Z < 1.2)$

$= 0.88493$



ii) $P(X = 5) = 0$

c) $P(X > 5) = 0.99$

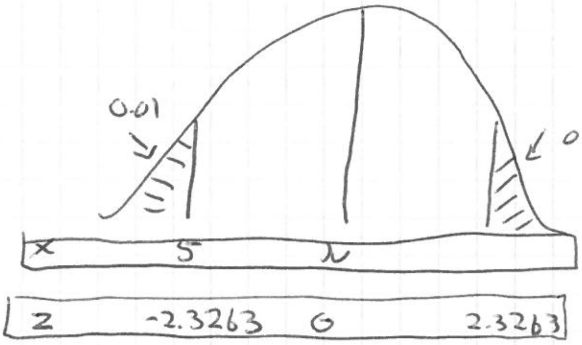
Z value for $0.99 = 2.3263$

Standardising:

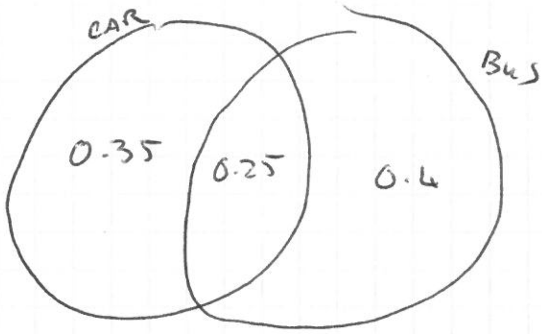
$\dfrac{5 - \mu}{0.05} = -2.3263$

$5 - \mu = -2.3263 \times 0.05$

$\mu = 5 + 0.116315 = 5.116315$



(4) a)



i) P(no car) = 0.4

ii) P(just car) = 0.35

iii) P(bus) = 0.65

b) i) $\boxed{\text{CAR}}$ $P(G \cap L) = 0.35 \times 0.9 = 0.315$

$\boxed{\text{BOTH}}$ $P(G \cap L) = 0.25 \times 0.7 = 0.175$

$\boxed{\text{BUS}}$ $P(G \cap L) = 0.4 \times 0.3 = 0.12$ +

$\underline{0.61}$

ii) P(no Larry) = 1 − 0.61 = 0.39

5 days → $0.39^5 = 0.009$

(5) $X \sim N(\mu, 8^2)$

$n = 30 \qquad \Sigma x = 1620 \qquad s = 8$

a) mean $= 1620 \div 30 = 54$ mins

b) $\bar{x} = 54 \qquad s = 8 \qquad n = 30$

98% value for Z (2 tailed) = 2.3263

98% CI for $\mu = \bar{x} \pm Z \times \frac{s}{\sqrt{n}}$

$= 54 \pm 2.3263 \times \frac{8}{\sqrt{30}}$

$= 54 \pm 3.397786\ldots$

$= (50.60, \ 57.40)$

c) $n = 1 \rightarrow \mu = 54 \pm 2.3263 \times \frac{1}{\sqrt{30}}$

$= 54 \pm 18.6104\ldots$

$= (35.39, \ 72.61)$

d) Not needed as data from Normal Distribution.

(6) a) See Mark Scheme

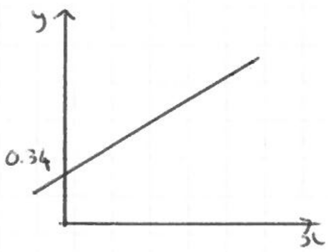
b) From calculator: $\Sigma x^2 = 40344$

$a = 0.34403\ldots$ ~~(gradient)~~ (intercept)

$b = 0.685015\ldots$ (gradient)

$\rightarrow y = 0.34 + 0.69x$

c)



d) i) Need vertical distance, so y values − predicted y from equation

(H) $41 - (0.344 + 0.685(55)) = 2.981$

(I) $46 - (0.344 + 0.685(62)) = 3.186$

(J) $51 - (0.344 + 0.685(70)) = 2.706$

Mean $= \frac{2.981 + 3.186 + 2.706}{3} = 2.95766\ldots$

ii) $x = 65$

Need predicted + residual

predicted: $y = 0.344 + 0.685(65) = 44.869$

residual from i): 2.957

$\therefore$ best estimate $= 44.869 + 2.957 = 47.819$

7) a) i) $X \sim B(16, 0.45)$

$P(X = 3) = {}^{16}C_3 \times 0.45^3 \times 0.55^{13} = 0.0215$

ii) $X \sim B(25, 0.45)$

$P(X < 10) = P(X \le 9) = 0.2424$ (from tables)

iii) $X \sim B(40, 0.45)$

$P(15 \le x \le 20)$

can be: 15, 16 ... 20

Need $P(X \le 20) - P(X \le 14)$

$= 0.787 - 0.1326 = 0.6544$

iv) $n = 50, \quad p = 0.45$

$\boxed{\text{MEAN}}$ $np = 50 \times 0.45 = 22.5$

$\boxed{\text{VARIANCE}}$ $np(1-p) = 50 \times 0.45 \times 0.55 = 12.375$

b) i) The travel of senior citizens may not be independent as they may travel in groups

ii) Passengers more likely to be workers or children, so value of p likely to be different.