S1 May 06 – Solutions

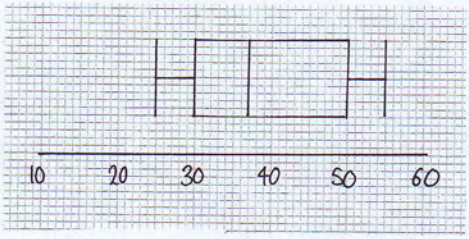
1 a)
- It shows the median and quartiles
- It shows any outliers
- It can be used to compare the spread of data.

b) I) 37mins

II) Upper (3rd) Quartile

c) Outliers. Data that doesn't fit with the general pattern.

d)



e)
- They both show positive skew
- A has outliers B does not
- School B ran generally faster (bigger median)
- School A were more consistant (smaller IQR)

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2 a) $\frac{11}{55} \times \frac{10}{54} = \frac{1}{27}$

b) $\frac{\Sigma fx}{\Sigma f} = \frac{1060}{55} = 19.3$ (3sf)

c) $80 \times 21 = 1680$ – total time in 80 weeks

1060 – total time in first 55 weeks

620 – total time in second 25 weeks

$\frac{620}{25} = 24.8$ mins

d) They spent longer on the phone in the 25 weeks than the 55 weeks in each conversation.

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3. a)

x	y
20.4	1.12
27.3	1.41
32.1	1.73
39.0	1.88
42.9	2.03
49.7	2.37
58.3	2.69
67.4	3.05

$\Sigma x = 337.1 \quad \Sigma y = 16.28$

$S_{xy} = \Sigma xy - \frac{\Sigma x \Sigma y}{n} = 757.467 - \frac{337.1 \times 16.28}{8}$

$= 71.4685$

$S_{xx} = \Sigma x^2 - \frac{(\Sigma x)^2}{n} = 15965.01 - \frac{(337.1)^2}{8}$

$= 1760.45875$

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3)

b) $b = \frac{S_{xy}}{S_{xx}} = \frac{71.4685}{1760.45875} = 0.041$ (3sf)

$a = \bar{y} - b\bar{x} = \frac{16.28}{8} - 0.04059... \times \frac{337.1}{8}$

$= 0.324$ (3sf)

$y = 0.324 + 0.041x$

c) When $x = 40°C \quad y = 0.324 + 0.041 \times 40 = 1.964$

$\therefore L = 2461.97$ (2dp)

d) $L - 2460 = 0.324 + 0.041t$

$L = 2460.324 + 0.041t$

e) When $t = 90°C$

$L = 2460.324 + 0.041 \times 90 = 2464.01$ (2dp)

f) It is unreliable as 90°C is outside the range of t values used to create the regression line.

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4)

4. a) $E(X) = \frac{n+1}{2} = \frac{5+1}{2} = 3$

$Var(X) = \frac{(n+1)(n-1)}{12} = \frac{6 \times 4}{12} = 2$

b) $3E(X) - 2 = 9 - 2 = 7$

c) $Var(4 - 3X) = (-3)^2 Var(X) = 18$

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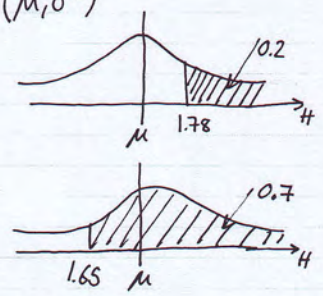
5. a) $H \sim N(\mu, \sigma^2)$



b) $P(H > 1.78) = 0.2$

$P\left(Z > \frac{1.78 - \mu}{\sigma}\right) = 0.2$

$P\left(Z < \frac{1.78 - \mu}{\sigma}\right) = 0.8$

$\Phi\left(\frac{1.78 - \mu}{\sigma}\right) = 0.8$

$P(H > 1.65) = 0.7$

$P\left(Z > \frac{1.65 - \mu}{\sigma}\right) = 0.7$

$P\left(Z < \frac{\mu - 1.65}{\sigma}\right) = 0.7$

$\Phi\left(\frac{\mu - 1.65}{\sigma}\right) = 0.7$

(5)

$\frac{1.78-\mu}{\sigma} = 0.84$ $\quad$ $\frac{\mu-1.65}{\sigma} = 0.52$

$1.78-\mu = 0.84\sigma$ ① $\quad$ $\mu-1.65 = 0.52\sigma$ ②

① + ② $\quad 0.13 = 1.36\sigma$

$\sigma = \frac{0.13}{1.36} = \underline{0.096}$ (3dp)

sub in ① $\quad 1.78-\mu = 0.84 \times 0.096$

$\mu = 1.78 - 0.84 \times 0.096 = \underline{1.700}$ (3dp)

c) $P(H>1.74) = 1-P(H<1.74)$

$= 1 - P\left(Z < \frac{1.74-1.7}{0.096}\right)$

$= 1 - \Phi\left(\frac{0.04}{0.096}\right)$

$= 1 - 0.6628 = \underline{0.3372}$

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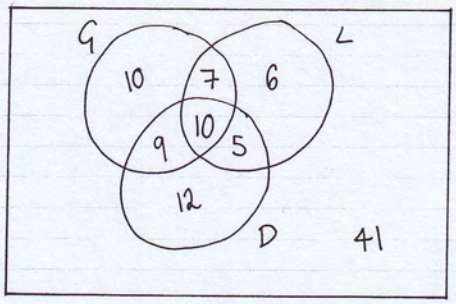
6. a)



(6)

b) $\frac{10}{100} = \underline{\frac{1}{10}}$ $\quad$ c) $\underline{\frac{41}{100}}$ $\quad$ d) $\frac{9+7+5}{100} = \underline{\frac{21}{100}}$

e) $\frac{10}{15} = \underline{\frac{2}{3}}$