1

S1 May 06 – Solutions

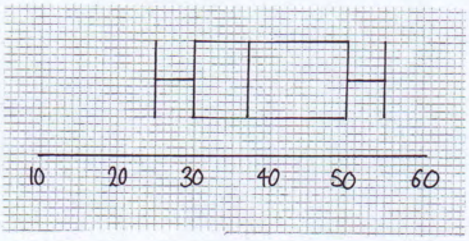
1 a) • It shows the median and quartiles
• It shows any outliers
• It can be used to compare the spread of data.

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)

2 a) $\frac{11}{55} = \underline{0.2}$

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

2

c) $80 \times 21 = 1680$ – total time in 80 weeks
1060 – total time in first 55 weeks
620 – total time in second 25 weeks

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

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

3. a) ~~$S_{xy} = \Sigma xy - \frac{\Sigma x \Sigma y}{n}$~~

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

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

$S_{xy} = \Sigma xy - \frac{\Sigma x \Sigma y}{n} = 757.467 - \frac{337.1 \times 16.28}{8}$
$= \underline{71.4685}$

$S_{xx} = \Sigma x^2 - \frac{(\Sigma x)^2}{n} = 15965.01 - \frac{(337.1)^2}{8}$
$= \underline{1760.45875}$

3

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

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

$= \underline{0.324}$ (3sf)

$\underline{y = 0.324 + 0.041x}$

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

$\therefore \underline{l = 2461.97}$ (2dp)

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

$\underline{l = 2460.324 + 0.041t}$

e) When $t = 90°C$

$l = 2460.324 + 0.041 \times 90 = \underline{\underline{2464.01}}$ (2dp)

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

4

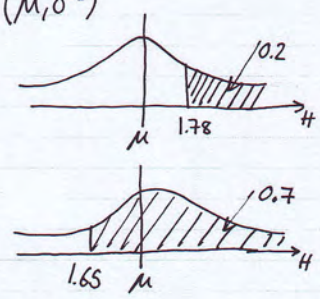
4. a) $E(X) = \frac{n+1}{2} = \frac{5+1}{2} = \underline{\underline{3}}$

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

b) $3E(X) - 2 = 9 - 2 = \underline{\underline{7}}$

c) $Var(4 - 3X) = (-3)^2 Var(X) = \underline{18}$

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



b) $P(H > 1.78) = 0.2$ $\qquad P(H > 1.65) = 0.7$

$P\left(Z > \frac{1.78 - \mu}{\sigma}\right) = 0.2$ $\qquad P\left(Z > \frac{1.65 - \mu}{\sigma}\right) = 0.7$

$P\left(Z < \frac{1.78 - \mu}{\sigma}\right) = 0.8$ $\qquad P\left(Z < \frac{\mu - 1.65}{\sigma}\right) = 0.7$

$\Phi\left(\frac{1.78 - \mu}{\sigma}\right) = 0.8$ $\qquad \Phi\left(\frac{\mu - 1.65}{\sigma}\right) = 0.7$

5

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

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

(1)+(2) $\quad 0.13 = 1.36\sigma$

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

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

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

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

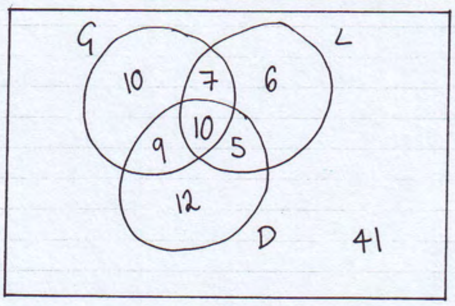
$$= 1 - P\left(Z < \frac{1.74-1.7}{0.096}\right)$$

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

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

---

6. a)



6

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

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