

SI - June 07 Solutions

1. a) $r = \frac{S_{xy}}{\sqrt{S_{xx}S_{yy}}} = \frac{-808.917}{\sqrt{113573 \times 8.657}} = -0.816$ (3dp)
 b) The further away from the station you are the lower the house price.
 c) -0.816. PMCC unaffected by coding.

2. a) 50%
 b) 54 kg
 c) Outlier. A heavy one.
 d) Symmetrical. As $Q_2 - Q_1 = Q_3 - Q_2$
 e) $X \sim N(45, \sigma^2)$ (mean = median because of symmetry).

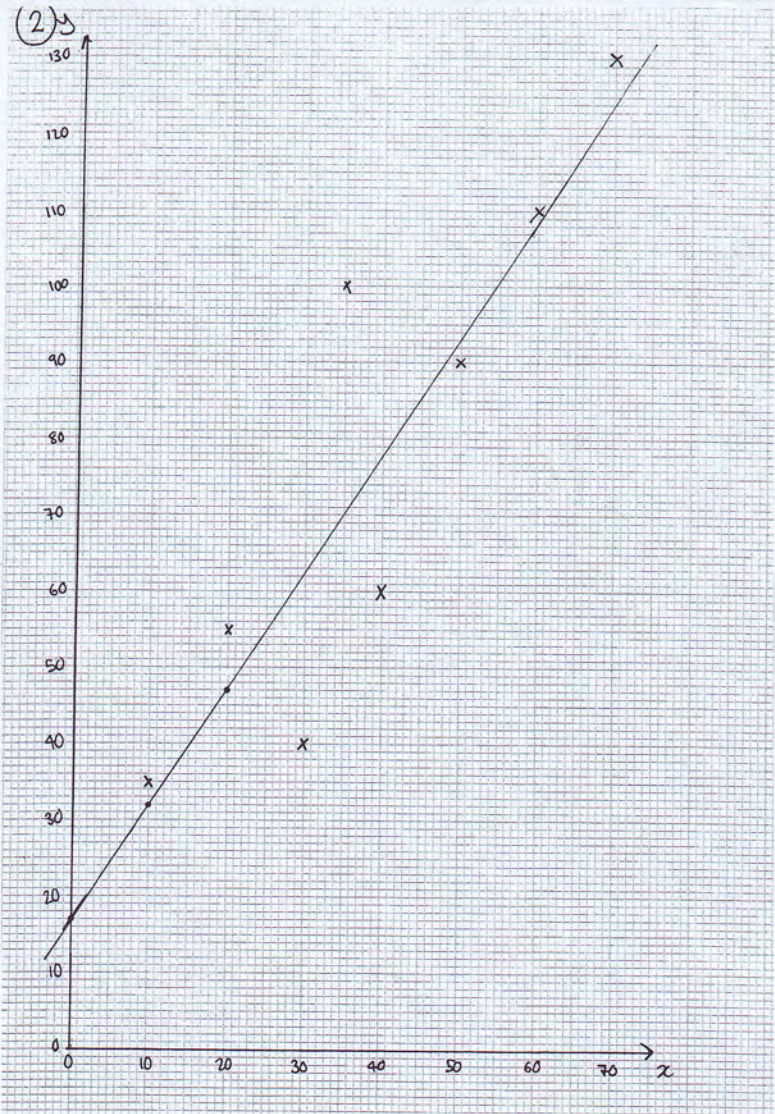
$$P(X \leq 54) = 0.75$$

$$P\left(Z \leq \frac{54 - 45}{\sigma}\right) = 0.75$$

$$P\left(Z \leq \frac{9}{\sigma}\right) = \Phi\left(\frac{9}{\sigma}\right) = 0.75$$

$$\frac{9}{\sigma} = 0.67$$

$$\sigma = \frac{9}{0.67} = 13.4$$



3

3. b) $S_{xy} = \sum xy - \frac{\sum x \sum y}{n} = 28750 - \frac{315 \times 620}{8} = 4337.5$

$$S_{xx} = \sum x^2 - \frac{(\sum x)^2}{n} = 15225 - \frac{315^2}{8} = 2821.875$$

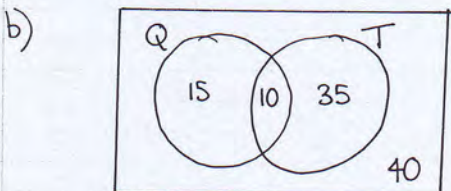
c) $b = \frac{S_{xy}}{S_{xx}} = \frac{4337.5}{2821.875} = 1.53709856$

$$a = \bar{y} - b\bar{x} = \frac{620}{8} - 1.53709856 \times \frac{315}{8} = 16.9767442$$

$a = 17.0$ $b = 1.5$

- e) \Rightarrow D as it is the furthest above the regression line.
 \Rightarrow 70p, this is the price suggested by the regression line

4. a) 40% don't read any so 60% read at least one:
 $45 + 25 = 70\% \therefore 10\%$ read both



4

c) $\frac{15}{60} = \frac{1}{4}$

t	5-10	10-14	14-18	18-25	25-40
Frequency	10	16	24	35	15

b) $5 \times 5 + 15 \times 1 = 40$

x	7.5	12	16	21.5	32.5
fx	75	192	384	752.5	487.5

$$\mu = \frac{\sum fx}{\sum f} = \frac{1891}{100} = 18.915$$

x^2	56.25	144	256	462.25	1056.25
fx^2	562.5	3072	6144	16178.75	15843.75

$$\sigma = \sqrt{\frac{\sum fx^2}{\sum f} - \mu^2} = \sqrt{\frac{41033 - 18.91^2}{100}} = 7.26$$
 (3sf)

e) $Q_1 = 10 + \frac{(25-10) \times 4}{16} = 13.75$

$$Q_2 = 14 + \frac{(50-26) \times 4}{24} = 18$$

$$Q_3 = 18 + \frac{(75-50) \times 7}{35} = 23$$

5

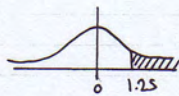
F) $\frac{3(18.91-18)}{7.26} = \underline{\underline{0.376}}$ (3sf)

Positive skew.

6. a) $X \sim N(20, 4^2)$

$P(X > 25) = P(Z > \frac{25-20}{4})$

$= P(Z > 1.25)$



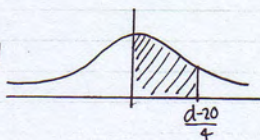
$= 1 - P(Z < 1.25)$

$= 1 - \Phi(1.25) = 1 - 0.8944 = \underline{\underline{0.1056}}$

b) $P(20 < X < d) = 0.4641$

$P(\frac{20-20}{4} < Z < \frac{d-20}{4}) = 0.4641$

$P(0 < Z < \frac{d-20}{4}) = 0.4641$



$\therefore P(Z < \frac{d-20}{4}) = 0.9641$

$\Phi(\frac{d-20}{4}) = 0.9641$

$\frac{d-20}{4} = 1.8 \quad \therefore \underline{\underline{d = 27.2}}$

6

7a) $0.2 + p + 0.2 + q + 0.15 = 1$

$\underline{p+q=0.45}$ ①

$0.2 + 3p + 1 + 7q + 1.35 = 4.5$

$\underline{3p+7q=1.95}$ ②

b) ① x 3 $3p+3q=1.35$ ③

② - ③ $4q=0.6$

$\underline{q=0.15} \quad \underline{p=0.3}$

c) $P(4 < X \leq 7) = P(X=5) + P(X=7) = \underline{\underline{0.35}}$

d) $Var(X) = E(X^2) - [E(X)]^2 = 27.4 - 4.5^2 = \underline{\underline{7.15}}$

e) $E(19-4X) = 19 - 4E(X) = 19 - 4 \times 4.5 = \underline{\underline{1}}$

f) $Var(19-4X) = (-4)^2 Var(X) = 16 \times 7.15 = \underline{\underline{114.4}}$