· S1 JAN 04 (1)

1) $\Sigma m = 150$ $\Sigma t = 71.6$ $\Sigma m^2 = 5500$ $\Sigma t^2 = 930$
$\Sigma mt = 2147$ $n = 6$ $(t \to y \quad m \to x)$

a) $S_{mt} = \Sigma mt - \frac{(\Sigma m)(\Sigma t)}{n} = 2147 - \frac{150 \times 71.6}{6} = \underline{357}$

$S_{mm} = \Sigma m^2 - \frac{(\Sigma m)^2}{n} = 5500 - \frac{150^2}{6} = \underline{1750}$

b) $t = a + bm$ $\quad b = \frac{S_{mt}}{S_{mm}} = \frac{357}{1750} = 0.204$

$a = \bar{t} - b\bar{m} = \left(\frac{71.6}{6}\right) - 0.204\left(\frac{150}{6}\right) = 6.8\dot{3}$

$t = 6.83 + 0.204m$

c) $m = 35 \Rightarrow t = 6.83 + 0.204 \times 35 = \underline{13.97}$

d) i) No, too far outside data range to be considered reliable.

ii) No, nothing to suggest model would be reliable one month later.

2) Normal distribution $\Rightarrow$ i) mode = median = mean
ii) Continuous data
iii) 'bell' shaped distribution
iv) Symmetrical distribution
v) · 68.3% data lies within 1σ of mean
·· 95% of data lies within 2σ of mean
··· 99% of data lies within 3σ of mean.

b) $X \sim N(27, 10^2)$

$P(26 < X < 28)$

$\Rightarrow P\left(\frac{26-27}{10} < Z < \frac{28-27}{10}\right)$

$= P(-0.1 < Z < 0.1)$

$= \Phi(0.1) - \Phi(-0.1)$

$= \Phi(0.1) - (1 - \Phi(0.1)) = 0.5398 - 0.4602 = \underline{0.0796}$

(2)

3) a) $P(1 < X \le 3) = P(3) + P(2) = \frac{1}{12} + \frac{1}{12} = \underline{\frac{1}{6}}$

b) $F(2.6) = P(2) + P(1) + P(0) = \frac{1}{12} + \frac{1}{2} + \frac{1}{3} = \underline{\frac{11}{12}}$

c)

x	0	1	2	3
P	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{1}{12}$	$\frac{1}{12}$

$E(X) = 0 + \frac{1}{2} + \frac{2}{12} + \frac{3}{12} = \underline{\frac{11}{12}}$

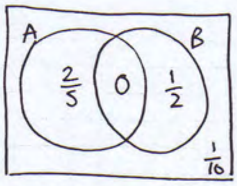
d) $E(2X-3) = 2E(X) - 3 = \frac{22}{12} - 3 = \frac{-14}{12} = \underline{\frac{-7}{6}}$

e)

x^2	0	1	4	9
P	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{1}{12}$	$\frac{1}{12}$

$E(X^2) = 0 + \frac{1}{2} + \frac{4}{12} + \frac{9}{12} = \frac{19}{12}$

$V(X) = E(X^2) - E(X)^2 = \left(\frac{19}{12}\right) - \left(\frac{11}{12}\right)^2 = \frac{228}{144} - \frac{121}{144} = \underline{\frac{107}{144}}$

4) 

$P(A|B') = \frac{P(A \cap B')}{P(B')} \Rightarrow \frac{4}{5} = \frac{P(A \cap B')}{\left(\frac{1}{2}\right)}$

i) $P(A \cap B') = \frac{4}{5} \times \frac{1}{2} = \frac{4}{10} = \frac{2}{5}$

$1 - \frac{2}{5} - \frac{1}{2} = 1 - \frac{4}{10} - \frac{5}{10} = \underline{\frac{1}{10}}$

ii) $P(A \cap B) = 0$ (iii) $P(A \cup B) = \frac{2}{5} + \frac{1}{2} = \frac{9}{10}$ iv) $P(A|B) = 0$

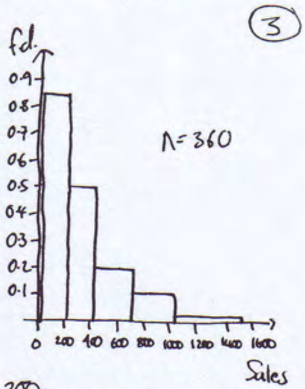
b) i) Mutually exclusive, Yes since $P(A \cap B) = 0$

ii) Independent, No $P(A) \times P(B) = \frac{2}{5} \times \frac{1}{2} = \frac{2}{10} = \frac{1}{5}$
$P(A \cap B) = 0$ $\quad P(A \cap B) \ne P(A) \times P(B)$

(3)

5)

Sales	freq	CW	f.d.
1-200	166 (166)	200	0.83
201-400	100 (266)	200	0.50
401-700	59 (325)	300	0.197
701-1000	30 (355)	300	0.10
1001-1500	5 (360)	500	0.01



$n = 360$

b) Q_1 $\frac{1}{4}n = 90 \Rightarrow Q_1 = x_{90}/x_{91} = 1\text{-}200$
$\Rightarrow 0.5 + \left(\frac{90-0}{166}\right) \times 200 = \underline{108.9}$

Q_2 $\frac{1}{2}n = 180 \Rightarrow Q_2 = x_{180}/x_{181} = 201\text{-}400$
$\Rightarrow 200.5 + \left(\frac{180-166}{100}\right) \times 200 = \underline{228.5}$

Q_3 $\frac{3}{4}n = 270$ $\quad Q_3 = x_{270}/x_{271} = 401\text{-}700$
$\Rightarrow 400.5 + \left(\frac{270-266}{59}\right) \times 300 = \underline{420.8}$

$IQR = 420.8 - 108.9 = \underline{311.9}$

median = $\underline{228.5}$

c) x = midpoint of sales

$\Sigma fx = 166 \times 100.5 + 100 \times 300.5 + 59 \times 550.5 + 30 \times 850.5 + 5 \times 1250.5$

$\Sigma fx = 110980$

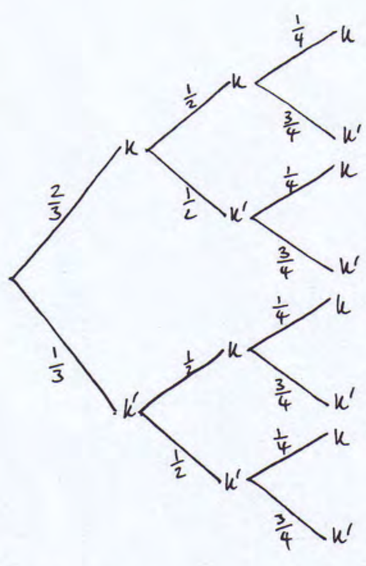
$\Sigma fx^2 = 166 \times 100.5^2 + 100 \times 300.5^2 + \ldots = 58105890$

$\bar{x} = \frac{\Sigma fx}{n} = \frac{110980}{360} = \underline{308.3}$ $\quad Var = \frac{\Sigma fx^2}{n} - \bar{x}^2 = 66370$

$sd_x = \sqrt{Var} = \underline{257.6}$

d) Median/IQR data is heavily positively skewed.

(4)

6) 

$P(kkk) = \frac{2}{24}$
$P(kkk') = \frac{6}{24}$
$P(kk'k) = \frac{2}{24}$
$P(kk'k') = \frac{6}{24}$
$P(k'kk) = \frac{1}{24}$
$P(k'kk') = \frac{3}{24}$
$P(k'k'k) = \frac{1}{24}$
$P(k'k'k') = \frac{3}{24}$

b) $P(kkk) = \frac{2}{24} = \underline{\frac{1}{12}}$

c) $P(kk'k') + P(k'kk') + P(k'k'k) = \frac{6}{24} + \frac{3}{24} + \frac{1}{24} = \frac{10}{24} =$

d) $P(k'k'k') + P(k'k'k) + P(kk'k') = \frac{3}{24} + \frac{1}{24} + \frac{6}{24} = \frac{10}{24} =$