Stats 1 - May / June 2011

① a) i) Mode $= 253$

ii) Cumulative Freq values $= 1, 2, 4, 7, 11, 17, 27, 40, 56, 76, 81, 84, 85$

Median $= \dfrac{85+1}{2} = 43\text{rd value} = 252$

LQ $= \dfrac{85+1}{4} = 21.5\text{th value} = 250$

UQ $= \dfrac{3(85+1)}{4} = 64.5\text{th value} = 253$

$\therefore$ IQR $= 253 - 250 = 3$

b) i) Range $= 271 - 227 = 44$

ii) Use midpoints when needed

From calculator: $\sum x^2 = 5365134$

$\sum x = 21,352$

Mean $(\bar{x}) = 251.2$

Standard deviation $(s) = 4.24207$

c) Standard Deviation : uses all data values.

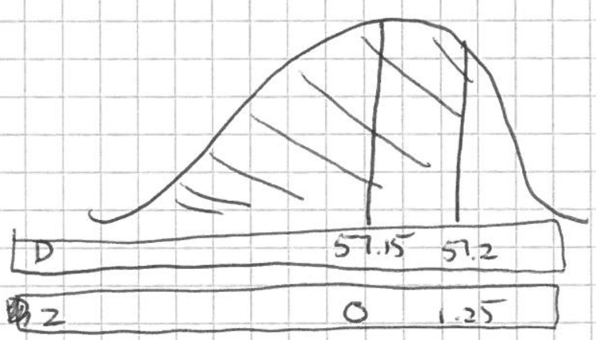
② $D \sim N(57.15, 0.04^2)$

a) i) $P(D < 57.2)$

$= P\left(Z < \dfrac{57.2 - 57.15}{0.04}\right)$

$= P(Z < 1.25)$

$= 0.89435$



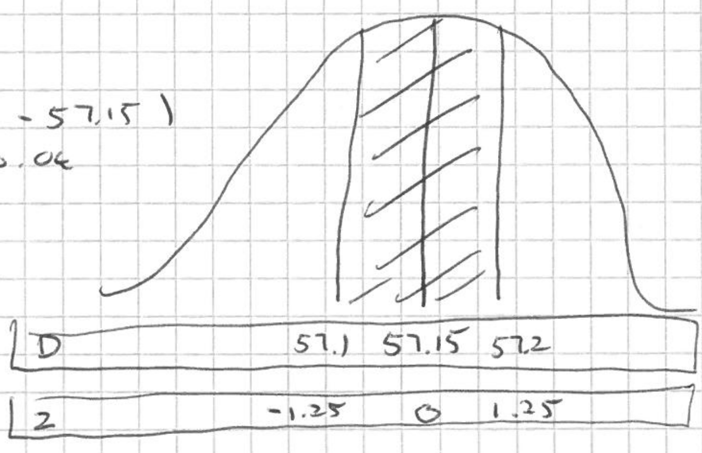
ii) $P(57.1 < D < 57.2)$

$= P\left(\dfrac{57.1 - 57.15}{0.04} < Z < \dfrac{57.2 - 57.15}{0.04}\right)$

$= P(-1.25 < Z < 1.25)$

$= P(Z < 1.25) - P(Z < -1.25)$

$= 0.89435 -$ ⊛ PTO



$P(Z < -1.25)$

$= P(Z > 1.25)$

$= 1 - P(Z < 1.25)$

$= 1 - 0.89435 = 0.10565$

$\therefore$ Answer $= 0.89435 - 0.10565 = 0.7887$

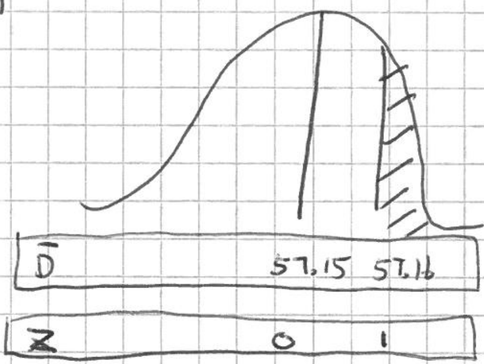
b) i) $D \sim B(16, 0.89435)$

$P(D < 57.6 \text{ for } 16) = 0.89435^{16} = 0.16754$

ii) $\bar{D} \sim N(57.15, \; 0.04^2/16)$

$P(\bar{D} > 57.16)$

$= P\left(Z > \dfrac{57.16 - 57.15}{0.04/\sqrt{16}}\right)$



$= P(Z > 1)$

$= 1 - P(Z < 1)$

$= 1 - 0.84134 = 0.15866$

(3) a) i) From calculator: $\Sigma x^2 = 3452$

$a = 115$ (intercept)

$b = 191$ (gradient)

$\rightarrow y = 115 + 191x$

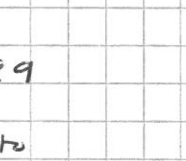
ii) $x = 24 \rightarrow y = 115 + 191(24) = £4699$

iii) Maximum temperature in February likely to be lower than July

iv) The amount of rainfall may affect takings.

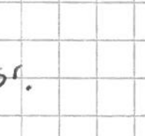
(3) b) i) See Mark scheme $z = 0.15v - 1$

v	0	10	40
z	-1	0.5	5



ii) See Mark scheme $z = -0.40w + 5$

w	0	10
z	5	1



(4) a) $s^2 = \frac{\Sigma(x-\bar{x})^2}{n-1} = \frac{184.5}{49} = 3.7653...$

$\rightarrow s = \sqrt{3.7653...} = 1.9404$

$= 1.94$ (2dp)

b) i) $\bar{x} = 251.1$ $s = 1.9404...$ $n = 50$

z value for 96% multiplier (2 tailed) = 2.0537

96% CI for $\mu = \bar{x} \pm z \times \frac{s}{\sqrt{n}}$

$= 251.1 \pm 2.0537 \times \frac{1.9404}{\sqrt{50}}$

$= 251.1 \pm 0.5635...$

$= (250.536, 251.66)$

$= (250.5, 251.7)$

ii) The claim seems valid as lower bound is > 250
Lower bound of CI is 250.5g.

c) Firstly, $\bar{x} = 251.1$, which suggests weight is higher

BUT/ For Normal Distribution, we expect a proportion of the data to be within one standard deviation of the mean.

$s = 1.94$

$\therefore \bar{x} - s = 251.1 - 1.94 = 249.16$

$\therefore$ Some individual packets will be less than 250g

(5) a) i)

	J	J'	TOTAL
W	0.55	0.1	0.65
W'	0.15	0.2	0.35
TOTAL	0.7	0.3	1

ii) $P(J, W') = 0.15$
$P(J', W) = 0.1$ } +

TOTAL = 0.25

iii) (A) For Mutually Exclusive $P(A \cap B) = 0$

But $P(J \cap W) = 0.55$

(B) For Independent $P(A) \times P(B) = P(A \cap B)$

But $P(J) \times P(W)$

$= 0.7 \times 0.65 = 0.455$

$P(J \cap W) = 0.55$

$0.455 \neq 0.55$, so not independent

b) i) $P(M', C', Y') = 0.15 \times 0.4 \times 0.45 = 0.027$

ii) P(Exactly 2)

$$\left.\begin{aligned} = P(M, C, Y') &= 0.85 \times 0.6 \times 0.45 = 0.2295 \\ P(M, C', Y) &= 0.85 \times 0.4 \times 0.55 = 0.187 \\ P(M', C, Y) &= 0.15 \times 0.6 \times 0.55 = 0.0495 \end{aligned}\right\} +$$

TOTAL = $\underline{0.466}$

(6) a) $F \sim B(10, 0.15)$

i) $P(F \leq 2) = 0.8202$ (tables)

ii) $P(F \geq 2) = 1 - F(\leq 1) = 1 - 0.5443 = 0.4557$

iii) $P(1 < F < 5)$

can be: 2, 3, 4

$= P(F \leq 4) - P(F \leq 1)$

$= 0.9901 - 0.5443 = 0.4458$

b) 5 boxes $\rightarrow 5 \times 10 = 50$ bulbs

$F \sim B(50, 0.15)$

i) $P(F > 5) = 1 - P(F \leq 5)$

$= 1 - 0.2194 = 0.7806$

ii) $P(5 \leq F \leq 10)$

CAN BE: 5, 6 ... 10

$\rightarrow P(F \leq 10) - P(F \leq 4)$

$= 0.8801 - 0.1121 = 0.768$

7) a) RYAN - we would expect a positive relationship between volume & weight, not negative

SUNIL - sunil's value indicates no relationship between volume & weight when there is likely to be one.

b) RYAN - the value of r is not affected by linear scaling / coding / units

TIM - the value of r is not affected by sample size

c) i) From calculator... $\Sigma x^2 = 6633.16$

$r = 0.5418...$

ii) weak, positive, linear correlation between volume and weight of suitcase.