STATS 1 - JUNE 2014

① a) i) Mode = 71

Range = 75 - 66 = 9

ii)

x	f	CF
66	1	1
67	2	3
68	3	6
69	5	11
70	7	18
71	8	26
72	4	30
73	2	32
74	2	34
75	1	35

Median $= \frac{35+1}{2} = 18\text{th} = 70$

LQ $= \frac{35+1}{4} = 9\text{th} = 69$

UQ $= \frac{3(35+1)}{4} = 27\text{th} = 72$

IQR $= 72 - 69 = 3$

iii) From calc: $\Sigma x = 2464$

$\bar{x} = 70.4$

$s = 2.06083...$

b) She keeps $(x - 60)$ $\rightarrow$ $\bar{x} = 70.4 - 60 = 10.4$

s is unchanged at $2.06083...$

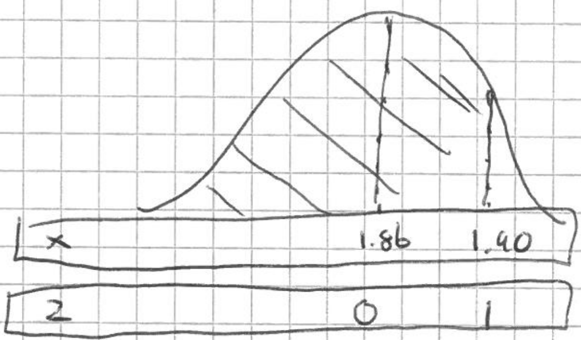
② $X \sim N(1.86,\ 0.04^2)$

a) i) $P(X < 1.90)$

$= P\left(Z < \frac{1.40 - 1.86}{0.04}\right)$

$= P(Z < 1)$

$= 0.84134$



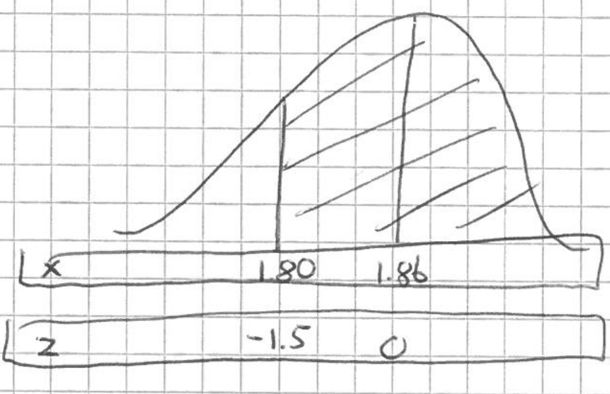
ii) $P(X > 1.80)$

$= P\left(Z > \frac{1.80 - 1.86}{0.04}\right)$

$= P(Z > -1.5)$

$= P(Z < 1.5)$

$= 0.93319$



iii) $P(1.80 < X < 1.90)$

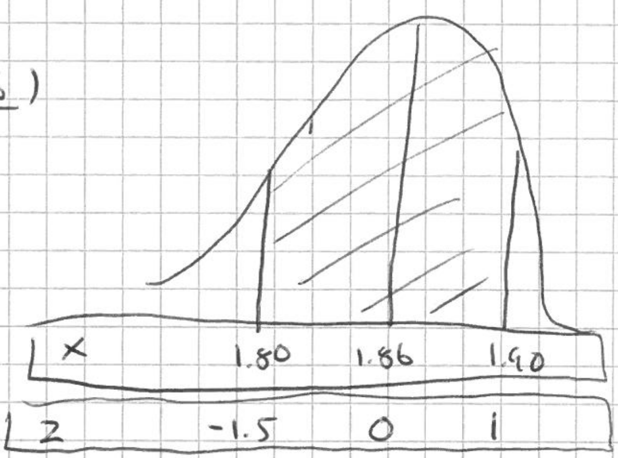
$= P\left(\frac{1.80 - 1.86}{0.04} < Z < \frac{1.90 - 1.86}{0.04}\right)$

$= P(-1.5 < Z < 1)$

$= P(Z < 1) - P(Z < -1.5)$

$= 0.84134 - (1 - 0.93319)$

$= 0.77453$



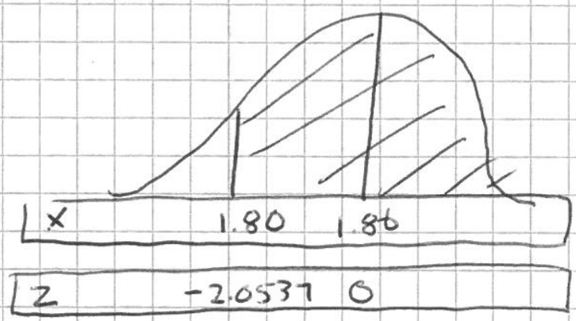
iv) $P(X \neq 1.86) = 1$

b) $X \sim N(1.86, \sigma^2)$

$P(X > 1.80) = 0.98$

Look up Z value for 0.98

$= 2.0537$



Standardise:

$\frac{1.80 - 1.86}{\sigma} = -2.0537$

~~1.80~~ $\frac{1.80 - 1.86}{-2.0537} = \sigma = 0.02921\ldots$

③ a) i) $P(F) = 220/750 = 0.293$

ii) $P(A \cap B_1) = 24/750 = 0.032$

iii) $P(A \cup B \text{ but not both}) = \frac{110 + 215 - 24 - 24}{750}$

$= 277/750 = 0.369$

iv) $P(G \mid F) = \frac{64}{220} = 0.291$

v) $P(F \mid G) = \frac{64}{195} = 0.328$

b) $P(DB \cap DB \cap MG) = \frac{92}{750} \times \frac{91}{749} \times \frac{55}{748} = 0.00109\ldots$

But there are 3 ways this can happen

$\rightarrow 3 \times 0.00109\ldots = 0.0032\cancel{8}9$ (3sf)

④ a) i) From calc: $r = 0.91468...$

ii) $r = 0.91468$ as linear scaling does not affect the value of r

b) There is a very strong, positive, linear correlation between average qualifying speed & average race speed.

⑤ a) i) $OH \sim B(30, 0.18)$

$P(OH = 3) = {}^{30}C_3 \times 0.18^3 \times 0.82^{27}$

$= 0.11151$

ii) $H \sim B(30, 0.1)$

$P(H \leq 5) = 0.9268$ (from tables)

iii) $H \sim B(30, 0.35)$

$P(H > 10) = 1 - P(H \leq 10)$

$= 1 - 0.5078 = 0.4922$

iv) $H \sim B(30, 0.25)$

$P(5 < H < 10)$

can be: 6, 7, 8, 9

$= P(H \leq 9) - P(H \leq 5)$

$= 0.8034 - 0.2026 = 0.6008$

b) $H \sim B(150, 0.72)$

Mean $= np = 150 \times 0.72 = 108$

Var $= np(1-p) = 150 \times 0.72 \times 0.28 = 30.24$

⑥ a) i) $a = 15$ as no pressure applied when $x = 0$

ii) From calc: $a = 14.90968...$

$b = -0.02093...$

$\rightarrow y = 14.91 - 0.03x$

~~b)~~ iii) When the pressure increases by 1, the seal depth decreases by 0.03 cm.

b) $x = 225 \rightarrow y = 14.91 - 0.029(225)$

$= 8.37442...$

c) i) 400 is outside the range of the data, so we would be extrapolating.

ii) $x = 525 \rightarrow y = 14.91 - 0.029(525)$

$= -0.33226$

Impossible to have a negative seal depth.

7 a) i) Try 2 standard deviations from mean

$\rightarrow 118 - 2 \times 65 = -12$

We would expect some data here, and yet it is impossible to have negative value.

ii) Sample size > 30, therefore we can apply the Central Limit Theorem.

b) i) $\bar{x} = 118 \quad s = 65 \quad n = 80$

98% z value (two tailed) = 2.3263

$\rightarrow \mu = \bar{x} \pm z \times s/\sqrt{n}$

$\mu = 118 \pm 2.3263 \times 65/\sqrt{80}$

$= 118 \pm 16.9057...$

$= (101, 135)$

ii) 140 lies outside confidence interval.

Therefore the claim seems unlikely to be true.