

Stats 1 - May / June 2013

(1) a) i) From calc: $\bar{x} = 62.25$ $\sum x = 747$
 $s = 17.51946...$

ii) MEAN $\frac{5}{n}(\bar{x} - 32)$
 $= \frac{5}{n}(62.25 - 32) = 16.8055...$

SD $= \frac{5}{n}(s)$
 $= \frac{5}{n} \times 17.51946... = 9.733...$

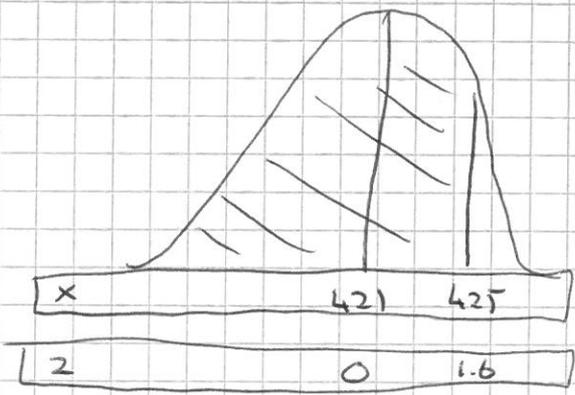
b) $r = 0.997$

The value of r is not affected by linear scaling.

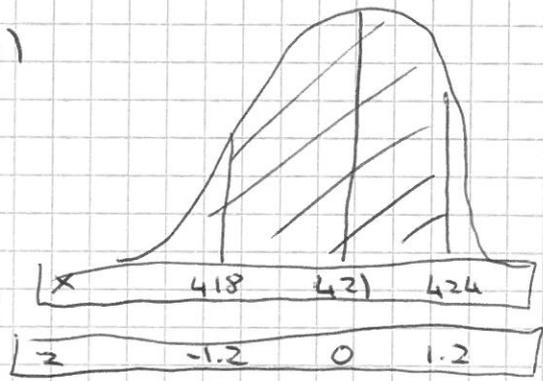
(2) $X \sim N(421, 2.5^2)$

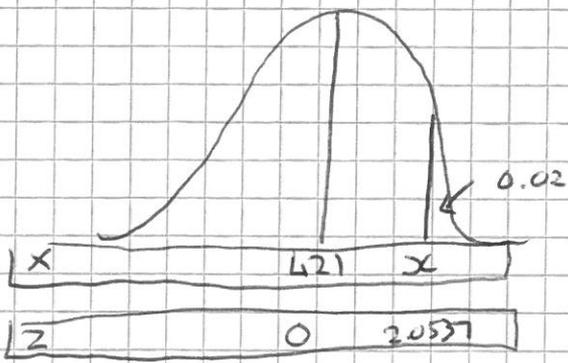
a) i) $P(X = 421) = 0$

ii) $P(X < 425)$
 $= P\left(Z < \frac{425 - 421}{2.5}\right)$
 $= P(Z < 1.6)$
 $= 0.94520$



iii) $P(418 < X < 424)$
 $= P\left(\frac{418 - 421}{2.5} < Z < \frac{424 - 421}{2.5}\right)$
 $= P(-1.2 < Z < 1.2)$
 $= P(Z < 1.2) - P(Z < -1.2)$
 $= P(Z < 1.2) - [1 - P(Z < 1.2)]$
 $= 0.88443 - [1 - 0.88443]$
 $= 0.76886$





$$Z \text{ value for } 0.98 = 2.0537$$

Standardize:

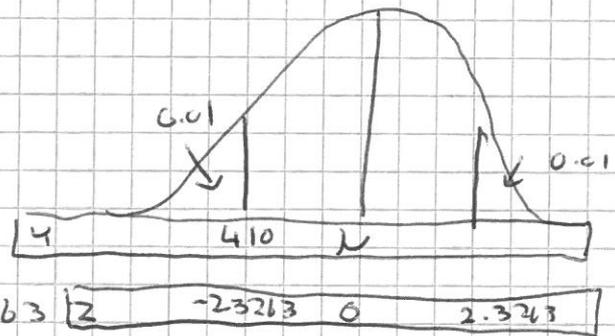
$$\frac{x - 421}{2.5} = 2.0537$$

$$x = 2.5 \times 2.0537 + 421 = 426.13425$$

c) $Y \sim N(\mu, 3^2)$

$$P(Y < 410) = 0.01$$

Look up Z of 0.99
= 2.3263



\therefore Z value we need = -2.3263

Standardize: $\frac{410 - \mu}{3} = -2.3263$

$$410 = -2.3263 \times 3 + \mu$$

$$\mu = 410 + 2.3263 \times 3 = 416.9709$$

③ a) i) $X \sim B(40, 0.15)$

$$P(X \leq 10) = 0.9701$$

ii) $X \sim B(40, 0.5)$

$$P(X \geq 25) = 1 - P(X \leq 24) = 1 - 0.9231 = 0.0769$$

iii) $X \sim B(40, 0.175)$

$$P(X = 2) = {}^{40}C_2 \times 0.175^2 \times 0.825^{38} = 0.0160\dots$$

iv) $X \sim B(40, 0.35)$ [0.85 - 0.5]

$$P(10 < X < 15)$$

can be: 11, 12, 13, 14

$$\therefore P(X \leq 14) - P(X \leq 10)$$

$$= 0.5721 - 0.1215 = 0.4506$$

$$b) \text{ Prob of } 1 = 0.85 - 0.175 = 0.675$$

$$\therefore \text{ Mean} = np = 40 \times 0.675 = 27$$

$$\textcircled{4} \text{ a) i) } r_{gy} = \frac{S_{gy}}{\sqrt{S_{gy} \times S_{yy}}} = \frac{24.15}{\sqrt{0.1196 \times 5880}}$$

$$= 0.91067...$$

$$\text{ii) } r_{ly} = \frac{S_{ly}}{\sqrt{S_{ll} \times S_{yy}}} = \frac{10.25}{\sqrt{0.0436 \times 5880}}$$

$$= 0.64017$$

b) $r_{gy} = 0.91 \rightarrow$ strong positive linear correlation between girth & weight

$r_{ly} = 0.64 \rightarrow$ moderate positive linear correlation between length & weight.

$$\text{c) i) } r_{oxy} = \frac{S_{oxy}}{\sqrt{S_{xx} \times S_{yy}}} = \frac{5662.97}{\sqrt{5656.15 \times 5880}}$$

$$= 0.98196$$

Y is most strongly correlated with X

$$\text{ii) } g = 1.25, \quad l = 1.15$$

$$\rightarrow \hat{y} = 69.3 \times 1.25^2 \times 1.15$$

$$= 124.52$$

$$\text{iii) } b = \frac{S_{oy}}{S_{xx}} = \frac{5662.97}{5656.15} = 1.00121$$

$$a = \bar{y} - b\bar{x} = 116 - 1.00121 \times 115.4$$

$$= 0.46085$$

$$\rightarrow y = 0.46085 + 1.00121x$$

iv) $r_{oxy} = 0.98196 \rightarrow$ very strong positive linear correlation

$$b = 1.00121 \rightarrow \text{very close to } 1$$

$$a = 0.46085 \rightarrow \text{close to } 0$$

\therefore Estimate is very likely to be accurate.

$$\textcircled{5} \text{ a) i) } P(W \cap T) = 0.9 \times 0.95 = 0.855$$

$$\text{ii) } P(W \cap T') = 0.9 \times 0.05 = 0.045$$

$$P(W' \cap T) = 0.1 \times 0.95 = 0.095$$

$$\text{Total Prob} = 0.14$$

$$\text{b) i) } P(A \cap D) = 0.9 \times 0.8 = 0.72$$

$$\text{ii) } P(A_w \cap D_w \cap A_T \cap D_T)$$

$$= 0.72 \times 0.95 \times 1 = 0.684$$

$$\text{iii) } 0$$

$$\text{iv) } P(A_w' \cap D_w' \cap A_T' \cap D_T')$$

$$= 0.1 \times 0.85 \times 0.05$$

$$= 0.00425$$

$$\textcircled{6} \text{ a) } X \sim N(\mu, 0.4^2)$$

$$\bar{x} = \frac{497.5}{25} = 19.9 \quad s = 0.4 \quad n = 25$$

$$98\% \text{ z multiplier (2 tailed)} = 2.3263$$

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

$$\mu = 19.9 \pm 2.3263 \times \frac{0.4}{\sqrt{25}}$$

$$= 19.9 \pm 0.186104$$

$$= (19.714, 20.086)$$

ii) 20 kg lies within our confidence interval
 \therefore no reason to doubt claim

iii) Weight of sand is known to be normally distributed.

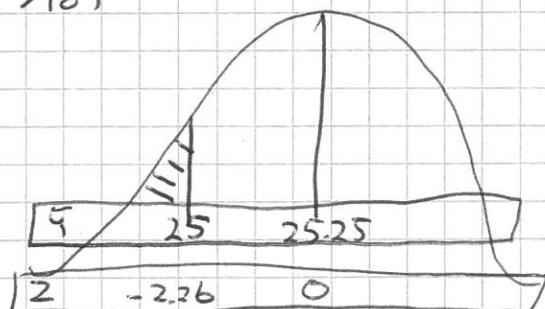
$$\text{b) } Y \sim N(25.25, 0.35^2)$$

$$\bar{Y} \sim N(25.25, \frac{0.35^2}{10})$$

$$P(\bar{Y} < 25)$$

$$= P\left(Z < \frac{25 - 25.25}{\frac{0.35}{\sqrt{10}}}\right)$$

$$= P(Z < -2.25877)$$



$$= P(Z < -2.26)$$

$$= 1 - P(Z < 2.26)$$

$$= 1 - 0.98804 = 0.01191$$

ii) work out 1 first: $(n=1)$

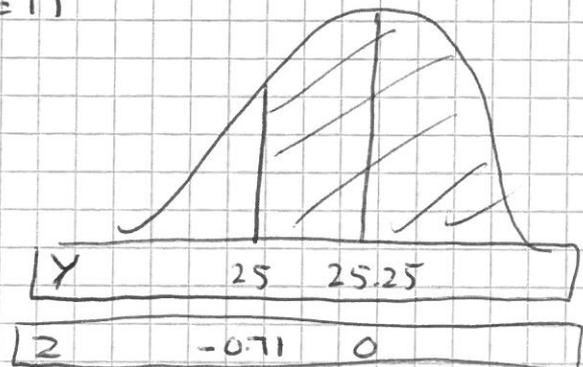
$$P(\bar{Y} > 25)$$

$$= P\left(Z > \frac{25 - 25.25}{0.35}\right)$$

$$= P(Z > -0.71429)$$

$$= P(Z < 0.71)$$

$$= 0.76115$$



Now we need all 10

$$\rightarrow 0.76115^{10}$$

$$= 0.06526...$$