Stats 1 - January 2012

(1) a)

Potatoes	6	7	8	9	10	11	12
CF	2	4	5	9	17	23	27

$\text{Median} = \frac{27+1}{2} = 14\text{th value} = 10$

$LQ = \frac{27+1}{4} = 7\text{th value} = 9$

$UQ = \frac{3(27+1)}{4} = 21\text{st value} = 11$

$\rightarrow IQR = 11 - 9 = 2$

b) Do not group results in the final 2 first classes

(2) a) Weak positive $\rightarrow$ probably correct

b) Above 1 $\rightarrow$ definitely incorrect

c) Negative correlation $\rightarrow$ probably incorrect

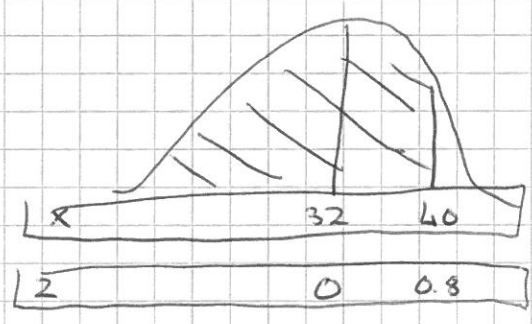
(3) $X \sim N(32, 10^2)$

a) i) $P(X < 40)$

$= P\left(Z < \frac{40-32}{10}\right)$

$= P(Z < 0.8)$

$= 0.78814$



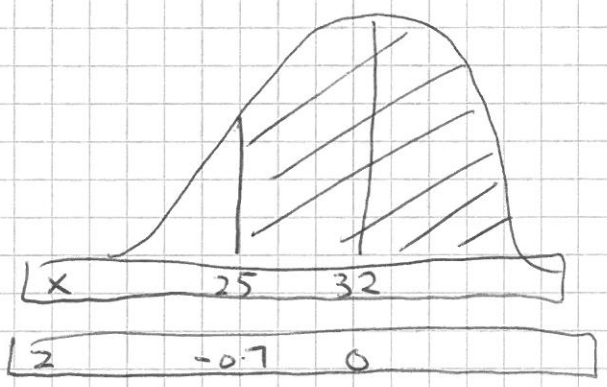
ii) $P(X > 25)$

$= P\left(Z > \frac{25-32}{10}\right)$

$= P(Z > -0.7)$

$= P(Z < 0.7)$

$= 0.75804$



iii) $P(25 < x < 40)$

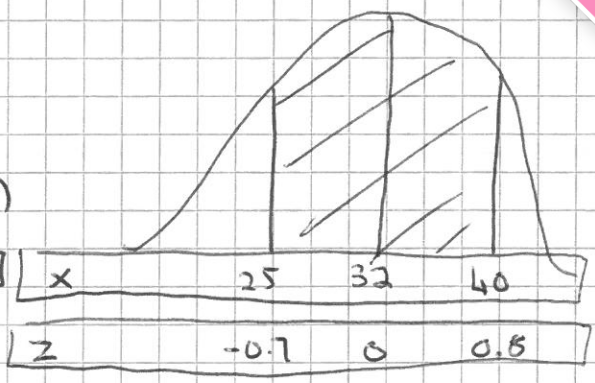
$= P(-0.7 < Z < 0.8)$

$= P(Z < 0.8) - P(Z < -0.7)$

$= P(Z < 0.8) - [1 - P(Z < 0.7)]$

$= 0.78814 - [1 - 0.75804]$

$= 0.546$



b) $P(\text{Bill} > £65) = P(X > {}^{65}/_{1.34})$

$= P(x > 48.5074\ldots)$

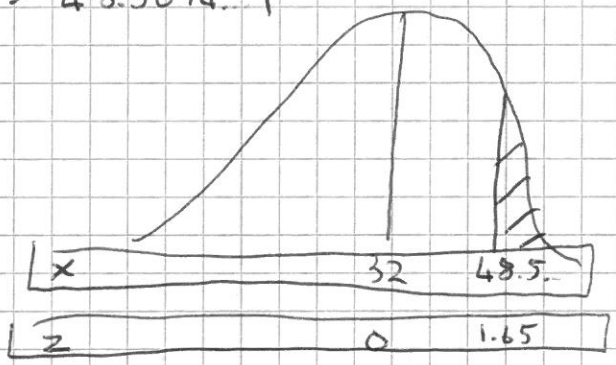
$= P\left(Z > \frac{48.50\ldots - 32}{10}\right)$

$= P(Z > 1.6507\ldots)$

$= P(Z > 1.65)$

$= 1 - P(Z < 1.65)$

$= 1 - 0.95053 = 0.04947$



c) ① Other fuels available, such as Diesel

② Other vehicles, such as lorries

(4) $X \sim B(40, 0.15)$

a) i) $P(X = 60) = {}^{40}C_6 \times 0.15^6 \times 0.85^{34}$

$= 0.174156\ldots$

ii) $P(X \leq 5) = 0.4325$ (from table)

iii) $P(5 < x < 10)$

can be: 6, 7, 8, 9

$= P(x \leq 9) - P(X \leq 5)$

$= 0.9328 - 0.4325$

$= 0.5003$

b) $X \sim B(32, 0.15)$

mean $= np = 32 \times 0.15 = 4.8$

var $= np(1-p) = 32 \times 0.15 \times 0.85 = 4.08$

SD $= \sqrt{4.08} = 2.01990...$

c) From calc: $\Sigma x = 77$, $\Sigma x^2 = 609$

$\bar{x} = 7.7$, $s = 1.337...$

MEAN Sample mean is bigger ($7.7 > 4.8$)

SD Sample sd is smaller ($1.337 < 2.0190...$)

$\therefore$ model appears unsuitable.

(5) a) calorific depends on moisture levels

b) From calc: $a = 5.3538...$ (intercept)

$b = -0.07582...$ (gradient)

$\rightarrow y = 5.3538 - 0.07582x$

c) a calorific value when no moisture / dry

b each 1% increase in moisture leads to 0.76 MWh/tonne decrease

d) $x = 27 \rightarrow y = 5.3538 - 0.07582(27)$

$= 3.30666...$

e) Actual $= 2.5$

Predicted $= y = 5.3538 - 0.07582(33)$

$= 2.7001$

Residual $=$ Actual $-$ Predicted

$= 2.5 - 2.7001 = -0.2$

f) Small residuals $\rightarrow$ reasonable accuracy.

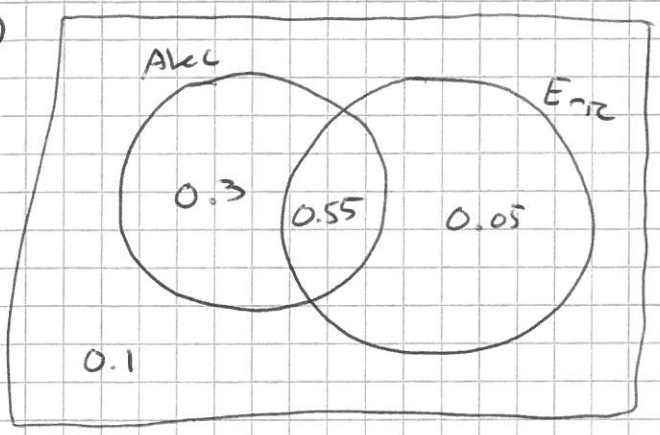
g) i) Outside the range of the observed data (x)

ii) $x = 80 \rightarrow y = 5.3538 - 0.07582(80)$

$= -0.71118$

calorific value cannot be negative.

(6)



a) i) $P(A' \cap E') =$

ii) $P(A \cap E) = 0.4$

iii) $P(\text{Just 1}) = 0.3 + 0.05 = 0.35$

b) i) $P(A \cap \bar{E} \cap C) = 0.55 \times 0.3 = 0.165$

ii) $P(A, \bar{E}, C') = 0.55 \times 0.7 = 0.385$

$P(A, E', C) = 0.3 \times 0.75 = 0.225$

$P(A', \bar{E}, C) = 0.05 \times 0.75 = 0.0375$

$P(A, \bar{E}, C) = 0.165$

0.8212 or $13/16$

(7) a) i) $\bar{x} = \frac{\Sigma x}{n} = \frac{2290}{50} = 45.8$

$s^2 = \frac{\Sigma (x - \bar{x})^2}{n-1} = \frac{28225.50}{49} = 576.0306...$

$\rightarrow s = \sqrt{576.03...} = 24.00625...$

ii) mean $-$ 2 $\times$ sd should still have data

$\rightarrow 45.8 - 2(24.0...) = -2.2$

Negative, and impossible to have negative salaries.

b) i) sample size > 30, so because of Central Limit Theorem.

ii) $\bar{x} = 45.8$, $s = 24.00$, $n = 50$

99% multiplier (2 tailed) $= 2.5758$

$\mu = \bar{x} \pm 2 \times s/\sqrt{n}$

$\mu = 45.8 \pm 2.5758 \times 24/\sqrt{50}$

$\mu = 45.8 \pm 8.7425...$

$\mu = (37.06, 54.54)$ £ thousands.

c) Average > £55k : £55k lies outside of the confidence interval.

∴ reject this claim

25% > £60k : From sample, 6/50 earn more than £60k, = 12%

∴ reject this claim