Stats 1 - January 2005

(1) a) 1/ Weak positive correlation: takings seem to increase as temperature increases

2/ One outlier / unusual result

b) Monday 10 : (4, 312)

c) From calculator : $\sum x = 71$

$r = 0.8177070...$

d) The weather : ie, if it is raining or not.

(2) a) From calculator:

$\bar{x} = 152.5 \qquad \sigma = 3.5 \qquad n = 12$

98% z multiplier (2 tailed) = 2.3263

$\therefore \quad \mu = \bar{x} \pm z_m \times \frac{\sigma}{\sqrt{n}}$

$\mu = 152.5 \pm 2.3263 \times \frac{3.5}{\sqrt{12}}$

$= 152.5 \pm 2.3504...$

$= (150.15, \ 154.85)$

b) Confidence Interval: 150 ml is below the range of the CI → mean volume is above 150 ml

Sample: 4/12 or 25% have volumes below 150 ml

$\therefore$ claim does not appear to be valid.

c) We know the volume is normally distributed.

(3) a) See Mark Scheme

b) From calculator: $a = 14.336283...$ (intercept)

$b = 7.500884...$ (gradient)

$\rightarrow y = 14.34 + 7.50x$

x	0	25
y	14.3	201.9

See mark scheme for graph

c) i) $x = 15 \rightarrow y = 14.34 + 7.5(15)$

$= 126.9$ (1dp)

reliable as data in observed range.

ii) $x = 35 \rightarrow y = 14.34 + 7.5(35)$

$= 276.9$ (1dp)

unreliable as 35 is outside observed range.

d) a = intercept = time to travel from area to/from depot

b = gradient = time to deliver each/one parcel

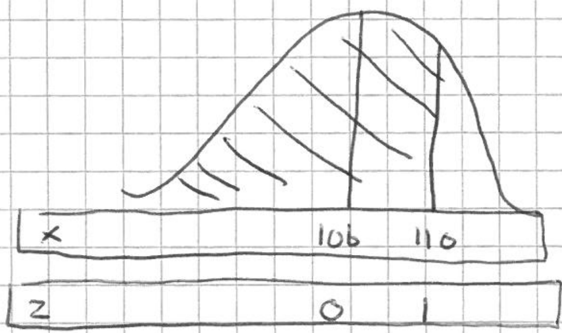
4) a) $X \sim N(106, 4^2)$

i) $P(X < 110)$

$= P\left(Z < \frac{110 - 106}{4}\right)$

$= P(Z < 1)$

$= 0.84134$



ii) $= P(X < 100)$

$= P\left(Z < \frac{100 - 106}{4}\right)$

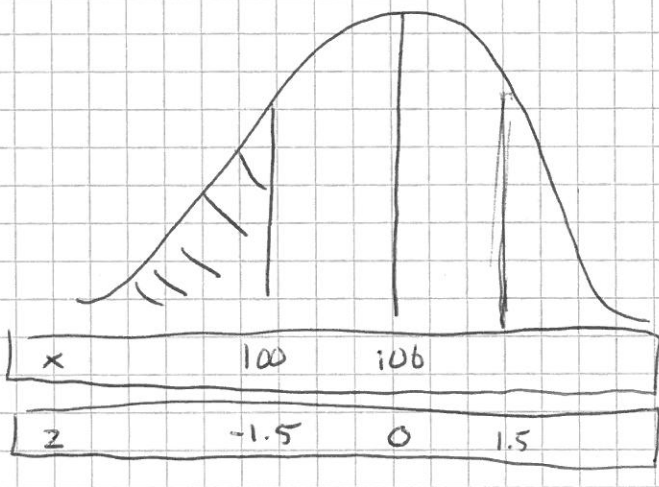
$= P(Z < -1.5)$

$= P(Z > 1.5)$

$= 1 - P(Z < 1.5)$

$= 1 - 0.93319$

$= 0.06681$

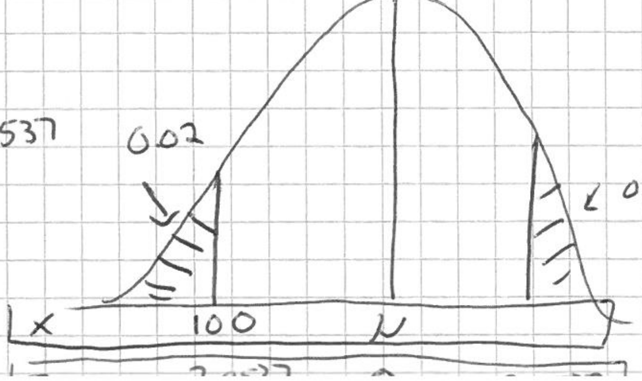


b) $X \sim N(\mu, 4^2)$

$P(X < 100) = 0.02$

Look up 0.98 → Z value of 2.0537

→ −2.0537



Standardise:

$$P\left(Z < \frac{100 - \mu}{4}\right) = 0.02$$

$$\Rightarrow \frac{100 - \mu}{4} = -2.0537$$

$$100 - \mu = -8.2148$$

$$\mu = 100 + 8.2148$$

$$= 108.2148$$

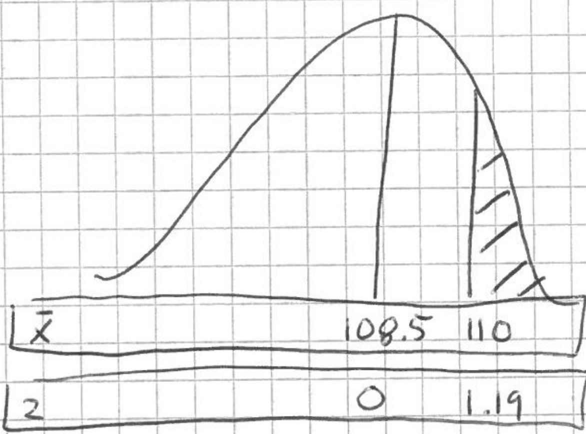
c) $\bar{X} \sim N(108.5, \; 4^2/10)$

i) Mean $= 108.5$

Variance $= 4^2/10 = 1.6$

ii) $P(\bar{X} > 110)$

$$= P\left(Z > \frac{110 - 108.5}{4/\sqrt{10}}\right)$$



$$= P(Z > 1.19)$$

$$= 1 - P(Z < 1.19)$$

$$= 1 - 0.88298 = 0.11702$$

5) a) $W \sim B(7, 0.4)$

i) $P(W \leq 2) = 0.4199$ (from tables)

ii) $P(1 < W < 5)$

can be: 2, 3, 4

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

$$= 0.9037 - 0.1586 = 0.7451$$

b) $W \sim B(28, 0.4)$

$$P(W = 7) = {}^{28}C_7 \times 0.4^7 \times 0.6^{21}$$

$$= 0.042556\ldots$$

c) Mean $= np = 7 \times 0.4 = 2.8$

Variance $= np(1-p) = 7 \times 0.4 \times 0.6 = 1.68$

$\rightarrow$ sd $= \sqrt{1.68} = 1.2961...$

d) i) From Calculator:

$\bar{x} = 2.8$

$s = 2.267786...$

$\Sigma x = 140$

$\Sigma x^2 = 644$

ii) Means are the same $\rightarrow$ support belief that probability $= 0.4$

sd are very different $\rightarrow$ does not support belief that probabilities are independent.

(6) a) Totals: 64, 644, 946, 710, 944 : Grand = 1654

i) $P(F) = 944/1654$

ii) $P(F \cap A) = 275/1654$

iii) $P(F \cup A) = \frac{944 + 369}{1654} = \frac{1313}{1654}$

iv) $P(F \mid A) = \frac{P(F \cap A)}{P(A)} = \frac{275}{1654} \div \frac{644}{1654}$

$= \frac{275}{644}$

b) i) $P(3M) = \frac{710}{1654} \times \frac{709}{1653} \times \frac{708}{1652} = 0.07890...$

ii) $P(FFM) = \frac{944}{1654} \times \frac{943}{1653} \times \frac{710}{1652}$

$= 0.13993...$

There are 3 arrangements of FFM

$\rightarrow 3 \times 0.13993 = 0.41980...$

c) i) $F \cap A$ Female and Academic

$F' \cup A$ Male, or Academic or both.