

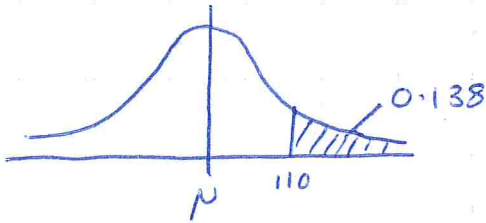
Statistics 8 - Normal distribution (Hypo testing)

Section 1

1, $B \sim N(\mu, 7.2^2)$ $P(B > 110) = 0.138$

$$p = 1 - 0.138 = 0.862$$

$$z = 1.0893$$

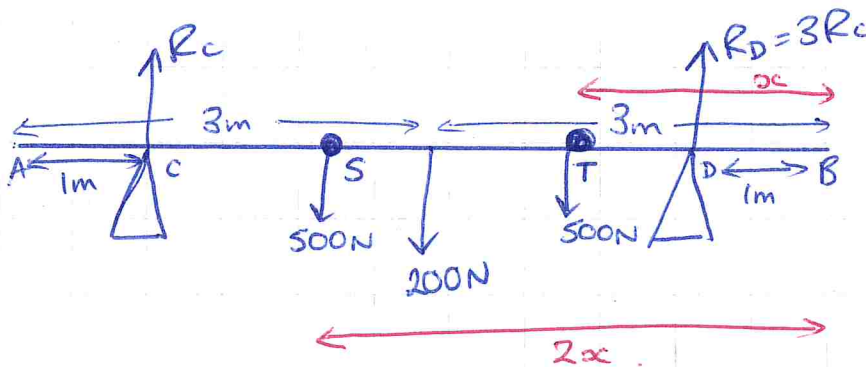


$$z = \frac{x - \mu}{\sigma}$$

$$1.0893 = \frac{110 - \mu}{7.2}$$

$$\underline{\underline{\mu = 102.2}}$$

2,



Resolving forces $R_c + R_D = 500 + 200 + 500$

$$R_c + 3R_c = 1200$$

$$4R_c = 1200$$

$$R_c = 300\text{N} \quad \therefore R_D = 900\text{N}$$

Moments about B

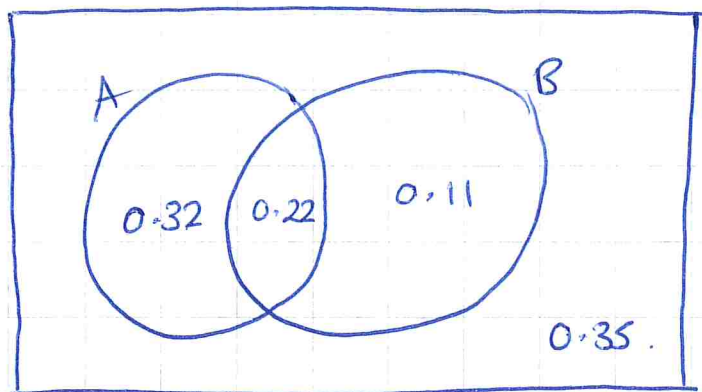
$$\begin{aligned} 1 \times R_D + 5 \times R_c &= 500 \times x + 200 \times 3 + 500 \times 2x \\ 900 + 1500 &= 500x + 600 + 1000x \end{aligned}$$

$$1800\text{N} = 1500x$$

$$\underline{\underline{x = 1.2\text{m}}}$$

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3, a,



$$0.65 - 0.32 - 0.11 = 0.22$$

b, $P(A) = 0.54$, $P(B) = 0.33$

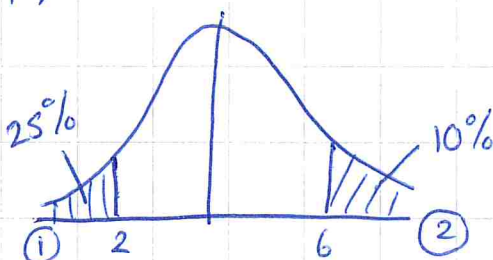
c, $P(A|B') = \frac{P(A \cap B')}{P(B')} = \frac{0.32}{0.67} = \underline{0.4776} = \frac{32}{67}$

d, If A & B are independent $P(A|B') = P(A)$

$$0.4776 \neq 0.54 \quad \therefore \underline{\text{not indep.}}$$

(or $P(A \cap B) = P(A) \cdot P(B)$
 $0.22 \neq 0.54 \times 0.33$
 $0.22 \neq 0.1782$
 $\therefore \text{not indep.}$)

4,



① $x=2, p=0.25, z = -0.6745$

$$-0.6745 = \frac{2 - \mu}{\sigma}$$

$$-0.6745\sigma = 2 - \mu$$

$$\textcircled{2} \quad X = 6, \quad p = 0.9, \quad z = 1.2816$$

$$1.2816 = \frac{6 - \mu}{\sigma}$$

$$\textcircled{2} \quad 1.2816 \sigma = 6 - \mu$$

$$\textcircled{1} \quad \frac{-0.6745 \sigma = 2 - \mu}{1.9561 \sigma = 4}$$

$$\underline{\underline{\sigma = 2.045}}$$

Sub into $\textcircled{2} \quad 1.2816 \times 2.045 = 6 - \mu, \quad \underline{\underline{\mu = 3.38}}$

b, $X \sim N(3.38, 2.045^2)$

$$P(X < 1) = 0.1222 = 12.2\%$$

c, The percentage predicted by the model is a lot larger than the observed percentage, so this suggests the Normal distribution is not a great Model in this situation

Section 2

1, $H_0: \mu = 80, \checkmark$
 $H_1: \mu > 80, \checkmark$

$$\bar{X} \sim N(80, \frac{15^2}{100}) \quad (\sigma = 1.5)$$

$$P(X > 83) = 0.02275 = 2.275\% \checkmark$$

$2.275\% < 5\% \therefore$ Reject H_0, \checkmark
 There is evidence to support the managers claim \checkmark

Alternatively

Critical value $= 1.645$
 $\frac{2}{2} = 2 \quad 5\%$

$\textcircled{2} > 1.645$
 \therefore Reject $H_0,$
 There is evidence to support the managers claim.

2,

$$W \sim N(\mu, 20.25)$$

$$H_0: \mu = 50$$

5% level

2 tailed test

$$H_1: \mu \neq 50$$

$$\Downarrow$$

 2.5%

$$\bar{W} \sim N(50, \frac{20.25}{81})$$

$$\sigma = 0.5$$

$$p = 2.5\%$$

$$z = -1.95$$

$$p = 97.5\%$$

$$z = 1.95$$

$$-1.95 = \frac{W - 50}{0.5}$$

$$W = 49.025$$

$$1.95 = \frac{W - 50}{0.5}$$

$$W = 50.975$$

Critical region \Rightarrow

$$\underline{\underline{\bar{W} \leq 49.025}}$$

 (or $<$)

$$\underline{\underline{\bar{W} \geq 50.975}}$$

 (or $>$)

3,

$$U \sim N(\mu, \sigma^2)$$

$$H_0: \mu = 50$$

1% , 1 tailed test.

$$H_1: \mu > 50$$

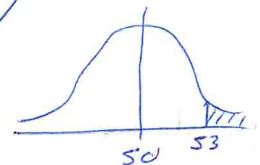
n = 10

$$\bar{U} \sim N(50, \frac{\sigma^2}{10})$$

$$\sigma = \frac{\sigma}{\sqrt{10}}$$

Sample mean = 53 \rightarrow H_0 is not rejected

$$\text{So } P(U > 53) > 1\%$$



Critical value for 1%

$$\text{is } z = 2.326$$

So if the z value of 53 is less than 2.326 then H_0 is not rejected.

$$2.326 > \frac{53 - 50}{\frac{\sigma}{\sqrt{10}}}$$

$$\underline{\underline{\sigma > 4.08}}$$

$$4, \quad n=4 \quad \bar{X} \sim (500, \frac{100^2}{4}) \quad \bar{X} = 435$$

10% level
1 tailed test

$$H_0: \mu = 500 \quad \checkmark$$

$$H_1: \mu < 500 \quad \checkmark$$

$$\sigma = 50 \quad \checkmark$$

$$P(X < 435) = 0.0968 \quad \checkmark = 9.68\% < 10\% \quad \checkmark$$

\therefore Reject H_0 , \checkmark there is evidence that the no. of visitors has decreased.

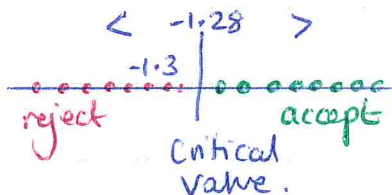
Alternative method (using critical values)

$$z = \frac{435 - 500}{50} = -1.3$$

$$10\% \text{ level} \Rightarrow \text{Critical value} = -1.28$$

$$-1.3 < -1.28$$

So Reject H_0 .



Total = 23 marks

