2/12/2025

Assignment - 2

Soham N

1) b) H_0: The new relaxation app does not reduce the average resting heart rate

H_1: The new relaxation app reduces the average resting heart rate

c) Standard error $= \frac{\sigma}{\sqrt{n}}$

$\sigma = 10$ bpm $\quad n = 64$

Standard error $= \frac{\sigma}{\sqrt{n}}$

Standard error $= \frac{10}{\sqrt{64}}$

Standard error $= \frac{10}{8}^{5}_{4}$

Standard error $= 1.2$ (Approx)

d) Z-Score, $Z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$

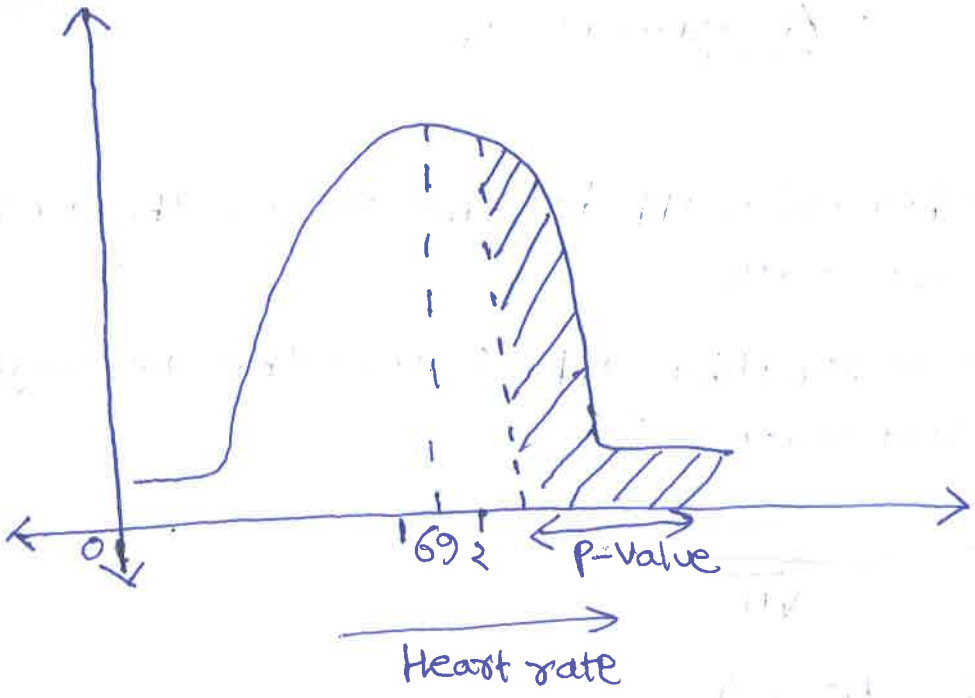
$\frac{\sigma}{\sqrt{n}} = \frac{5}{4}$ $\quad \bar{x} = 72$ bpm $\quad \mu = 69$ bpm

$Z = \frac{72 - 69}{\frac{5}{4}}$

$Z = \frac{3}{\frac{5}{4}}$

$$\boxed{Z = \frac{12}{5} = 2.4}$$

e)



a) Population mean = 72 bpm

Sample mean = 69 bpm

2) $$P(A|B) = \frac{P(A)\,P(B|A)}{P(B|A)P(A) + P(B|A^c)P(A^c)}$$

$$P(B) = P(B|A)\,P(A) + P(B|A^c)\,P(A^c)$$

Let A be the spam message and A^c be the non-spam message and B is the filter

(i) P(A) is the prior in the above equation.

$$P(A) = \frac{20}{100} = \frac{2}{10} = \frac{1}{5}$$

$$P(A) = \frac{1}{5}$$

b) P(A|B) is the posterior probability in the above equation. Posterior is being the Product prior and evidence factor.

$$\text{Evidence factor} = \frac{P(B|A)}{P(B)} = \frac{P(B|A)}{P(B|A)P(A) + P(B|A^c)P(A^c)}$$

c) Since P(A|B) is final probability from the expression given in question then P(A|B^c) will be it's compliment so that when P(A|B) and P(A|B^c) adds up it gives 1 as total Probability.

$$P(A) = \frac{1}{5}$$

$$P(A^c) = 1 - \frac{1}{5} = \frac{4}{5}$$

$$P(B|A) = 0.9$$

$$P(B|A^c) = 0.05$$

~~b) The posterior probability will be higher depending upon evidence factor. Based on that~~

d) The posterior probability will be higher than Prior. Reason is that ~~Bigmulti~~ Prior multiplies with evidence factor.