University of Pennsylvania

BIOL4536 Fall 2023

Professor: Gregory R. Grant

QUIZ#1 (SOLUTIONS)

(Hypothesis Testing / Regression)

Question 1. (2 pts.) p-values control the probability of:
(Circle One)

(A) False Negatives
(B) False Positives ⟵ **THIS ONE**
(C) True Negatives
(D) True Positives

Question 2. (1 pt.) If testing for disease X, which of the following is the False Positive Rate?

(A) Prob(test positive $|$ not infected) ⟵ **THIS ONE**
(B) Prob(not infected $|$ test positive)

Question 3. (2 pts.) If testing for disease X in a population where nobody is infected, what is the following probability?

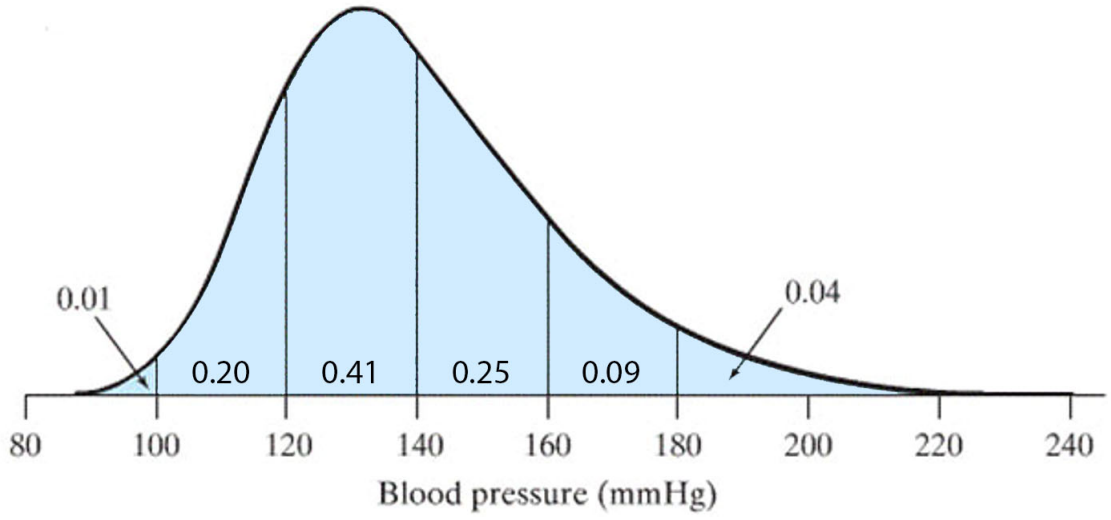
$$\text{Prob}(\text{infected} \,|\, \text{test positive})$$

Answer: Zero. Somebody cannot be infected no matter how they test, since nobody in the population is infected.

Question 4. (1 pt.) Suppose you randomly sample a person from a population and measure their blood pressure. Suppose that random quantity is given by the probability density $f(x)$ shown in the figure below (x = blood pressure).
Calculate the following integral and interpret it in words. Specifically, what does it say about the population?

$$\int_{120}^{\infty} f(x)dx$$

ANSWER: Sum the areas where the x-axis is greater than 120, to get $\int_{120}^{\infty} f(x)dx = 0.41+0.25+0.09+0.04 = 0.79$. This means that 79% of the population has blood pressure greater than or equal to 120.



Question 5. (1 pt.) True or False. A linear regression model must have a regression curve that is a straight line.

ANSWER: False.

Question 6. (2 pt.) Circle the one correct statement about the regression model $Y = \beta_0 + \beta_1 X + \epsilon$. The word "constant" here means "does not depend on X".

(A) ϵ has constant variance 0

(B) ϵ has constant mean 0 ⟵ **THIS ONE**

(C) ϵ has constant mean σ

Question 7. (1 pt.) Draw a line from the statement on the left to the relevant graph on the right.

Small σ, large β_1

Large σ, small β_1