1. Sign: Bohao Zou

2, The probability histogram of $X$ is incorrect.

$Y$ is correct.

This is because this is a probability histogram, the probability of some value can not exceed 1.

3. $A$ = disease occuring

$B$ = test positive

$P(B|A) = 0.85$

$P(\bar{B}|\bar{A}) = 0.92$

$P(A) = 0.31$

$P(A|B) = ?$

$P(B|\bar{A}) = 1 - 0.92 = 0.08$

$P(B) = P(B|A) \cdot P(A) + P(B|\bar{A}) \cdot P(\bar{A})$

$= 0.85 \cdot 0.31 + 0.08 (1 - 0.31)$

$= 0.3187$

$$P(A|B) = \frac{P(AB)}{P(B)} = \frac{P(B|A) \cdot P(A)}{P(B)}$$

$$= \frac{0.85 \cdot 0.31}{0.3187} = 0.8268$$

4. P-value represents the probability of some event, assuming the null hypothesis is true.

A small p-value tells me we tend to reject the null hypothesis.

A big p-value tells me we tend to not reject the null hypothesis.

5. $Var(X+Y) = Var(X) + Var(Y) + 2Cov(X,Y)$

we do not have enough information to compute $var(X+Y)$.

This is because we do not know if the X, Y are independent or not, if X and Y are not independent, we also need to know the value of $Cov(X,Y)$.

6. estimator : $\hat{p}$

Estimator $\hat{p}$ is estimated by samples that randomly selected from population, From this we can know a sample "$X_i$" must obey one distribution "D". we can write as $X_i \sim D$. By this we can know Var($X_i$).

Because estimator $\hat{p}$ is estimated by samples "$X_i$" and we know the variance of "$X_i$", so we can have the ☆ standard error of $\hat{p}$ ☆. It can be exactly calculated and is a fixed value.

However, the estimated standard error of $\hat{p}$ is an estimated value of standard error of $\hat{p}$. It will change if we calculated by different samples.

7. Joint Probability is a probability for two or more events occurring. For continuous r.v X and Y, we can write the joint probability as:

$$P((X,Y) \in A) = \iint_A f_{xy}(x,y)\,dx\,dy.$$

where "A" is the area and $f_{xy}(x,y)$ is the Joint density function.

we can compute marginal probability from Joint probability:

$$P(X < x) = \int_{-\infty}^{x} \int_{-\infty}^{+\infty} f_{xy}(u,y)\,dy\,du.$$

$$f_x(x) = \int_{-\infty}^{+\infty} f_{xy}(x,y)\,dy.$$

$$f_y(y) = \int_{-\infty}^{+\infty} f_{xy}(x,y)\,dx$$

So, marginal probability is a probability of an event X or Y occurring. It is a unconditional probability.