Short Questions

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Question 1

1/1 point (graded)

You realize your wallet is missing. You have either left in the office or at a friends' place. It seems very likely, say 80% likely, that your friend would have texted you by now if you had left it at her place. You know it is unlikely, (say 5% probability), that someone in the office would have tracked you down by now if you had lost it there. You have not been contacted.

What other information do you need in order compute the probability that you left it in the office? (Select all that apply)

- [ ] a. the conditional probability that you left it at your friends.
- [ ] b. the conditional probability that you left it in the office.
- [x] c. the prior probability that you left your wallet at your friends.
- [x] d. the prior probability that you left your wallet in the office.
- [ ] e. None of the above.

Explanation

We want to find the probability that the phone was lost at the office conditional on not having received a phone call, $P(O|Call^C)$. By Bayes rule:

$$P(O|Call^C) = \frac{P(Call^C|O)P(O)}{P(Call^C|O)P(O)+P(Call^C|F)P(F)}$$

where we know $P(Call^C|O) = 1 - P(Call|O) = 0.2$ and $P(Call^C|F) = 1 - P(Call|F) = 0.95$ Hence, we would need $P(O)$ and $P(F)$. Which are the prior probabilities that you left the wallet in the office, and at your friends' place, respectively.

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Correct (1/1 point)

Question 2

1.0/1.0 point (graded)

True or False? The Poisson distribution is a special case of the exponential distribution.

- a. True

b. False ✔

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Question 3

1/1 point (graded)

Consider a $\mathcal{B}(n,p)$ and a $\mathcal{H}(A,B,n)$ where $p = A/(A+B)$. Which of the following statements is true? (Select all that apply)

- [ ] a. The variance of the binomial is always smaller than the variance of the hypergeometric.
- [x] b. The variance of the hypergeometric is always smaller than or equal to the variance of the binomial.
- [ ] c. The relative sizes of the variances depend on the choice of n and p.
- [ ] d. The variance of the binomial is always smaller than or equal to the variance of the hypergeometric.

✔

Explanation

Let $X \sim B(n,p)$. Then, $V(X) = np(1-p)$. When $p = \frac{A}{A+B}$, $V(X) = n\frac{AB}{(A+B)^2}$.

Let $Y \sim H(A,B,n)$. Then, $V(Y) = n\frac{AB}{(A+B)^2}\frac{A+B-n}{A+B-1}$. Hence $V(X) > V(Y) \iff 1 > \frac{A+B-n}{A+B-1}$.

But this is always true. Hence the variance of the hypergeometric is always smaller than the variance of the binomial, unless $n = 1$, in which case they are equal.

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✔ Correct (1/1 point)

Question 4

1/1 point (graded)

True or False? Knowing the distribution of the test statistic under the null allows you to calculate α and β.

- a. True
- b. False ✔

Explanation

Recall, knowing the distribution of the test statistic under the null allows you to calculate α (the probability of a type I error), but does not allow you to compute β.

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✔ Correct (1/1 point)

Question 5

1/1 point (graded)

Suppose that judges can decide to whom they give a GPS bracelet to when individuals who have been arrested for a crime are released on bail (pending judgement).

Separately, a researcher runs an RCT for the impact of bracelets: people who are released on bail are randomly assigned to recieve a bracelet or not. She finds that the bracelet reduces the probability of committing a crime while on bail by 5 percentage points (and this difference is significant).

Another researcher obtains a separate data set on the regular program (where the judge can decide whether or not to give the bracelet), that has many variables about the people who were arrested (including whether or not they were given a bracelet when released), and runs a machine learning algorithm to find out what predicts whether someone will commit a crime while on bail.They find that the bracelet tends to predict **greater** recidivism (recidivism means relapse into criminal behavior)

This implies that one of the two studies must be incorrect.

- a. True
- b. False ✔

Explanation

Machine learning is concerned with prediction, whereas the RCT is concerned with causal estimation. Since judges probably give out the bracelets to individuals who are more likely to be arrested for crime, the machine learning algorithm could be picking that up.

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✔ Correct (1/1 point)