

CSE 312 : Practice Quiz 2 (Version 1)

Name:

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Instructions

- You have twenty minutes to complete this exam.
- You are permitted one piece of 8.5x11 inch paper with handwritten notes (notes are allowed on both sides of the paper). You should also get a provided formula sheet (in section it'll be on different colored paper separate from the exam; if you take the exam with DRS it will be the last page of your exam).
- You may not use a calculator or any other electronic devices during the exam.
- We will be scanning your exams before grading them. Please write legibly, and avoid writing up to the edge of the paper.
- If you run out of room, you may also use the last page for extra space, but tell us where to find your answer if it's not right below the problem.
- Since you don't have a calculator, you are generally free to **not** simplify expressions (though you may if you think it will be helpful).
- In general, you should show us the work you used to get to an answer, and explanations will help us reward partial credit, but we do **not** expect explanations at the level we usually require on homeworks.

Advice

- Writing a few words about where an expression came from is often very helpful for awarding partial credit.
- Remember to take deep breaths.

Question	Max points
Independence	10
Bayes	15
Total	25

1. Independence

Consider the following silly experiment. You flip a (fair) coin. If it comes up heads, you roll a (fair) 6-sided die. If it comes up tails, you roll a (fair) 4-sided die.

Let H be the event “the coin comes up heads.”

Let S be the event “the die shows a 6.”

Let O be the event “the die shows a 1.”

- (a) Are H and S independent? Fill in the appropriate circle **and** do an appropriate calculation to justify your answer. **Be sure to tell us what you’re calculating with notation, e.g., $\mathbb{P}[X|Y]$.** [4 points]

- H and S are independent.
 H and S are **not** independent (i.e., they are dependent).

- (b) Are H and O independent? You do not need to show us a calculation for this part. [3 points]

- H and O are independent.
 H and O are **not** independent (i.e., they are dependent).

- (c) Are S and O independent? You do not need to show us a calculation for this part. [3 points]

- S and O are independent.
 S and O are **not** independent (i.e., they are dependent).

2. (Bayes) Check this box to say you're a human [17 points]

You are designing a CAPTCHA system (a system that checks that users are humans, rather than bots). You know that 80% of the submissions to your system come from bots. If a submission comes from a bot, the bot fails the test 99% of the time; while humans pass the test 75% of the time.

Let H be the event the submission comes from a human, B be the event the submission comes from a bot. Let P be the event the test is passed, and F be the event the test is failed.

- (a) Give the notation and fill in the value for “the probability a test is failed, given that the submission came from a human.” **be sure to fill in both blanks.** [4 points]

$$\mathbb{P}(\text{_____}) = \text{_____}$$

- (b) What is the probability a test is failed? [4 points]

- (c) You wish to ban the IP addresses of submitters that you think are bots, but you want to be sure they're really bots. What is the probability a submission came from a bot, given that the test failed. [4 points]
You may use b to represent “the correct answer from part b”

- (d) Suppose that a human gets frustrated after failing a test once, and so when you show the same human a second test, they have only a 50% change of succeeding. What is the probability of a human failing two consecutive tests? [3 points]