Cors 236 test 2   32 questions, 3 pages

Answer every question (1-32) with a single letter. If not specified otherwise, assume

A = True/yes   B =False/no

If any part of a question/option is wrong, treat the entire question as wrong, but in some cases you must pay attention to whether a true statement also answers the question. *Italicized phrases and sentences are true.*

Random

1. (2 pts) Representative versus probability. The following set of options specifies sequences of heads and tails in 7 or 8 consecutive coin flips (option A specifies 7 flips, the others 8). Which specific sequence of heads and tails is the most probable, assuming a fair coin (probability of heads = 0.5)? This question refers to the specific sequence given by each option.
key: H = heads, T = tails

A) H   H   H   H   H   H   H
B) T   T   T   T   T   T   T   T
C) H   T   H   T   H   T   H   T
D) T   H   H   T   H   T   T   T
E) H   H   H   H   H   H   H   H

one answer: (A)   (B)   (C)   (D)   (E)   or

option (F): At least 2 sequences are tied for the most-probable outcome.

2-5 (4 pts) Regression. You are a student whose average performance in a class is B, but 20% of your tests get an A, 60% get a B, and 20% get a C. We'll suppose there are 30 tests in the course – lots. Your teacher praises you when you get an A, admonishes you when you get a C, and says nothing when you get a B. What is the likely pattern of your exam grade and her praise/admonishment if your exam performance is purely random (subject to the probabilities above)? Choose all that are correct. For some options, you need to think beyond the specific cases discussed in class.   (A) = True, (B) = false

2 (A)(B) Her praise of an A will most often be followed by you getting a B or C on the next exam – your next score will usually go down.

3(A)(B) Her admonishment of a C will most often be followed by you getting an A or B on the next exam – your next score will usually go up.

4 (A)(B) Your getting an A will most often have been *preceded* by you getting a B or C on the previous exam – you will usually have gotten something worse than an A immediately before.

5 (A)(B) Your getting a C will most often have been *preceded* by you getting an A or B on the previous exam – you will usually have gotten something better than a C immediately before.

6-7 (2 pts) Clustering/multiple comparisons. You and two of your friends (Joe, Mary) sort through health records from 1,000 rural counties across the US. Each county is analyzed separately of the others. You are looking for clusters of miscarriages in each county that might reflect an environmental/pollution cause of maternal-fetal rejection. (A cluster is the occurrence of several cases in one county over a short period of time.) Clusters are expected to be rare.
You want to avoid counting clusters that would happen by chance, so you set a 0.2% statistical threshold for a cluster to be meaningful – meaning that a cluster that large would be expected by random chance only 0.2% of the time (1 out of 500). If you find such a statistically 'improbable' cluster, then you will claim it is meaningful – that it reflects some underlying environmental or polluted cause.
All three of you use the same methods in searching for clusters, but you are more energetic in your work than are your two friends. You analyze the data from each of 500 counties, your friend Joe analyzes only 200 counties and Mary analyzes 300. Which are true about what is expected?

6 (A)(B) It is expected that, after analyzing all 1000 counties, you and your friends will find a couple clusters that attain your 0.02% threshold yet arose purely by chance – that have no environmental cause.

7 (A)(B) You are likely to discover the most clusters, Mary the next most, and Joe the least. These expectations hold regardless of whether the clusters are real or random.

Models – general (where needed, goals are <u>underlined)</u>

8-12 (4 pts) The AMES test is used to <u>identify chemicals that might cause cancer in people if people were to eat them</u>. The AMES test mixes the chemical of interest with bacteria, plates the bacteria on a petri dish, and then looks at whether the bacteria show an elevated mutation rate. (*Mutations are changes in DNA, and an elevated mutation rate in humans would probably lead to increases in cancer, at least in the long term.*) Any chemical that raises the bacterial mutation rate is then considered likely to also raise the human mutation/cancer rate and is excluded from further consideration for human consumption. Bacteria are used instead of mice or humans, because vast numbers of bacteria can be tested fast – in as little as a day.

Which are true about the models here?

(A) = True, (B) = false

8 (A)(B)   This use of the AMES test treats the bacteria as models of humans.

9 (A)(B) The bacteria are considered abstract models because they have so little in common with humans.

10 (A)(B) Although the bacteria are so different from humans, they are nonetheless considered **accurate** models for this goal because we can measure the mutation rate so precisely.

11 (A)(B) Limitations of the AMES test for this goal include (i) the petri dish is not the same environment as human ingestion, (ii) bacterial physiology is not the same as human physiology, and (iii) there might be types of mutations that can occur in people but not bacteria such that the AMES test would miss those.

12 (A)(B) The AMES test would be considered seriously flawed for this goal if it could be shown that most chemicals causing mutations in bacteria failed to cause mutations or cancer in humans.

13 (2 pts) Two people are arguing about whether the ABT is a useful model of condom performance. David says that the ABT is indeed a useful model, because it can be used to identify poorly manufactured condoms that might break during use. John says that the ABT is <u>not</u> useful because it fails to measure actual transmission of STDs. Which one of the following options is true as regards this disagreement.   One answer only.

(A) David is wrong; John is right. The ABT does indeed fail to measure pore size and thus STD transmission.

(B) John is wrong; David is right. The ABT can identify at least major problems in codom quality.

(C) They are both correct; each of their statements refers to a different goal, so the ABT can be a useful model for one goal while not being a useful model for other goals.

(D) Both are wrong because the ABT is not a model at all, it is a test.

14-17 (4 pts) To determine a chemical's possible lethality in humans, you feed it to hamsters and measure hamster death rates. You then calculate the lethal dose for humans by multiplying the hamster's lethal dose per body weight times the weight of a human, as if humans were merely very big hamsters. What are limitations of this approach in <u>calculating the dose that will kill a human</u>? A major limitation means that you could not trust the predicted lethal dose in humans to be accurate.

(A) a major limitation for this goal   (B) Not a major limitation for this goal

14. (A)(B) The toxicity threshold of this chemical may differ greatly from those of other toxins

15. (A)(B) People might never eat an amount close to your predicted toxic dose.

16. (A)(B) Hamsters may be more sensitive to the toxin than are rats

17. (A)(B) The dose per body weight that kills a hamster may not be the same as what kills a human

DWI (where needed, goals are underlined)

18-20 (3 pts) If we accept that the BAC is a valid model of impairment, what are relevant limitations of using a back calculation (Widmark plot) to <u>decide if you were legally impaired at the time you were stopped</u>. (*For this question, we are assuming your BAC was measured hours after you were stopped.*)

(A) is both true and a relevant limitation of this use of the back calculation

(B) is either not true or not a relevant limitation of this use

18. (A)(B) The back calculation does not measure coordination or any component behaviors of driving ability

19. (A)(B) The data used to calibrate the back calculation come from non-human animals

20. (A)(B) The data used to calibrate the back calculation are based on alcohol metabolism under idealized conditions and do not account for normal factors such as food in the stomach, varying periods of alcohol consumption, or age.

21-24 (3pts) Which of the following options are true about the SFST?

<div align="center">(A) = true   (B) = false</div>

    21. (A)(B) The fact that officers provide the same instructions each time the SFST is administered renders it a convenient model (among the three ACU properties).

    22. (A)(B) The horizontal gaze nystagmus (HGN) test is administered to test mental faculties, whereas the other two tests (walk and turn, one leg stand) are administered to assess only physical faculties (coordination).

    23. (A)(B) A limitation of the SFST for <u>measuring driver impairment</u> is that there are no baseline data from the person when sober. If many people would fail the SFST when sober, then test failure is not a reliable model of impairment.

    24. (A)(B) *The law considers a BAC greater than 0.08% to be evidence of impairment, even if someone passes the SFST (and vice versa, by the way).* The fact that exceeding the BAC threshold can 'trump' an SFST result that you are not impaired can be interpreted in our language as though the law does ***not*** consider model accuracy to have a greater standing than model convenience.

Condom Testing (ABT is airburst test)

25-26. (2 pts) Each of the following questions consists of a Claim followed by an explanation of whether and why the claim is right or wrong. You are to indicate which of the explanations of the claim are true. Not only must the 'Right vs. 'Wrong be correct about the claim, but the explanation for why it is right/wrong must also be correct.

<div align="center">(A) = TRUE explanation (B) = False</div>

25. (A)(B) Claim: The ABT is considered an accurate model because we can know almost exactly how much air a condom holds before breaking

    Wrong because: We don't measure the volume at which the condom breaks, we merely determine whether the condom fails or exceeds a threshold volume

26 (A)(B) Claim: No single model used in condom testing is adequate for all goals. Our understanding of and confidence in condom quality and efficacy comes from a patchwork of overlapping models that have compensating strengths and limitations.

    Wrong because: The tests cannot be argued to have overlapping strengths and weaknesses, because only <u>one</u> destructive test can be applied to any single condom.

27-29 (2 pts) Decide true or false in the options below. (A) = True (B) = False

    27. (A)(B) Rejecting a batch of condoms because too many failed a destructive test is treating the tested condoms as models of the untested condoms in the same batch.

    28. (A)(B) The ABT used for quality control is a case in which one condom is considered a model of all condom brands.

    29. (A)(B) The use of volunteers to test condom efficacy in blocking HIV transmission is a case in which one condom is considered a model of all condom brands.

30-31 (2 pts) What are common themes between the realms of condom testing and DWI testing?

    30 (A)(B) For both realms, the models used to achieve the goals are not the most accurate models that, in theory, we could develop

    31 (A)(B) For both realms, some of the models used are both convenient and uniform

32. (1 pt) Fill in (A) on #32 to indicate your version of the exam.

<div align="center">Correctly format and upload a Word or pdf file to the 'test 2 upload' column in BbLearn.</div>

Format: **last name first name** , last 4 digits of your V00 number , 1 answer 2 answer

<div align="right">and so on.</div>