Cors 236 Exam 1 (2023) : 48 questions, 3 pages

Answer every question (1-48) with a single letter. Put your answers on Canvas (Test 1_2023).

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.

SM = Scientific method; where applicable, goals are underlined

1-10. (10 pts) The use of evidence to evaluate a model is part of what we are calling the scientific method. Which of the following questions/problems fall within the realm of and could be addressed with evidence-based evaluation of models (or more generally, could be studied with the scientific method as we are using it in this class)?

(A) Could be studied and lies within bounds of science,

(B) Could not be studied as a science problem and/or lies outside the bounds of science

1. (A)(B) What characteristics of job candidates will affect their abilities to get tenure at a university?

Lies within science. You can imagine gathering data to answer the question.

2. (A)(B) What was the gross income of Home Depot last year?

In hindsight, this one is ambiguous. I intended to be a 'math' problem, and the key reflects that. But gross income may not be straightforward, and you could imagine repeated cycles of testing different models to get closer and closer to the actual gross income. It certainly is a data problem.

3. (A)(B)   Does partying the night before an exam affect your performance on the exam?

Lies within science. Easy to imagine the type of data you would need to answer the question.

4. (A)(B)   Does Bigfoot exist?

Lies within science. You can easily imagine the type of data you need to demonstrate the existence of Bigfoot. However, we went over in class that this type of question presents a different challenge for science than other types of questions, such as whether the earth is flat. But we did not say that Bigfoot questions were not science.

5. (A)(B) Are telecommuters (workers at home) as productive for a company as in-person workers?

5-7 all lie within science. Easy to imagine the type of data you would need to answer the question(s).

6. (A)(B)   Does diet affect lifespan?

7. (A)(B) Are psychics better at picking winning lottery numbers than are other people?

8. (A)(B) How do we use geometry to calculate the height of a tree?

Not science; this is pure math (aside from the application)

9. (A)(B) What moral obligations does society have to offer reparations to descendants of individuals who were mistreated by the US establishment in earlier times?

Not science; is ethics.

10. (A)(B) What kinds of management styles result in companies avoiding bankruptcy?

Lies within science. You could gather data on management styles of companies that did and did not go bankrupt.

11-14 (4 pts) A field test is done to measure the effect a biological control agent on pest numbers. Assuming the trial is done correctly by scientific standards, what are possible outcomes (and possibly from later work, also done well)? Each option should be considered independently of others.

(A) is a possible outcome if the trial is done right   **(B)** not a possible outcome

Pretty much any set of outcomes is possible, whether considering a single study or several. And prior results are often overturned in science.

11. (A)(B) The trial finds that the biological control agent definitely reduces pest numbers.

12. (A)(B) The trial finds that the biological control agent definitely increases pest numbers.

13. (A)(B) Study results are so inconclusive that the biological control agent might work at increasing or decreasing pest numbers, but the study cannot say.

14. (A)(B) The field test finds the opposite effect of a previous trial of the same biological control agent.

15-23 (9 pts) Which descriptions allow you to suspect a failure to adhere to proper scientific method (for the goal underlined)? If needed, rely on the 'shortcuts' given in class for some of the questions.

(A) is suspicious -- likely not good SM   **(B)** not suspicious – very possibly consistent with SM

15. (A)(B) A new forensic method claiming to <u>match suspects to crime scene samples</u> has never been tested for its true success rate.

'has never been tested' implies an absence of data (violating 'data are paramount').

16. (A)(B) A company developing a computer model to <u>detect breast cancer from ultrasound </u>changes the model often because the predictions are imperfect.

This is typical science. Not suspicious because the model keeps changing in response to poor outcomes.

17. (A)(B) A farmer wanting to<u> maintain financial stability</u> continues to use age-old farming methods as profits increase over the years.

Not suspicious – no model turnover, which might be suspicious, except the goal is being met.

18. (A)(B) A teacher wanting <u>to use the best ways to prepare students for finding jobs in today's society </u>teaches the same material for decades without knowing the success rate of those students in job searches.

Similar to 15 – no data if student success rates are unknown

(A) is suspicious -- likely not good SM   **(B)** not suspicious – very possibly consistent with SM

19. (A)(B) A company charged with<u> protecting consumer health</u> claims that smoking is safe because 60% of smokers die of natural causes but neglects to account for the other 40%.

Suspicious because data are being selectively chosen (thus not 'paramount')

20. (A)(B) A politician wishing to <u>maximize her voter support</u> frequently changes her style of campaigning but never measures the public impact of each style.

Suspicious. A little more subtle, because the model is being changed often, but without data (data not paramount)

21. (A)(B) A homeowner <u>wants his gasoline mower to start</u>. He changes the spark plug, discovers that the mower now starts, **a**nd makes no other changes to the mower.

Not suspicious – has data initially, revision once, but after that, the goal is being met

22. (A)(B) A student hoping <u>to avoid hangovers</u> after partying keeps partying and hoping he will grow out of hangovers.

Suspicious: no model turnover and goal is not being met.

23. (A)(B) A fisherman <u>wanting to catch lots of fish</u> changes lures often if the fish are not biting.

Not suspicious – frequent turnover because the goal is not being met.

24-48. Identifying SM elements. Below are paragraphs, each giving a description of a process with possible parallels to the scientific method (SM). In the questions that follow each paragraph, you are asked either to match a scientific method element with a quote taken from the paragraph or asked something about SM elements. In each paragraph, the<u> goal is underlined</u>. Answers should be based only on what is explicitly described. Not all answers need be used for a paragraph, and some elements may be used more than once. If a model is used as a Revision, choose Revision. Using the goal given, you are to thread the description in the paragraph onto the scientific method template and then answer how the quoted phrases fit into the scientific method template. Some problems may not describe a fit to all scientific method elements – you need to figure this out. To qualify as a SM element, the quote need not describe all instances of that element in the paragraph.

24-26 (3 pts) The developer of a new method of voice analysis hopes his method is able to <u>determine whether a person is telling the truth</u> in statements given to the police. The method (word lie detection) was developed by comparing word combinations used in known lies with word combinations used in known true statements. Once developed, the method is being used to analyze the words used in 911 calls to determine whether they match the known lies or truths. Around the US, there is a lot of interest from prosecutors in word lie detection of 911 calls. However, there have been no formal efforts to determine whether the method actually works at discovering lies.

(A) True   **(B)** False

24. (A) (B) in the context here, an 911 call analysis by 'word lie detection' is a model of whether a person told the truth in a 911 call

Yes it is a model of truth telling (whether it works or not is irrelevant – it is being used as a model for that purpose)

25. (A) (B) the fact that prosecutors are interested in 911 call analysis indicates that there are data supporting the method

No. The problem indicates the opposite – that there have been no formal efforts, hence no data.

26. (A) (B) that there have been no formal efforts to determine whether the method actually works means that evaluation is absent.

Yes, determining whether the method actually works would be a form of evaluation, and the problem doesn't offer any alternative evaluation either.

27-30 (4 pts) A veterinarian wants to <u>avoid infecting dogs and cats during surgeries</u>. Her usual method of sterilizing wounds is to scrub the incision site with alcohol immediately before incision. However, when using that method, pets sometimes develop an infection, which is undesirable. She guesses that the problem is poor cleansing of the dog's skin before incision. She has heard that chlorhexidine gluconate (CG) is a better antiseptic than alcohol, so she decides to start using CG instead of alcohol.

        (A) Model   **(B)** Data   **(C)** Evaluation   **(D)** Revision   **(E)** None

Start by stringing together parts that fit into a SM cycle. She wants to avoid infections during surgeries (goal). Her usual method (model) is alcohol. She has data indicating that her goal is sometimes not met – pets sometimes develop an infection. The evaluation is 'which is undesirable.' So she revises her model (CG instead of alcohol), but we don't have any data on it yet.

        27. (A) (B) (C) (D) (E)   scrub the incision site with alcohol

        28. (A) (B) (C) (D) (E)   pets sometimes develop an infection

        29. (A) (B) (C) (D) (E)   decides to start using CG instead of alcohol

        30. (A) (B) (C) (D) (E)   A veterinarian

31-33 (3 pts) You are starting a company hired to remove snow from residential sidewalks and driveways. The snowfalls in your area are usually no more than 3" deep, so you decide that a snowblower is not cost-effective, and you will use shovels. However, there are 3 different types of shovels that you might use (differing in size and weight: shovels X, Y and Z). You want <u>to use the type of shovel that leads to the fastest clearing of snow</u>. You have three choices: shovel X, shovel Y, or shovel Z.   When used on 50 feet of sidewalk, shoveling with X takes 10 minutes, shoveling with Y takes 12 minutes, and shoveling with Z takes 8 minutes.

        (A) Model   **(B)** Data   **(C)** Evaluation   **(D)** Revision   **(E)** None

Start by stringing together parts that fit into a SM cycle. The goal is to find the 'best' shovel. There are 3 models (shovels, X, Y, and Z). Data are the times it takes for a particular shovel. Evaluation would be the comparison, but none is mentioned (even if it is obvious).

31. (A) (B) (C) (D) (E) shovel X

32. (A) (B) (C) (D) (E) shoveling with Z takes 9 minutes

33. (A) (B) (C) (D) (E) snowfalls in your area are usually no more than 3" deep

34-37 (4 pts) You are attempting to find out <u>how to soak dried split peas prior to cooking so that they soften when boiled for an hour</u>. The problem is that they usually remain hard and crunchy after cooking. Your approach in the past has been to add 1 tablespoon of salt to a half gallon of tap water and 1 pound of peas, soaking for 8 hours, then rinsing before cooking. You try several different approaches, always soaking them for 8 hours but changing what is added to the half gallon of water, and then rinsing before cooking. On Monday, you soak the peas as before in tap water, but without salt. After cooking, they remain crunchy, which is not what you want. On Wednesday, you soak in distilled water without salt. After cooking, they are a mix of soft and crunchy, still not quite what you want. On Friday, you use tap water with a teaspoon of baking soda. This time the peas are soft after cooking, as desired, so you abandon your salt method and decide to use baking soda henceforth.

        (A) Model   **(B)** Data   **(C)** Evaluation   **(D)** Revision   **(E)** None

Start by stringing together parts that fit into a SM cycle. You want to soak peas so they are not hard after boiling. Your models are then different methods of soaking. The data are the softness/crunchiness of the peas after boiling. Your evaluation will be whether the peas are satisfactory (e.g., 'not what you want,, 'still not what you want,' and 'as desired'). Revision is any change to the model, of which there are two.

34. (A) (B) (C) (D) (E)   After cooking, they remain crunchy

35. (A) (B) (C) (D) (E)   you soak in distilled water without salt.

36. (A) (B) (C) (D) (E)   still not quite what you want

37. (A) (B) (C) (D) (E)   you abandon your salt method and decide to use baking soda henceforth

38-40 (3 pts) Carol is an avid duck photographer. She wants to <u>attract ducks to fly close to her blind so she can</u> <u>take closeup</u> <u>pictures of birds in flight</u>. To attract lots of ducks for closeup pictures, she uses decoys. However, there are many different kinds of decoys that can be purchased. Her gut feeling (intuition) is that the kinds of decoys used makes a difference to how many ducks she attracts, so every year, she buys new decoys, thinking that the most-recently advertised decoys are better than decoys that have been on the market longer. However, she never actually keeps records of how well each kind of decoy works, she just keeps changing the decoys used based on how they appeal to her.

                (A) True   **(B)** False

38. (A) (B)   decoys are used as models to achieve her goal

Yes, the decoys are used to attract ducks

39. (A) (B)   'Her intuition' describes a scientifically-based evaluation

No, an evaluation requires data; intuition is data-free by definition.

40. (A) (B)   The fact that she keeps changing decoys indicates that she is using a scientific basis for revision.

Even if the paragraph described her using a scientific basis for revision, the question itself would require an answer of 'false,' because the mere fact that someone keeps changing their models does not itself imply a scientific basis for it.

41-44 (4 pts) John works at a restaurant and is trying to reduce a mouse infestation with <u>the most effective method of killing mice</u>. He tries several methods and counts the number of mice killed by each: poison, glue, and traps. In the course of a week, poison kills 20 mice, glue kills 15, and traps kill 11. John decides that poison is the best method.

I think this one was used on a previous exam (perhaps using rats instead of mice). The goal is the most effect method of killing, trying the methods ('models'0 of poison, glue, and traps. The data are the numbers killed – numbers are often data. His evaluation is that poison is the best method. Technically, no revision is described, because it does not say that John then uses only poison.

       (A) Model   **(B)** Data   **(C)** Evaluation   **(D)** Revision   **(E)** None

41. (A) (B) (C) (D) (E) poison kills 20 mice, glue kills 15, and traps kill 11.

42. (A) (B) (C) (D) (E) John works at a restaurant

43. (A) (B) (C) (D) (E) John decides that poison is the best method.

44. (A) (B) (C) (D) (E) poison, glue, and traps

45-48 (4 pts) David wants to get a good job, but thinks it will take time to get something he will get one, so he plans on making many applications. He <u>wants the best resume for his qualifications – the resume style that will get him the most invitations for</u> <u>interviews</u>. He does not have much experience with applications or interviews and so he uses what he thinks is the scientific method. He develops s short resume style and sends it to 10 different job advertisements. He is invited to only 1 interview, which is not satisfactory. He thus develops a second resume style and sends it to 10 more job advertisements. He is invited to 3 interviews. He thinks he can do better, so he develops a third resume style and sends it to 10 more job advertisements.

       (A) Model   **(B)** Data   **(C)** Evaluation   **(D)** Revision   **(E)** None

Goal is the best resume, measured as number of interviews. He tries 3 different styles, each of which is a model. Since the first style is replaced by the second, and the second by the third, there are two revisions. The data are the numbers of interviews invited. His evaluations are his conclusions about each style: 'not satisfactory,' and 'thinks he can do better.'

    45. (A) (B) (C) (D) (E) a short resume style
    46. (A) (B) (C) (D) (E) a third resume style
    47. (A) (B) (C) (D) (E) 1 interview
    48. (A) (B) (C) (D) (E) thinks he can do better