61 questions, 4 pages   name_____(req'd)

Answer every question (1-61) with a single bubble. If not specified otherwise, assume

A = True/yes   B =False/no

Italicized statements should be taken as true.
If any part of a question is wrong, treat the entire question as wrong.

Scientific Method (SM)

1-5. (10 pts) Which of the following are valid possible uses of, conclusions or outcomes from the SM? **(A) = True, (B) = False**

1. (A)(B) In attempting to establish the proof of a mathematical theorem, PhD students in mathematics use data from the properties of an electrical circuit to decide if the theorem is right or wrong.

2. (A)(B) A poll reveals that nearly 1/3 of the American public thinks that extraterrestrial aliens inhabit earth. This widespread belief is evidence (perhaps weak) that extraterrestrial aliens are here.

3. (A)(B) In the US during the 1930s and 1940s, the number of polio cases ranged from 10,000 – 40,000 per year. Following widespread use of a polio vaccine in the early 1950s, the number of US cases dropped to no more than hundreds per year. These observations can be used to help evaluate whether the polio vaccine was effective.

4. (A)(B) A proof of a model is the last step in scientific support for a model. It often takes a long time for studies to reach that point, however.

5. (A)(B) Darwinism, or evolutionary biology, is a well-established scientific discipline. Its scientific success has been used as a justification for certain social practices (known as Social Darwinism). The fact that nature appears to be 'Darwinian' is a moral justification for using its principles to structure societies.

6-9. (5pts) A clinical trial tests the effect of a new drug. 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) a possible outcome if the trial is done right   (B) not a possible outcome

6. (A)(B) The trial finds a beneficial effect of the drug.

7. (A)(B) The study finds a detrimental effect of the drug.

8. (A)(B) Study results are so inconclusive that the drug might be harmful or might be beneficial, but the study cannot say.

9. (A)(B) A later trial finds the opposite effect of the drug from what the first trial reported.

10-14. (8 pts) Using shortcuts. Each of the following questions describes a process to achieve a goal (goal is underlined). Using the Scientific Method shortcuts given in class, indicate whether the process appears to deviate from proper Scientific Method (option A) or does not obviously deviate (option B). The goal here is to identify suspicious practices.   Note that these descriptions do not allow you to assess all 5 elements of the S.M., so you must rely on the shortcuts.

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

10. (A)(B) An advertising company wishing to market effective ads continually tests new versions of its ads on consumers to find out better ways to advertise.

11. (A)(B) A doctor wishes to support a claim that his acne-reduction cream is effective by gathering lots of evidence but reporting only supporting evidence

12. (A)(B) A politician wishing to maximize her voter support frequently changes her style of campaigning and measures the public impact of each style.

13. (A)(B) Astrologers wanting to predict the future continue to use unchanging, centuries-old rules for generating predictive horoscopes.

14. (A)(B) A company marketing a dietary bacterial mix that is intended to improve health gathers no information on the health of its customers.

15-22. Below are paragraphs, each giving a description of a process with parallels to the scientific method. In the questions that follow each paragraph, you are asked to match a scientific method element with a quote taken from the paragraph. In each paragraph, the initial goal is underlined. You would select (A) if the quote describes a new goal. An option may be used once, none, or more than once – not all elements are necessarily present nor represented in the quotes.

15-18. (7pts) Neal Caffrey is attempting to find the best ways to getting donor support of crowdfunding projects. He invents 5 different project descriptions, each with different emotional appeals and web designs. After 6 months, he compares the monies donated to each. One design worked far better than the others. He then abandons the 4 poorest designs and creates 5 more projects using the design that worked the best.

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

15. (A) (B) (C) (D) (E) (F) worked far better than the others

16. (A) (B) (C) (D) (E) (F) monies donated to each

17. (A) (B) (C) (D) (E) (F) after 6 months

18. (A) (B) (C) (D) (E) (F) 5 different project descriptions

19-22 (7pts) The company known as Ctrip wanted to find business practices that increase worker productivity.   It specifically considered whether a telecommuting worker is more productive than a physically-commuting worker. Six months after assigning some workers to telecommute and others to physically commute, the measured productivity levels revealed that telecommuting was superior. The company then changed its practices to encourage telecommuting.

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

19. (A) (B) (C) (D) (E) (F) telecommuting was superior

20. (A) (B) (C) (D) (E) (F) a telecommuting worker is more productive than a physically commuting worker

21. (A) (B) (C) (D) (E) (F) measured productivity levels

22. (A) (B) (C) (D) (E) (F) changed its practices

Models (general) ACU is accuracy, convenience, uniformity

23-26. (7 pts)   Which of the general points about models are true?   **(A) = True, (B) = False**

23. (A)(B) The scientific method works fundamentally differently with physical models than with abstract models

24. (A)(B) A model's limitations (differences from what it represents) cannot be identified until we know the goal.

25. (A)(B) The importance of model's limitations cannot be decided until we know the goal.

26. (A)(B) Among the 3 criteria of model ACU, accuracy is NOT necessarily considered more important to usefulness than are C and U.

27-30 (6 pts) A DNA sample is obtained from a bat used to hit someone and break their leg. The DNA is matched to a suspect who claims he did not commit the crime. Which are important limitations of this DNA sample as a model of the true assailant who used the bat in committing this crime?

(A) the limitation would be important for this goal   (B) Not important

27. (A)(B) The DNA is merely a small part of the person who left the sample, not the entire person

28. (A)(B) The DNA might have been left on the bat at a different time than the assault

29. (A)(B) The suspect's DNA might have been placed on the bat by someone other than the suspect (he was framed)

30. (A)(B) The DNA is not used to give insight to the person's criminal mindset

31-35 (7pts) Matching models to goals. In which of the following contexts is a mouse used as a model of humans? If the possible human use is ambiguous, mark it as 'false.' **(A) = TRUE – mice are used as models of humans**

31. (A)(B) Genetically engineering mice to have defects that mimic human disease and thereby understand how to treat those diseaes in people.

32. (A)(B) Testing substances in mice to set standards for human exposures

33. (A)(B) Studying mouse behavior to find ways to scare mice out of people's homes.

34. (A)(B) Identifying genes for hair color in mice to understand how to breed a white strain of Angus cattle.

35. (A)(B) Studying mouse brains to understand how humans smell.

Condom Testing (ABT is 'airburst test', STD is 'sexually transmitted disease')

36-45. (15 pts) Themes from and general points about condom testing. Which major points were made from the condom-testing lectures? **(A) True (B) False**

36. (A)(B) Many different mechanical tests are used to specifically ensure the tests collectively span all three ACU criteria.

37. (A)(B) Volunteer studies are sometimes used because mechanical tests do not satisfactorily address some personal goals of condom use.

38. (A)(B) Condom tests involving 'trained technicians' are not used because such tests would be too inconvenient

39. (A)(B) We suggested that the manufacturing of condoms faces conflicting goals of avoiding pregnancy versus avoiding STD transmission

40. (A)(B) The ABT is not useful for assessing STD passage through an intact condom

41. (A)(B) The ABT is weak on Uniformity because not all condoms break at the same air volume

42. (A)(B) 'One condom is a model of all condoms in the same batch' applies to the use of destructive tests in evaluating condom quality.

43. (A)(B) 'One condom is a model of all condom brands' applies to the use of volunteer tests of STD transmission.

44. (A)(B) A major theme is that multiple models of sex are used to test condoms *because* together they collectively have fewer limitations than does any one test.

45. (A)(B) Mechanical tests of condom performance are driven by industrial goals of convenience and uniformity.

DWI
(SFST is the standardized field sobriety test, BAC is blood alcohol concentration)

46-48. (6 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. **(A) = TRUE explanation (B) = False**

46. (A) (B) Claim: The fact that the BAC *can be measured to within 2% of the true value (at least in blood)* means that it is a more accurate model of driving performance than the SFST, which is measured subjectively.

> **Wrong because**: The two models (BAC and SFST) are of such different types that their accuracies cannot be compared.

47. (A) (B) Claim: A limitation of using the same BAC threshold in all drivers to measure actual impairment is that the same alcohol concentration does not impair everyone to the same degree.

> **Right because**: The BAC is not a measure of impairment, so two individuals can have the same BAC but experience different effects on their driving abilities.

48. (A) (B) Claim: A limitation of the SFST for measuring driver impairment is that some drivers may have practiced the SFST and thus be more likely to pass it than other drivers at the same level of impairment.

> **Wrong because**: The HGN part of the SFST is not under conscious control, so there is no way to 'practice' it. Thus practicing the SFST cannot affect one's chance of passing the test.

49-53 (8pts) Which limitations (or other considerations) are relevant to 'back calculations' of blood alcohol concentration (BAC) as a model to determine whether a driver exceeded 0.08% when stopped by the police. These back calculations use a Widmark plot. (The goal here is to <u>determine whether someone exceeded the 0.08% limit at the time they were stopped</u>)?

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

49. **(A)(B)** The main data on how fast alcohol is cleared from the body come from computer models rather than from people.

50. **(A)(B)** The back calculation based on a Widmark plot accounts for many factors that may affect alcohol clearance, such as food in stomach, male-female differences and body size differences, but it does not account for how long ago the person finished drinking alcohol.

51. **(A)(B)** The driving abilities of two people may be differently impaired at the same BAC.

52. **(A)(B)** The Widmark plot does not account for possible differences between individuals in how fast they metabolize alcohol.

53. **(A)(B)** The BAC of a person whose actual BAC increased between the time stopped on the road and the time the BAC was read would **definitely** be miscalculated by the back calculation method based on a Widmark plot (assume the subject did not consume alcohol after being stopped).

<div align="center">Extrapolation</div>

54-59. (10pts) Identify the type of dose extrapolation in each of the following problems. If the problem does not describe an actual dose extrapolation, you should choose (E).

<div align="center">(A) Linear   (B) Threshold   (C) Accelerating   (D) Decelerating (E) None</div>

54. **(A)(B)(C)(D)(E)** The total dollars in interest Joe got from his account with $20,000 was more than twice the interest he got with $10,000. What form of extrapolation (if any) applies to the difference in interest between the two account levels?

55. **(A)(B)(C)(D)(E)** When Joe failed to study for an exam, his score was 50. When he studied 4 hours, his score went to 75. He predicted that his score would be 90 if he studied 8 hours. Which extrapolation model (if any) underlies his calculated exam improvement with 8 hours of studying?

56. **(A)(B)(C)(D)(E)** Your car's fuel tank holds 25 gallons. On several occasions, you observe that you can drive 100 miles and the tank still has 20 gallons remaining. From this, you calculate that you can drive 500 miles on a full tank of fuel. What form of extrapolation (if any) is used in this calculation?

57. **(A)(B)(C)(D)(E)** In an Easter egg hunt with 100 hidden eggs, the first 50 were found in 30 minutes. During the next 30 minutes, 25 more were found. After yet another 30 minutes, only 10 were found. What extrapolation (if any) applies to this pattern of egg recovery?

58. **(A)(B)(C)(D)(E)** A company marketed a product that contains a substance that has been found to be harmful in high doses. At 10 times the recommended dose, approximately half (50%) of the exposed subjects develop skin rashes for 2 days. Without evidence a company representative assures the public that there is no harm whatsoever from the recommended dose. What type of extrapolation (if any) underlies this claim?

59. **(A)(B)(C)(D)(E)** As a young boy, Bruce Levin bakes a cake. Faced with a time crunch, he decides to double the cooking temperature and thus hopes to cut the cooking time in half. What type of extrapolation (if any) underlies this calculation of expected cooking time from a change in temperature?

60. (4 pts) Which type of extrapolation was indicated as the problem in the Chapter 9 example of 'Rodent Models of Cancer?'

<div align="right">(One answer)</div>

<div align="center">(A) across species   (B) across doses   (C) across related hazards   (D) None</div>

61. (4 pts) <u>Key code A</u>. Bubble **A** on 61 of your scantron to indicate which version of the test you have; do not fill in any other bubbles. Correctly bubble in your EID and name in the appropriate blanks, and put your name on the first page of this exam form.