65 questions, 5 pages name_____(req'd)

Answer every question (1-65) 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); goals are underlined

1-3. (4.5pts) Consider applying the lamp example to the SM template. If we let the MODEL be that the lamp is activated by warmth and let DATA be what the lamp did when it was bumped (or tapped) which outcome of evaluation applies?

(**A**) = TRUE, (**B**) = FALSE

1. (A)(B) We accept the model
2. (A)(B) We reject the model
3. (A)(B) We cannot say whether we accept or reject the model.

4-6 (4.5pts) Which statements are consistent with proper use and interpretation of the scientific method?

(**A**) = Proper Use (**B**) = not

4. (A)(B) A study using only mathematics and (only) data generated by a computer indicated that up to 4 cups of coffee a day has little to no health risk.

5. (A)(B) A study done properly failed to reject the model that up to 4 cups of coffee a day has a health risk. The company conducting the study concluded that there are no health risks associated with up to 4 cups of coffee/day.

6. (A)(B) The scientific method is assured of ultimately answering nearly any question to which it is applied.

7-10. (6 pts) The garden in Alex's yard is being dug up by something. He wants to know what is doing the digging so he can stop it. His first guess is that any of several neighborhood dogs are coming through a small hole in his fence. (*There is no other way a dog could get into his yard.)* The neighborhood dogs are of various breeds and sizes. He focuses on Bandit, the large terrier next door, as a likely possibility. Alex measures the size of the fence hole and the size of Bandit for comparison. He finds that Bandit is too big to fit through the hole, though not by much. Alex thus concludes that no dogs in the neighborhood are stealing his belongings.

Alex's conclusion is not necessarily appropriate for his data. Which model(s) below can be rejected by his data?

(A) can be rejected, **(B)** cannot be rejected

7. (A)(B) an animal of any sort (possibly a wild animal) is getting into his yard

8. (A)(B) the dog next door (Bandit) is getting into his yard

9. (A)(B) a dog as large as or larger than Bandit is getting into his yard

10. (A)(B) any neighborhood dog is getting into his yard

11-14 (6 pts) Charlie works at a pub and is trying to reduce a rat infestation with the most effective method of killing rats. He tries several methods and counts the number of rats killed by each. Charlie uses poison, glue, and traps. In the course of a week, poison kills 20 rats, glue kills 15, and traps kill 11. Charlie decides that poison is the best method.

Each question below lifts text from this paragraph. Indicate which element of the scientific method applies to the quote. Your options follow. You would select (A) if the quote describes a new goal.

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

11. (A) (B) (C) (D) (E) (F) poison kills 20 rats, glue kills 15, and traps kill 11.
12. (A) (B) (C) (D) (E) (F) Charlie works at a pub
13. (A) (B) (C) (D) (E) (F) Charlie decides that poison is the best method.
14. (A) (B) (C) (D) (E) (F) poison, glue, and traps

15-19 (7.5pts). A professional golfer hopes to win his next tournament, which consists of four rounds on different days. He thinks that his activities the night before a round are important to his performance, so the night before his first round, he adopts a simple plan to maximize his performance by eating a peanut butter and jelly sandwich (PBJ), watching some relaxing TV and going to sleep early. The next day he shoots a 66, enough to place first. He is confident that his evening plan was responsible for his good performance, so he does the same thing the night before his second round. This time, he shoots a 71 and falls to 5rd place, which is unacceptable to him. He decides to change his nightly routine, choosing to eat spaghetti and read a book before going to bed at the same time. In his third round he shoots a 67 and improves to 2nd place. Happy with his performance, he decides to stay with spagetti, a book and early to bed before his final round.

Which of the following are true? (**A**) = TRUE, (**B**) = False

15. (A)(B) Revision is absent because he did not change when he went to bed.

16. (A)(B) His choice of spaghetti instead of PBJ for dinner before the third round constitutes evaluation.

17. (A)(B) His nightly meal of PBJ, TV and early bed is a model for performing well on the golf course.

18. (A)(B) His scores of 66, 71 and 67 constitute data for evaluating his goal.

19. (A)(B) His being happy with his score of 67 is an evaluation.

20-23 (6 pts) In searching for a method of improving student exam performance that could be used by any US college student, researchers tested whether caffeine leads to higher scores. They gave one group of Bio301D students caffeinated coffee before exam 1 and another group of Bio301D students decaffeinated coffee (decaf) before the same exam. Students who consumed caffeinated coffee had an average 10 points higher than the students who had decaf. For the second exam, the treatment was switched so that the students who were given caffeinated coffee before the first exam now got decaf before the second exam (and vice versa). Again the group that got caffeine performed better (by 8 points on average). The researchers concluded that caffeine does indeed increase test performance for the average student.

Which of the following are true? (**A**) = TRUE, (**B**) = False

20. (A)(B) The students in this test are used as a model of other students.

21. (A)(B) The study lacks abstract models but has physical models (the students, the coffee used)

22. (A)(B) Revision is illustrated by reversing who got caffeinated coffee between the first and second exams.

23. (A)(B) Evaluation is indicated by the conclusion that "caffeine does indeed increase test performance."

Models

24-27. (6 pts) A theme is that *all models are false (all models have limitations)*. Which of the following are consequences of or fixes for this principle? **(A)** = TRUE, **(B)** = FALSE

24. **(A)(B)** We recognized 3 properties of models that reflect their possible strengths and limitations, ACU (accuracy, convenience, uniformity). Any single model is strong on only one of these properties. The successful application of the scientific method to any goal thus needs a different model with each property.

25. **(A)(B)** Scientific progress comes from finding models that are progressively more accurate than their predecessors.

26. **(A)(B)** Limitations of a model do not necessarily create problems for scientific progress because of a "2 wrongs make a right" principle – multiple limitations in one model cancel each other.

27. **(A)(B)** One way to overcome a model's limitations is to gather data that avoid the limitations.

28-33 (9pts) Each of the following questions compares two models for a particular goal. You are asked to evaluate whether the **first model (in bold**) is more ACCURATE than the second model (underlined). Use lecture and the book as the basis for your answers.

(A) First model is the more accurate **(B)** Second model is the more accurate

28. (A)(B) Humans accidentally exposed to dioxin instead of guinea pigs deliberately exposed to dioxin in testing the toxicity of dioxin for humans

29. (A)(B) High doses of a pesticide versus low doses fed to rats for testing whether traces of the pesticide in food cause cancer.

30. (A)(B) BAC obtained when the driver is stopped versus back calculations of BAC to assess driver BAC while driving.

31. (A)(B) Airburst test instead of volunteers in tests of condom breakage during sex.

32. (A)(B) Rats instead of mice in testing the toxicity of rat poison

33. (A)(B) For the goal of passing government tests of condom quality**, volunteers** instead of mechanical tests of condom breakage.

34-37. **(6pts)** For which options is the limitation of the model likely important to the goal – could prevent attaining the goal?

(A) the limitation COULD prevent attaining the goal; **(B)** the limitation would NOT prevent attaining the goal

Question	Model	Goal	Limitation
34 (A)(B)	exam scores of the first 10 students to turn in the exam as a model of the average exam score of the entire class of 300	to know the approximate class average before grading most exams	the first 10 students to turn in the exam may have finished early because they had an advance copy of the exam
35 (A)(B)	the box of Loratadine you buy at a store as a model of boxes of Loratadine at other stores	relieve your allergy symptoms	the box is out of date and the medicine has deteriorated chemically
36 (A)(B)	DNA from a cigarette butt at a crime scene as a model of the perpetrator	to identify the perpetrator	the cigarette butt may have been dropped elsewhere and blown into the crime scene by a wind
37 (A)(B)	DNA from a cigarette butt at a crime scene as a model of the perpetrator	to identify the perpetrator	the DNA is just a small sample of the person who left it

Condom testing (ABT = airburst test)

38-41 (6pts) General points about condom testing. (**A**) = TRUE (**B**) = FALSE

38. (A)(B) No single model of 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.

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

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

41. (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.

42-44 (5pts) Given the limitations of the ABT (noted in class) for quality control, which of the following are true about a batch of condoms that passes the ABT?

(A) TRUE **(B)** FALSE

42. (A)(B) The condoms sold from that batch will have a known, low breakage rate during sex

43. (A)(B) The condoms sold from that batch will have a known STD transmission rate during sex

44. (A)(B) All condoms sold from the batch will have been individually tested with the ABT

45-48 (6pts) Which of the following are limiitations of the ABT as a model of condom performance for the goals of STD and pregnancy prevention?

(A) Is both True and Is a limitation **(B)** Not a limitation or is False

45. (A)(B) The ABT environment differs radically from the environment of sex

46. (A)(B) The ABT tests the whole condom, not just part of it

47. (A)(B) Passing the ABT requires stretching beyond any actual requirements during sex

48. (A)(B) The ABT is difficult to apply so consistently that test failure is attributable to the condom

DWI testing

(BAC = blood alcohol concentration; SFST = standardized field sobriety test)

(A Widmark plot is a graph of BAC decay over time after a person consumed alcohol; the plot is obtained under standardized conditions mentioned in class)

49-51 (5pts) *The BAC as a legal measure of impairment can be applied uniformly to all drivers -- it is an absolute criterion that can be determined to high precision for each person*. Which limitation(s) below applies/apply to use of the BAC in blood as a model of actual driver performance under the influence of alcohol?

(**A**) = TRUE (**B**) = FALSE

49. (A)(B) The BAC measured in breath may not be the same as that measured in blood.

50. (A)(B) The same BAC level does not yield the same level of impairment in all drivers.

51. (A)(B) The BAC does not measure the level of drugs other than alcohol.

52-56 (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 determine whether someone exceeded the 0.08% limit at the time they were stopped)?

(**A**) = TRUE (**B**) = FALSE

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

53. (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.

54. (A)(B) Different people may be differently impaired at the same level of BAC.

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

56. (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.

Extrapolating Health Risks

57-60 (6 pts) Identify the type of extrapolation in each of the following problems..

(**A**) Dose (**B**) Animal (**C**) Related effects (**D**) None

57. (A)(B)(C)(D) The problem with rodent models of cancer is this type of extrapolation.

58. (A)(B)(C)(D) The issue with Fetal Alcohol syndrome is of this type.

59. (A)(B)(C)(D) The early estimates of high toxicity of dioxin stemmed erroneously from this type of extrapolation.

60. (A)(B)(C)(D) The use of Rem and Rad to measure radiation is an example of which type of extrapolation?

61-64. (6pts) Identify the type of dose extrapolation or relationship in each of the following problems. Even if the problem does not describe an extrapolation, you should identify the underlying form of the relationship.

(A) Linear **(B)** Threshold (**C**) Accelerating (**D**) Decelerating

61. (A)(B)(C)(D) The total dollars in interest you get from an account with $20,000 is more than twice the interest you get with $10,000.

62. (A)(B)(C)(D) When Joe failed to study for an exam, his score was 50. When he studied 5 hours, his score went to 80. When he studied 10 hours, his score went to 90. Which model do the data fit for his exam improvement with hours of studying?

63. (A)(B)(C)(D) The effect of second hand smoke was initially fit to this model (*and still appears to fit i*t).

64. (A)(B)(C)(D) Sally is a tolerant person. When students around her are either quiet or making small amounts of noise, she does not notice. However, when the noise level reaches a moderate level, she then notices and shows a small amount of displeasure. When the noise level becomes high, she gets very annoyed and yells at them to be quiet.

65 (4 pts) Key code **A**. Bubble **A** on #65 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.