

You must turn in both this hard copy (with your name on it) and your scantron to receive credit for this exam.

**One answer and only one answer per question.** Leaving a question blank or filling in 2+ answers will be incorrect no matter what.

### **Intrinsic Difficulties (ID)**

**1-5. (7 pts)** The following questions deal with general properties of intrinsic difficulties. **A = true, B = false**

1. **(A)(B)** 'Intrinsic difficulties' refers to types of problems for which the scientific method is not easily applied or does not easily obtain answers. We did not suggest, however, that these problems should be solved by using an alternative to the scientific method.
2. **(A)(B)** We noted that intrinsic difficulties are expected to become less important in the future, as societies develop a better understanding of the scientific method.
3. **(A)(B)** We noted that the theme 'correlation does not imply causation' underlies three of the difficulties.
4. **(A)(B)** Intrinsic difficulties are responsible for most 'failures' of the scientific method, i.e., those in which the model is rejected by the data.
5. **(A)(B)** The flash powder demonstration illustrated that a fundamentally different outcome could come from the combination of two things than from either alone; this was a type of interaction or complexity.

**6-29** These questions ask for the intrinsic difficulty (difficulties) illustrated by the given statement. Do not assume any more than what is explicitly given in the question. That is, address only the difficulties specifically mentioned. **A = yes B = no**

**6-9. (3pts).** Card games were listed as an illustration of which intrinsic difficulty?

6. **(A)(B)** Rare events
7. **(A)(B)** Time lags
8. **(A)(B)** Interactions
9. **(A)(B)** Humans make difficult subjects

**10-13. (3pts)** Early progress in the field of human molecular genetics was made using bacteria and bacterial viruses. These microbes facilitate research because they have short generation times, which allows a researcher to get results in a day that would take thousands of years in humans. Furthermore, the ability to conveniently grow large numbers of microbes in small volumes means that we can observe events that might not occur even once in a population the size of the US. Which difficulties were overcome by using microbes?

10. **(A)(B)** Rare events
11. **(A)(B)** Time lags
12. **(A)(B)** Interactions
13. **(A)(B)** Humans make difficult subjects

**14-17. (3pts)** Adding just nitrogen fertilizer to the soil causes a farmer's wheat to increase 4 inches in height. Adding just phosphate fertilizer causes them to increase 2 inches. Adding both nitrogen and phosphate fertilizer causes them to increase 6 inches. What kind of difficulties underlie the relationship between increased height and type of fertilizer?

14. **(A)(B)** Rare events
15. **(A)(B)** Time lags
16. **(A)(B)** Interactions
17. **(A)(B)** Humans make difficult subjects

**18-21. (3pts)** HIV is unusual among viruses in that the infected person can start transmitting the virus for nearly a decade before symptoms of AIDS appear. What kind of difficulty is created when trying to track the transmission chains among people based on who develops AIDS?

- 18. (A)(B) Rare events
- 19. (A)(B) Time lags
- 20. (A)(B) Interactions
- 21. (A)(B) Humans make difficult subjects

**22-25. (3pts)** The side of the moon facing us remains the same, so we have never been able to observe the far side of the moon with telescopes from earth. We first viewed the far side of the moon when we sent satellites to take pictures. Which difficulties are illustrated by our inability until 'recently' to view the far side of the moon?

- 22. (A)(B) Rare events
- 23. (A)(B) Time lags
- 24. (A)(B) Interactions
- 25. (A)(B) Humans make difficult subjects

**26-29. (3pts)** Asbestos is considered a lung cancer risk. However, this conclusion was drawn largely from asbestos miners, many of whom were smokers, so it is less clear whether asbestos alone is a lung cancer hazard. Which type of ID would apply if there was little risk of cancer from asbestos alone but a high risk attributed to it if the person also smoked?

- 26. (A)(B) Rare events
- 27. (A)(B) Time lags
- 28. (A)(B) Interactions
- 29. (A)(B) Humans make difficult subjects

### **Biological Determinism**

**30-34. (7pts)** Which of the following are true about Biological Determinism, as covered in class? **A=true, B = false**

- 30. (A)(B) Biological determinism is the question of whether society should mandate how humans should behave.
- 31. (A)(B) Some US state laws persisted into the 1970s that allowed the castration of individuals judged to be feeble-minded.
- 32. (A)(B) The castration of individuals deemed to be 'inferior' as a way of preventing them from having children, was motivated by the presumption that their 'inferiority' had a genetic basis.
- 33. (A)(B) In principle, observing whether offspring resemble parents is a common way of determining whether a characteristic has a genetic/inherited basis.
- 34. (A)(B) It was pointed out that knowledge of the human genome sequence (and its applications) will quickly lead to a resolution of most questions about biological determinism.

**35-39 (6pts)** With respect to sexual preference in general, and the study by Simon LeVay in particular, which are true?

- 35. (A)(B) The results of LeVay's study showed that sexual preference in humans is genetically determined.
- 36. (A)(B) Two of the class themes that pertain to the lecture are (i) correlation does not imply causation, and (ii) humans make difficult subjects.
- 37. (A)(B) In lecture, the anterior hypothalamus was shown to lie on the upper frontal surface of the brain.
- 38. (A)(B) Besides LeVay's study, other anatomical/behavioral correlates of sexual preference noted were fraternal birth order, finger length ratio and otoacoustic emissions.
- 39. (A)(B) Undermasculinization is a general property of the known correlates of same-sex preference in males.

**40-41** LeVay's study involved measuring the volume of INAH 3 in the groups listed as (a)-(f). For the following two questions, you are asked to choose two groups that, when compared to each other, allow you to evaluate correlates of INAH 3 volume when controlling for unwanted factors. Your answer should indicate the comparison that controls for all unwanted factors (the factors are AIDS status, sexual preference, gender). Assume that the listed groups differ only in the ways indicated.

|   |                                     |                                       |
|---|-------------------------------------|---------------------------------------|
| (a) gay males with AIDS                                   | (c) heterosexual males with AIDS    | (e) heterosexual females without AIDS |
| (b) heterosexual males (some with, and some without AIDS) | (d) heterosexual males without AIDS | (f) Lesbian females with AIDS         |

**40. (3 pts)** Which two groups allow you to test the hypothesis that volume of INAH 3 differs with AIDS status? Choose the appropriate option below.

|          |          |          |          |          |
|----------|----------|----------|----------|----------|
| (A) a, b | (C) a, d | (E) b, d | (G) c, e | (I) a, f |
| (B) a, c | (D) b, c | (F) c, d | (H) d, e | (J) None |

**41. (3 pts)** Which two groups allow you to test whether sexual preference remains correlated with INAH 3 volume when the other listed factors are controlled? Choose the appropriate option below.

|          |          |          |          |          |
|----------|----------|----------|----------|----------|
| (A) a, b | (C) a, d | (E) b, d | (G) c, e | (I) a, f |
| (B) a, c | (D) b, c | (F) c, d | (H) d, e | (J) None |

### Conflict

**42-46. (6 pts).** The money game. Which of the following options apply to the "money game" that used strips of paper? **A = true, B = false**

42. (A)(B) Winning money was based on an individual's ability to outwit others; if one was clever enough, he/she could win money regardless of the behavior of others.
43. (A)(B) The largest monetary gain a person could get was possible if the entire class, excluding them, cooperated with each other
44. (A)(B) The game illustrated how one can bias a study.
45. (A)(B) Randomization of the choices given to participants was critical to the outcome.
46. (A)(B) This year is the first in which Bull lost money to the class.

**47-50 (6 pts)** Each of the following options describe a property of a vaccine, disease, or population. Indicate which of them works in favor of a tragedy of the commons (ToC) conflict. **A = works in favor, B = does not**

47. (A)(B) Herd immunity exists for the disease
48. (A)(B) Individuals get vaccinated for selfish reasons
49. (A)(B) The infectious agent cannot spread from person to person
50. (A)(B) The vaccine does not prevent an individual from getting infected but does prevent transmission by the infected individual

**51-54. (6 pts)** Which of the following explicitly describes a ToC conflict or outcome? **A = a ToC B = not ToC**

51. **(A)(B)** Wheat farmers have the goal of making money. The market price of wheat is an important determinant of profits that benefits all of them when the price is high. When the per-pound wheat price drops catastrophically, farmers respond by increasing production and converting more land to production – each individual farmer hopes to offset the drop in per-pound prices by increasing the amount of wheat sold. But all farmers respond in the same way, so the total wheat harvest increases, and wheat prices drop even further. Then all farmers are financially worse off than if the wheat harvest had remained the same. Does the farmer response to the drop in wheat prices constitute a ToC?
52. **(A)(B)** Together, ten professors purchase an apartment house that they run collectively with the objective of making money. Through mismanagement due to the general financial incompetence of professors, the endeavor loses money.
53. **(A)(B)** Oil is an important resource in our society. We have become so used to its cheap availability that we have invested in many industries and products that rely on it. Now, as the supply is dwindling, we find the price increasing because the demand is great relative to the supply, and the companies that own the oil rights are making large profits.
54. **(A)(B)** Six farmers form a cooperative to manage their separate lands. During a long drought, it becomes necessary to irrigate. Collectively, they make a decision to pump water from the aquifer faster than it is replenished, and eventually, it runs dry. All six farmers suffer financially in future years because of the dry aquifer.

**55-59. (7 pts)** Which of the following are true about conflict in general? Some options require distinguishing conflict from bias. **A=true B = false**

55. **(A)(B)** All types of conflict we considered are different versions of “tragedy of the common” conflicts.
56. **(A)(B)** The effect of Lysenko on Soviet genetics was given as an example of conflict due to political factors dominating scientific ones.
57. **(A)(B)** It was suggested that the social acceptance of science in the U.S. has advanced to the point that political factors no longer subvert science.
58. **(A)(B)** Bias usually appears in the evaluation stage of a study. Conflict usually appears in the design.
59. **(A)(B)** Conflict refers to different people/institutions having different goals. Bias refers to a way of distorting a study or its conclusions away from “truth.”

**60-62 (4pts).** Which are true, as given in the economics of drug development lecture?

60. **(A)(B)** It was suggested that new technologies will soon provide drugs for all sorts of diseases (including uncommon ones that have not received much attention). The rate-limiting step in the drug-to-market pipeline has been the research to create the array of compounds needed for testing.
61. **(A)(B)** Drug companies can only afford to develop drugs for which they have obtained patent protection.
62. **(A)(B)** Companies prefer long clinical trials to short ones, as the long ones provide more opportunity to detect complications that pose liability problems.

### **Bias**

**63-66 (4pts).** Each of the following options lists a practice that affects the possibility of bias in a study. For which of the following options is the impact of that practice to facilitate reducing bias? If the practice would have no obvious effect on bias, do not mark it. **A = reduces bias, B = does not**

63. **(A)(B)** Identify and anticipate conflict of interest.
64. **(A)(B)** Publish the raw data instead of just summaries of the data.
65. **(A)(B)** Specify the evaluation criteria before obtaining the results rather than after obtaining results.
66. **(A)(B)** Publish protocols at the completion of the study rather than in advance of the study.

**67-77 (2 pts each)** Match the example to the options (A)-(J). Everything in the list pertains to bias, but some are ways to bias a study and others are signatures of bias. The underlined part is that which must be matched to the options.

|  |   |
|--|---|
| A) refusal to admit error  | F) use anecdotes to defend a model        |
| B) character assassination of opponent                                 | G) assay for a narrow spectrum of results |
| C) make non-random assignments or non-random selections among the data | H) appeal to authority                    |
| D) build causation from correlation                                    | I) use 'either-or' arguments              |
| E) require refutation of all alternatives                              | J) NONE                                   |

67. A B C D E F G H I J You are considering purchasing a car from its current owner. When you ask him about its miles per gallon (mpg), he recalls one time when it got 40 mpg, but he does not tell you the average.
68. A B C D E F G H I J In explaining why he decided plan A was better than plan B for the city, a city councilman defends his choice by noting that the plan was the favorite of a well known local celebrity.
69. A B C D E F G H I J A student paper argues on the basis of a student-run test that there is no evidence to support local beliefs in a ghost that haunts city hall. The professor criticizes the conclusion on the grounds that the evidence does not rule out the possibility of haunting on other occasions or in ways not addressed by the student test.
70. A B C D E F G H I J A defense lawyer attempts to discredit the scientific testimony of a prosecution witness by pointing out that the witness has done business in the past with an ex-convict.
71. A B C D E F G H I J A scientist who has come up with a new theory for cancer argues that her theory must be correct because the previous one has been shown to be wrong.
72. A B C D E F G H I J A company suspecting that its product will cause reproductive dysfunction designs the phase III trial to look at just cancer rates and cardiovascular health.
73. A B C D E F G H I J A company testing its drug writes the methods as double-blind but makes sure the patients are given subtle hints about how to tell the drug from the placebo.
74. A B C D E F G H I J A lawyer in a suit against McDonald's argues that because people who eat at McDonald's are disproportionately in poor health, the food served by McDonald's is to blame.
75. A B C D E F G H I J A lawyer in a suit against the British government argues that nuclear power plants are causing cancers in nearby residents because they have higher incidences of cancer than the population at large.
76. A B C D E F G H I J Doug Bicklen's claim that it does not matter how many failed attempts there are when trying to show whether FC works.
77. A B C D E F G H I J A student claims that a test debunking horoscope accuracy has not convinced him that there is "nothing to" horoscopes, and thus that he still believes in them.

**78-82. (6pts)** Bias can be introduced at several levels in a study, as given below. Which of (A)-(F) apply to the following questions:

- |                                    |   |
|------------------------------------|---|
| (A) Before the design of the study | (D) In the evaluation   |
| (B) In the design                  | (E) Is an argument indicative of bias, not a way of biasing the study |
| (C) During the study               | (F) None (not a way of or opportunity for introducing bias)           |

78. A B C D E F Make non-random assignments

79. A B C D E F Small samples to avoid unwanted, rare outcomes

80. A B C D E F Control the null model

81. A B C D E F Choose a statistical analysis to support desired conclusion

82. A B C D E F Assay for a narrow spectrum of unlikely results

**83. (3pts) (A)** Fill in **bubble A** on 83 to indicate your key.