A = True, B = False unless stated otherwise   name (required) _____

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 <u>not</u> suggest, however, that these problems should be solved by using an alternative to the scientific method. True for both. First, 'intrinsic difficulty' does indeed refer to hard problems. Second, we don't have 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. No such suggestion was made. The difficulty has nothing to do with our understanding of the SM.

3. **(A)(B)** We noted that the theme 'correlation does not imply causation' underlies three of the difficulties. No. The difficulties are quite separate from correlations hampering understanding causation.

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. Statement is nonsense. Failure has nothing to do with rejecting a model. Furthermore, intrinsic difficulties have nothing to do with model rejection, except that intrinsic difficulties make it difficult to test models.

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. Yes, exactly the point of the demo.

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 because the 'value' of a particular card depends on other cards in the hand.

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 <u>short generation times, which allows a researcher to get results in a day that would take thousands of years in humans</u>. Furthermore, the ability to conveniently grow large numbers of microbes in small volumes means that we can <u>observe events that might not occur even once in a population the size of the US</u>. Which difficulties were overcome by using microbes?

10. **(A)(B)** Rare events   indicated by the second underlined phrase

11. **(A)(B)** Time lags indicated by the first underlined phrase

12. **(A)(B)** Interactions

13. **(A)(B)** Humans make difficult subjects ambiguous; option was graded either way.

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 dfficulties underlie the relationship between increased height and type of fertilizer?

14. **(A)(B)** Rare events

15. **(A)(B)** Time lags

16. **(A)(B)** Interactions this is the relevant option to the problem. However, because the effect of adding both nitrogen and phosphorus together is what you expect from the effect of each separately, there is actually NO interaction. So all of 14-17 are (B).

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 this one is relevant because of the delay between transmission and disease. Before we knew how to detect HIV infection, this was a real problem in understanding AIDS.

    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? Although all of this is true, no 'intrinsic difficulties' underlie this problem.

    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 a classic interaction – little effect alone but a big effect with something else.

    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. No. It is about the biological bases of behaviors.

    31. (A)(B) Some US state laws persisted into the 1970s that allowed the castration of individuals judged to be feebleminded. Sadly, yes.

    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. Noted in class. As part of a 'eugenics' movement, castration makes no sense if the trait is not inherited.

    33. (A)(B) In principle, observing whether offspring resemble parents is a common way of determining whether a characteristic has a genetic/inherited basis. True and noted in class.

    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. First, there was no mention of this in class. Second, and contrary to what many may think, having the sequence does not do much to help us understand causes.

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. Not at all. The volume of INAH3 might even change during life.

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. Yes, as noted in class. The 'humans' theme is illustrated by the difficulty in doing the study; the 'correlations' them is illustrated by the fact we have only correlations to work with.

37. (A)(B) In lecture, the anterior hypothalamus was shown to lie on the upper frontal surface of the brain. No, was inside, near the brainstem.

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. Straight out of the table.

39. (A)(B) Undermasculinization is a general property of the known correlates of same-sex preference in males. No, several show overmasculinization.

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. You need to compare individuals of the same gender and sexual preference but differing in AIDS status. Thus c & d works (option F)

(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. You need to compare individuals of the same gender and AIDS status: a & c works (option B)

(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). <u>The money game</u>. 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. Although it was a game of individual versus group, it had nothing to do with outwitting others. If 4 or more others in the class chose the $100 option, you lost no matter what you did.

43. (A)(B) The largest monetary gain a person could get was possible if the entire class, <u>excluding them</u>, cooperated with each other. Yes – if you were the only one to choose $100, you got more than anyone else.

44. (A)(B) The game illustrated how one can bias a study. It was about conflict, not about bias.

45. (A)(B) Randomization of the choices given to participants was critical to the outcome. Randomization was irrelevant because everyone got the same choice.

46. (A)(B) This year is the first in which Bull lost money to the class. Fortunately, Bull has never lost the money.

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** A ToC requires (i) a group benefit and (ii) the selfish interests of individuals work against the group benefit.

47. (A)(B) Herd immunity exists for the disease Works in favor because herd immunity is a group benefit.

48. (A)(B) Individuals get vaccinated for selfish reasons Works against – you need people to avoid vaccination for selfish reasons

49. (A)(B) The infectious agent cannot spread from person to person Works against because herd immunity is not possible

50. (A)(B) The vaccine does not prevent an individual from getting infected but does prevent transmission by the infected individual works in favor because there is no selfish reason for an individual to get vaccinated – they would get vaccinated only to avoid spreading the disease to others.

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? Yes, a classic ToC and one that underlay the problems that precipitated the Dust Bowl – as wheat prices dropped, more land was put into production by individuals trying to maintain their income. Consequently, wheat prices dropped even further, and when the drought it, most of the land was bare.

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. No – nothing indicated about selfish interests leading to ruin of the communal resource (the apartment).

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. Not a tragedy of the commons. First, oil is not described as being a communal resource. Without that, there is no possiblity of the individual owners causing its collapse.

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. Not a ToC because the owners made a collective decision that proved poor.

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. No – other way around – ToC is a special type of conflict.

56. (A)(B) The effect of Lysenko on Soviet genetics was given as an example of conflict due to political factors dominating scientific ones. Yes, straight out of book (and maybe notes)

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. No way, although we may not have discussed this as much in 2013 as in previous years. We certainly did not say it and even gave some counter examples.

58. (A)(B) Bias usually appears in the evaluation stage of a study. Conflict usually appears in the design. Conflct is about goals so would not be in 'design.' Furthermore, Bias can occur before the design, during design and conduct or afterward.

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." Yes, and this one would help you answer 58.

60-62 (4pts). Which are true, as given in the economics of drug development lecture? Not given in 2013

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. No – economic forces work against drugs for uncommon disease.

61. (A)(B) Drug companies can only afford to develop drugs for which they have obtained patent protection. Yes, otherwise they cannot recover investment costs.

62. (A)(B) Companies prefer long clincal trials to short ones, as the long ones provide more opportunity to detect complications that pose liability problems. The opposite is true because clinical trials cost $$ and delay the time to market.

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. Helps avoid bias.

64. (A)(B) Publish the raw data instead of just summaries of the data. Helps avoid bias by allowing others to see all the results.

65. (A)(B) Specify the evaluation criteria before obtaining the results rather than after obtaining results. Helps avoid bias by preventing post hoc interpretation of the data.

66. (A)(B) Publish protocols at the completion of the study rather than in advance of the study. Works in favor of bias by enabling the researcher to conceal the true protocol, changing the design in mid course and developing statistical tests to support the desired conclusion.

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. An anecdote

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 <u>defends his choice by noting that the plan was the favorite of a well known local celebrity</u>.   appeal to authority (well known 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 <u>the evidence does not rule out the possibility of haunting on other occaions or in ways not addressed by the student test.</u> The professor is requiring that all alternatives be refuted.

70. A B C D E F G H I J A defense lawyer attempts to discredit the scientific testimony of a prosecution witness <u>by pointing out that the witness has done business in the past with an ex-convict</u>. Character assassination.

71. A B C D E F G H I J A scientist who has come up with a new theory for cancer <u>argues that her theory must be correct because the previous one has been shown to be wrong.</u>   an either-or argument – there is no support being offered for the new theory.

72. A B C D E F G H I J A company suspecting that its product will cause reproductive dysfunction <u>designs the phase III trial to look at just cancer rates and cardiovascular health.</u> is a form of bias that involves assaying for a narrow spectrum of (unlikely) results.

73. A B C D E F G H I J A company testing its drug <u>writes the methods as double-blind but makes sure the patients are given subtle hints about how to tell the drug from the placebo.</u> The true protocol is being concealed. Not in the above list, however, so NONE.

74. A B C D E F G H I J A lawyer in a suit against McDonald's argues that because <u>people who eat at McDonald's are disproportionately in poor health, the food served by McDonald's is to blame.</u>   An easy example of using a correlation to argue causation.

75. A B C D E F G H I J A lawyer in a suit against the British government argues that <u>nuclear power plants are causing cancers in nearby residents because they have higher incidences of cancer than the population at large</u>.   Another example of arguing causation from correlation.

76. A B C D E F G H I J Doug Bicklen's claim that <u>it does not matter how many failed attempts there are when trying to show whether FC works.</u>   Biklen is refusing to admit that his model of FC may be wrong. Gone over in class

77. A B C D E F G H I J A student claims that a test debunking horoscope accuracy <u>has not convinced him that there is "nothing to" horoscopes, and thus that he still believes in them.</u> Another example of requiring refutation of all alternatives; noted in class.

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:
The book now combines 'in the design' with 'during the study' so (B) and (C) would now be combined into a single option.

(A) Before the design of the study

(B) In the design

(C) During the study

(D) In the evaluation

(E) Is an argument indicative of bias, not a way of biasing the study

(F) None (not a way of or opportunity for introducing bias)

78. A B C D E F Make non-random assignments Could be in the design or during the study

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

80. A B C D E F Control the null model The only example we gave of 'before'

81. A B C D E F Choose a statistical analysis to support desired conclusion must occur after the data are in, so in the evaluation

82. A B C D E F Assay for a narrow spectrum of unlikely results we listed this as in the design; the key was wrong until 13:13 on Sunday

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