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.

Italicized phrases and sentences should be considered true.

Infectious Diseases

If needed in the next questions, use the following formula.

$$R_0 = \beta S/(r+d),$$

β – infection rate parameter

S – number of susceptible individuals in population

r – recovery rate of infected individuals

d – death rate of infected individuals

1-5 (7pts) Which of the following points are true about infectious diseases? **A = True**

1. **(A)(B)** The epidemic threshold differs among viruses and cannot be calculated for a virus until its specific R_0 value is known.

2. **(A)(B)** The magnitude of R_0 indicates (approximately) how serious the symptoms are for a disease – you get sicker with higher R_0.

3. **(A)(B)** As an epidemic proceeds, the value of R_0 progressively increases with the number of people being infected.

4. **(A)(B)** *An altruistic vaccine is one that does not prevent infection but blocks transmission by the infected person. The number of susceptible individuals, the recovery rate and death rate are not affected by an altruistic vaccine.* We can conclude, therefore, that the R_0 of the disease will not be affected by widespread use an altruistic vaccine.

5. **(A)(B)** From the formula, the R_0 of an infectious agent is expected to be higher in large communities than in small communities, if everyone is susceptible.

6-10 (7pts) Which of the following points are true about infectious diseases? **A = True**

6. **(A)(B)** An R_0 = 4 means that a single infected individual in a fully susceptible population will infect on average 4 new people every day.

7. **(A)(B)** Reported values of R_0 for different infectious diseases typically lie close to 1.0.

8. **(A)(B)** Wearing masks to prevent being infected would reduce β.

9. **(A)(B)** Two viruses with the same value of R_0 are also expected to have the same value of β.

10. **(A)(B)** If the initial R_0 of a disease is 7, eradicating it with a vaccine requires vaccinating (just) over 6/7 of the population.

11-14 (6pts) The following questions pertain to influenza (flu). Which are true? **A = True**

11. **(A)(B)** The flu vaccine is updated annually because our immunity to the virus decays within a year.

12. **(A)(B)** There are multiple types of flu strains, and the case mortality rate is very high for some (30% or more) and low for others.

13. **(A)(B)** A concern about some flu strains that currently have low R_0 is that they might evolve a higher R_0 and start epidemics.

14. **(A)(B)** We can be immune to some flu strains yet be susceptible to others – immunity is strain-specific.

Intrinsic Difficulties

The term 'rare events' is used here for the different forms of 'intrinsically limited replication' discussed in class.

15-18. (6pts) Which of the following options accurately explains an intrinsic difficulty and/or correctly explains why it constitutes (or they constitute) a special difficulty for the scientific method?   **A = true**

15. (A)(B) Intrinsic difficulties: These problems were said to arise from people being opposed to good science – people wanting to prevent others from discovering the truth.

16. (A)(B) Rare events: They include problems in which it is difficult to get a large enough sample to get a good estimate of the frequency of the (rare) event, and is possibly even difficult to observe the event at all.

17. (A)(B) Interactions: the scientific method is poor at addressing this kind of problem because the effect of a factor (X) being studied changes depending on the background in which X occurs.

18. (A)(B) Rare events: the decades-long use of the drug DES was given as an example.

19-42. 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 – address only the difficulties or phenomena specifically mentioned. **A = described B = not described**

19-22. (4pts) The science of climate change in response to human acitivities poses mulitple problems for science. One is that all countries are part of the same global atmosphere, so we have no replicate global atmospheres to study. Second, the effects of current human acitivities may not manifest themselves on climate for centuries, so cause-effect relationships are slow to be identified. Third, we have no prior history of studying many of these effects – they are new to us.

19. (A)(B) Rare events

20. (A)(B) Time lags

21. (A)(B) Interactions

22. (A)(B) Humans make difficult subjects

23-26. (4pts) The arch-villain Joker in the 1989 movie Batman devised a plan to poison the citizens of Gotham City. Rather than simply put a single poison into one product, Joker used a poison which required the combined effects of multiple ingredients. No single product was by itself toxic. What problem makes the discovery of the poison formula unusually difficult?

23. (A)(B) Rare events

24. (A)(B) Time lags

25. (A)(B) Interactions

26. (A)(B) Humans make difficult subjects

27-30. (4pts) Politicians have only recently embraced the scientific method in their quest for election. Electronic media has made it possible to measure voter response to compaign ads and speeches, so different voter groups are exposed to different messages, and the feedback from voter polls is used to choose the most popular message in future ads and speeches. The absence of appropriate technology has not been the only limitation, however. Politicians have been slow to embrace the scientific method, having been poorly educated about science. What intrinsic difficulties account for the slow embrace of the scientific method by politicians?

27. (A)(B) Rare events

28. (A)(B) Time lags

29. (A)(B) Interactions

30. (A)(B) Humans make difficult subjects

A = described B = not described

31-34. (4pts) Effective, new drugs are increasingly hard to come by. For one, biochemists have already found the easy targets for most ailments, so the identification of new targets requires a lot more time and effort. Second, despite vast gains in our knowledge of cell biology, we still do not understand many dimensions to how cells function and how disease is caused. Third, drug delivery to the cell has proved to be an important limiting step, and we as yet lack the technology to do this well. Which difficulties underlie the problems in developing new drugs?

> **31. (A)(B)** Rare events
>
> **32. (A)(B)** Time lags
>
> **33. (A)(B)** Interactions
>
> **34. (A)(B)** Humans make difficult subjects

35-38. (3pts) Which intrinsic difficulty is illustrated by Douglas Bicklen's challenging the results from Facilitated Communication (FC) experiments (in the second part of the FC video)? *Biklen was the adminstrator at Syracuse University.*

> **35. (A)(B)** Rare events
>
> **36. (A)(B)** Time lags
>
> **37. (A)(B)** Interactions
>
> **38. (A)(B)** Humans make difficult subjects

39-42. (4pts) Most merchants of goods sold in stores face a major challenge in anticipating consumer demands. Even when they know what consumers want at present, they cannot usually provide those goods in a timely fashion -- they must order the goods many months in advance, pay to have it stocked on the shelves, and then hope that consumers will still want the product. In the time from ordering goods until those goods are sold, consumer preferences may change profoundly, and the goods may not sell. The problem would be solved if the goods could be made available at the time consumer preferences were known. Which difficulties underlie this problem of matching consumer preferences with the goods being sold?

> **39. (A)(B)** Rare events
>
> **40. (A)(B)** Time lags
>
> **41 (A)(B)** Interactions
>
> **42. (A)(B)** Humans make difficult subjects

Biological Determinism

43-50. (10pts) Which of the following are true about Biological Determinism, as covered in class? **A=true, B = false**

43. (A)(B) The issues underlying biological determinism are now being resolved with sequencing of the human genome because the genome sequence tells us whether behaviors are inherited or not.

44. (A)(B) It was noted in class that biological determinism in the broad sense (that a person's behavior is not due entirely to their choice) has influenced some criminal penalties issued by U.S. courts in recent years.

45. (A)(B) Eugenics societies existed in the US as early as the 1920s.

46. (A)(B) The topic was relevant to 2 major class themes: (i) Humans make difficult subjects, and (ii) correlation does not imply causation

47. (A)(B) Several studies have found anatomical correlates of gender identity.

48. (A)(B) When anatomical correlates of sexual preference are found in men, the trend is invariably that gay men appear to be feminized relative to heterosexual men.

49. (A)(B) State laws in the U.S. during the 1900s allowed the castration of individuals judged to be feebleminded.

50. (A)(B) From studies of identical twins, we can conclude <u>both</u> that there is a genetic basis to sexual preference <u>and</u> there is also a non-genetic basis to sexual preference.

51-55 (10 pts) Which of the following paragraphs describe a tragedy of the commons conflict or outcome?   **A = is a ToC conflict, B = is not**

51. (A)(B) A professor agrees to provide optional review sessions before each exam if at least 25% of the class show up prepared for the review. The review session is very beneficial to all students who attend, regardless of advance preparation. However, preparing for the review session takes time and effort, and it is just as useful to attend without advance preparation. When the review session for the second exam is held, 90% of the class attends, but only 10% have prepared, and the review session is canceled, with disastrous effects on the exam average score.

52. (A)(B) A rancher with 100 head of sheep fails to vaccinate them for blue tongue disease because of the high cost of the vaccine. A large fraction of the sheep get sick with blue tongue and cannot be sold, and the rancher loses 3 times the money that the vaccine would have cost.

53. (A)(B) Ten individuals collectively own a patch of forest that contains the last population of a plant with medicinal value. The owners calculate that it is financially beneficial to harvest all remaining individuals of the plant and invest the money, rather than to maintain the population. Their calculation is based on a conservative estimate of the future value of the plant, which proves to be wrong. In future years, they realize that they would have made more money if they had maintained the population.

54. (A)(B) A rancher owns 6 different properties, all adjacent (maintained as separate properties for tax purposes). There is a common aquifer spanning the 6 properties. 4 properties are used for grazing cattle, 2 for crops. The rancher's decision to irrigate the crops eventually causes the aquifer to dry up, at which point it is not only no longer feasible to grow crops on the two properties, but it is also no longer possible to keep cattle on the other 4.

55. (A)(B) Three men together commit a robbery and quickly hide the money. They mutually agree to leave it buried for 10 years, until the threat of capture has diminished, at which time they will dig up the money and share it equally. They form an agreement that, in the event of capture, none of them will reveal the location of the money. All 3 are captured and charged with the robbery. When presented with the option of reduced jail time for all of them, they collectively agree to tell the authorities where to find the money, and the money is recovered by the police.

56-59 (4pts) The following paragraph is modified from a previous exam. Answer the questions that follow it. **A = true   B = false**

Wheat farmers have the goal of making enough money to pay the bills. 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 is stable for many years and then drops greatly (because good weather produces a surplus), 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.

56 (A)(B) A communal resource is described – it is the market price of wheat

57 (A)(B) Selfish interests of individuals are described – attempting to compensate wheat price declines by increasing production

58 (A)(B) The problem does <u>not</u> describe a tragedy of the commons because the initial drop in price is due to weather, not selfish interests.

59 (A)(B) It cannot be decided if the problem describes a tragedy of the commons because the consumer benefit of wheat prices is not considered in the problem.

60-63 (6 pts) The video on Facilitated Communication (FC) part II illustrated several examples of bias. Which are true? **A = true**

60. (A)(B) The video reported that approximately ¼ of studies published on FC had observed at least partial child communication/authorship, but those were from outside the U.S.

61. (A)(B) We suggested that the experiments debunking FC would have been more convincing to skeptics had they used a different control group.

62. (A)(B)   The arguments challenging the FC experiments centered on 3 details of the experimental design, and maybe 1/3 of the video considered the ramifications of those design features.

63. (A)(B) At one point in the video, the untested adoption of FC was compared to the marketing of a drug before it had been adequately tested.

64-69 (12pts). Identify the bias in the following questions using options (A)-(J). An answer may be used once, never, or many times. Each option pertains to bias (except J), but some are ways to bias a study and others are arguments/statements indicative of bias.

(A) character assassination of opponent	(D) build causation from correlation	(G) assay for a narrow spectrum of results	(J) None of A-I
(B) use 'either-or' arguments	(E) require refutation of all alternatives	(H) appeal to authority	
(C) make non-random assignments	(F) use anecdotes to defend a model	(I) Use small samples	

64. In attempting to justify a city-wide effort to improve oral hygeine using evidence that tooth decay levels are high, a politician argues that his son has high levels of tooth decay.

　　　(A)　　(B)　　(C)　　(D)　　(E)　　(F)　　(G)　　(H)　　(I)　　(J)

65. Many creationists argue that, if weaknesses exist in modern theories of evolution, their view must be correct that life was created by an Intelligent Designer.

　　　(A)　　(B)　　(C)　　(D)　　(E)　　(F)　　(G)　　(H)　　(I)　　(J)

66. In a series of trials to test a company's drug, those trials with unfavorable early results are terminated before completion and thus not included in the final analysis.

　　　(A)　　(B)　　(C)　　(D)　　(E)　　(F)　　(G)　　(H)　　(I)　　(J)

67. In attempting to discredit the USDA's insistence on the use of pesticides, a lawyer argues that pesticides are not effective because pest levels are actually <u>higher</u> in agricultural fields sprayed with pesticides than in fields not sprayed with pesticides.

　　　　　(A)　　(B)　　(C)　　(D)　　(E)　　(F)　　(G)　　(H)　　(I)　　(J)

68. In defending their beliefs in the validity of facilitated communication, parents shown in the video recalled incidents in which their child responded in a way that, upon interpretation, suggested to them that facilitated communication worked.

　　　(A)　　(B)　　(C)　　(D)　　(E)　　(F)　　(G)　　(H)　　(I)　　(J)

69. In the standardized field sobriety test that police give to drivers suspected of being intoxicated, police ask the driver to perform simple coordination tests. Then, if the coordination performance is sub-par, the driver is asked to submit to a blood or breath test. What type of bias is indicated in this police procedure?

　　　(A)　　(B)　　(C)　　(D)　　(E)　　(F)　　(G)　　(H)　　(I)　　(J)

70-75. (9 pts) Identify the appropiate type (or stage) of bias in the following questions. If a question does not give a type of bias, or if the type of bias is not in the list, choose 'None' (option E).

(A) Before the design and conduct	(B) In the design and conduct	(C) In evaluation and presentation	(D) Arguments indicative of bias, instead of ways to bias	(E) None

70. (A)(B)(C)(D)(E) Publish the raw data

71. (A)(B)(C)(D)(E) Choose a statistical analysis to support desired conclusion

72. (A)(B)(C)(D)(E) Assay for a narrow spectrum of unlikely results

73. (A)(B)(C)(D)(E) Specify evaluation criteria before obtaining results

74. (A)(B)(C)(D)(E) Use anecdotes to defend a model

75. (A)(B)(C)(D)(E) Build causation from correlation

76. (4 pts) (A) Fill in **bubble A** on 76 to indicate your key. **Likewise make sure your name and EID are correctly bubbled in.**