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.

Language of evaluation: falsifiability, irrelevant, consistent, support, null, ...

1-6. (**7 pts**) Which statements are true?

1. **(A)(B)** If data are consistent with a model then they also support it. No. Support implies consistent, but the reverse does not apply: data can be consistent without supporting the model
2. **(A)(B)** The scientific method dictates that we adopt strict thresholds for acceptance of a model, rejecting the model if the probability of observing the data is less than 0.05. This acceptance threshold is inflexible; a test value of 0.04 provides as meaningful a rejection as a value of 0.0000001, for example. No. The threshold for rejection is both arbitrary and also depends on the consequences of incorrectly accepting/rejecting the model.
3. **(A)(B)** For a model to be deemed falsifiable, we must be able to imagine data that are irrelevant to it. No. We must be able to imagine data that would falsify it (cause us to reject it). We can imagine irrelevant data for all models.
4. **(A)(B)** Examples of null models in use in the US include 'innocent until proven guilty' in criminal trials and 'safe until proven harmful' for drugs being proposed for marketing. Almost but not quite: the last part is not true: drugs being proposed for marketing have the null model of harmful until proven safe.
5. **(A)(B)** For data to be deemed falsifiable, there must be at least one model for which they are relevant. Statement is nonsense – data are not considered 'falsifiable;' only models are.
6. **(A)(B)** A null model is part of every properly designed study. A study lacking a null model is not properly designed. No. We mentioned that a study can be designed from the perspective of 'equal alternatives.' Thus not all studies need to use a null model.

Correlations, Causation & Hidden variables

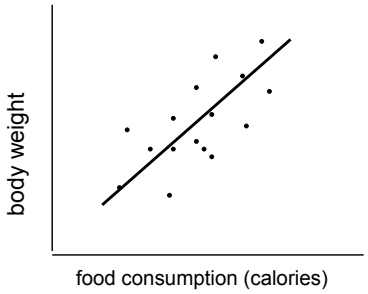
7-13. (7 pts) Which of the following statements describe a (non-zero) correlation? Do not choose any option that describes a zero correlation, for which a correlation is undefined, or which describes causation but no correlation. If insufficient information is given to determine whether a correlation exists, treat it as if there is no correlation. If part of a group is described as having some attribute, assume that others in the group do not have it. **A = is a (non-zero) correlation, B = not a correlation**

7. **(A)(B)** Smoking causes lung cancer but has no effect on colon cancer Not a correlation. These are causal models.
8. **(A)(B)** On average, the 11:00 lecture of Bio301D has more attending students than the 10:00 lecture Yes. Attending students is a variable and we are measuring the variable on two 'entities' or populations (10:00 class and the 11:00 class). The value of the variable is not the same for the two classes, so there is a non-zero correlation.
9. **(A)(B)** Texting while driving increases accident rates No. Causal model
10. **(A)(B)** 25% of A&M students attend home football games; the same 25% also attend A&M rallys; the other 75% attend neither. Yes but not obvious. Dissect it as follows. There is one population (A&M students) and 2 variables (attending games and attending rallys). So you have enough data for a correlation to possibly exist. Now the question is whether the state of one variable is associated with the state of the other. The fact that all students who attend rallys also attend games (and all students who do not attend rallys also do not attend games) means that there is a (strong) correlation here. This one may be confusing because the 25% and 25% appears to be a zero correlation. But the problem should be plotted with one axis as 'attend games' (yes or no) and the other axis plotted as 'attend rallys' (yes or no) because those are the two variables. Individuals are either 'yes' 'yes' or 'no' 'no', so there is a perfect correlation. Note that you could not decide if there is a correlation here if you did not know whether the same students who attend games were also the ones who did (or did not) attend rallys.
11. **(A)(B)** 25% of A&M students attend home football games but not rallys; the other 75% attend A&M rallys but not home games Yes. This problem is the reverse of 10. When plotting these data the same way recommended for 10, one again gets a perfect correlation – if a student attends a rally, they do not attend games, and vice versa.
12. **(A)(B)** Adult men are on average taller than adult women Yes. Height is a variable, gender is the other variable, or you can think of the problem is one variable (height) and two populations. Since height is greater for one gender than the other, there is a correlation.

13. (A)(B) 35% of UT students have blood type A. 35% of SMU students have blood type A. No. We have blood type as a variable measured on two groups (UT, SMU students). Since the blood type value is the same for both groups of students, the correlation is zero.

14-16 (6 pts) Cancer rates of dogs whose owners use lawn pesticides are higher than cancer rates of dogs whose owners do not use pesticides. Which of the following models invokes a third variable to explain the **cause** of this correlation? Recall that, for models that invoke a third variable, reducing lawn pesticide use will not by itself reduce dog cancer rate. **A = 3rd variable present, B = absent**

Choose (A) if third variable present	Causal model
14. (A)(B)	Dog owners that use lawn pesticides also put insecticidal flea collars on their dogs; owners that do not use lawn pesticides avoid flea collars. The flea collars lead to dog cancer. (A), the third variable is use of flea collars, stated as being the cause of the cancer.
15. (A)(B)	Lawn pesticides are used more heavily in yards that are infested by insects and other 'bugs.' The bugs carry disease agents that infect dogs, and it is those disease agents that cause dog cancer. (A), the third variable is bugs, stated as being the cause of the cancer.
16. (A)(B)	Pesticides change the composition of bacteria and fungi in the yard. Different bacteria and fungi determine the cancer rate of dogs inhabiting the yard. (B), no third variable in the sense we have defined a third variable. Pesticides are working through bacteria and fungi to cause cancer, so if we change pesticide use, we WILL change cancer rate.



17-19. (6 pts) What does the graph actually show/illustrate – what can you conclude is necessarily true from the graph?

The graph is a correlation, so you can only conclude correlation from it, not causation.

17. (A) (B) Heavier people consume more calories than lighter people (on average) Yes. This statement is a correlation that goes in the same direction as shown in the graph.

18. (A) (B) Increasing food consumption has no effect on body weight No, this is a causal model; you cannot infer causation from correlation.

19. (A) (B) Increasing food consumption causes increased body weight No, this is a causal model; you cannot infer causation from correlation.

20-23 (8 pts) The following table gives percent of people belonging to the Republican party according to whether they own a car and whether they have health insurance. Answer the following options about the possible correlations that could result from this table.

This question is about correlations – when they might exist in a table that gives percents (rates) rather than numbers of individuals.

		Health Insurance	
		yes	no
Own car	yes	45% Republican	15% Republican
	no	25% Republican	12% Republican

A = true, B = false

20. (A)(B) The table shows that the combination of owning a car and having health insurance has the highest fraction of Republicans among the 4 cells. The statement merely asks you to interpret which cell has the highest value. The upper left cell does, which consists of owning a car had having health insurance. True.

21. (A)(B) If no other 3rd variables apply, the table shows that owning a car will be (positively) correlated with being Republican no matter what numbers of people go in each of the 4 cells. False. This question gets at the fact that the correlation among these variables depends on the numbers of individuals that go in each cell, which are not given in the problem. You thus need to see if you can generate the stated correlation by imagining that some cells have almost no individuals and other cells have lots of individuals. Thus, for owning a car to be correlated with being Republican, it must be the case that no matter what numbers of individuals you put in the cells, there will always be a higher level of Republican associated with car ownership. If you suppose that the upper left and lower right cells have almost no individuals, car ownership will be about 15% Republican but car non-ownership will be about 25% Republican. So no, the table need not have a positive correlation between being Republican and owning a car.

22. (A)(B) If no other 3rd variables apply, the table shows that having health insurance will be (positively) correlated with being Republcan no matter what numbers of people go in each of the 4 cells. True. Use the same reasoning as in 21, but this time, having Health Insurance will always have a higher level of being Republican than not having Health Insurance.

23. (A)(B) Until you get the numbers for each of the cells, you cannot say what per cent of car ownership (or car non-ownership) is Republican. True. Without the numbers of individuals for each cell, the only way you would know the per cent of car ownership that is Republican would be if the top and bottom cells in a column both had the same percentage.

24-26. (5 pts) Consider the example of moderate alcohol consumption and longevity. How could people who drink moderately live longer than non-drinkers even though moderate alcohol consumption reduces longevity? Which models produce this combination of patterns? **A = produce the pattern, B = do not** This is another twist on the third variable problem.

24 (A)(B) Healthy people drink moderately, whereas those who are sick and prone to die somewhat early avoid alcohol. The reduced lifespan from drinking alcohol has only a mild effect on the longevity of healthy people, so the moderat drinkers tend to live longer than the sick ones who avoid alcohol. (A) This problem produces the correlation by invoking the third variable of 'health.'

25 (A)(B) People who drink moderately take better care of their health in other ways that more than compensates for the negative effect of the alcohol. Non-drinkers do not take care of their health and thus have shortened lifespans. (A) This problem produces the correlation by invoking the third variable of 'taking care of themselves.'

26 (A)(B) Moderate consumption of alcohol causes people to eat more and be heavier. The increased body weight reduces their life span. Non-drinkers experience less weight gain and thus do not suffer the life-shortening effects. (B) This problem does not produce the correlation – it argues that moderate alcohol consumption reduces lifespan, but it does not explain how moderate alcohol consumption is correlated with increased longevity.

27-30. (8 points) Which of the following constitutes an example of **inferring causation from correlation** (i.e., in which a correlation leads someone to infer the causal basis of the correlation)? Base your answer only on the information provided. Do not choose answers as true that merely describe a correlation, that argue correlation from causation, or that test the causal basis of a correlation. **A = infers causation from correlation; B = does not infer causation from correlation**

27 (A)(B) You read that people who eat fast food have more health problems than average. (a correlation) You have never eaten much fast food, but this information increases your resolve to avoid fast food. (inferring causation) A – you are modifying your behavior in response to a correlation, hence inferring causation.

28 (A)(B) A person is more apt to make mistakes when they are sleepy than when they have had adequate sleep because the lack of sleep impairs judgment. First sentence is casuation. As a consequence, sleepy drivers are involved in auto accidents more often than are awake drivers. Second sentence is correlation. So correlation is being argued from causation. B

29 (A)(B) A scientist observed that milk maids tended not to get smallpox (correlation). He guessed that this low incidence of smallpox was due to a milkmaid's exposure to cowpox, so he developed a vaccine against smallpox using the cowpox virus. Inferring causation. A

30 (A)(B) Quitting the smoking habit reduces a person's lung cancer rate (causation). As a consequence, former smokers who have quit the habit have lower lung cancer rates than those who continue smoking. (correlation). B

Controls

31-38 A professor conducts an experiment with the incoming 2011 UT Freshman class (thousands of male and female students across all college disciplines and all majors) to determine the effect of exposing them to different 'mindset' training exercises. Students are assigned randomly to either of two groups. One group watches a video emphasizing that intelligence can be developed ('growth mindset'). The other is exposed to a video emphasizing that intelligence is static ('fixed mindset'). Grades of the students from each group are compared at the end of the first year.

31-34 (6 pts) What variables are explicitly controlled for or expected to be controlled for within the individuals included in this experiment? Do not infer more than is given. **A = controlled, B = not**

31. (A)(B) student major controlled because of randomization

32. (A)(B) student gender controlled because of randomization

33. (A)(B) courses taken controlled because of randomization; you answer to this might depend on whether you interpreted 'taken' as courses already taken or courses that will be taken by the students. If exposure to the different videos affected the future courses taken by the students, then you could argue that those future courses are not controlled for.

34. (A)(B) SAT score controlled because of randomization; but you need to know that SAT score is something that the students already had when they arrived at UT.

35-38 (6 pts) What variables lie outside the study? **A = outside the study B = not**

If a variable lies outside the study, it means that everyone within the study has the same value of the variable.

35. (A)(B) student major inside the study

36. (A)(B) student gender inside the study

37. (A)(B) Texas universities (UT, Rice U, SMU, Baylor U, …) Outside, since the study is conducted at UT

38. (A)(B) class rank (Freshman, Sophomore, Junior, Senior) Outside, since the study is confined to Freshmen

39-42. (5 pts) The Monty Python video compared penguin intelligence to human intelligence. Which are true about that video?

This question is merely asking whether you observed the video and had a pulse at the time. All of these points were discussed in class afterward.

39. (A)(B) Three models of intelligence were tested: IQ score, performance in a maze (at the zoo), and brain size No, maze performance was not something shown as being tested.

40. (A)(B) No brain size comparison between humans and penguins controlled for other variables No. One comparison controlled for body size.

41. (A)(B) The maze test controlled for body size by using a larger/taller maze for humans than for penguins No. This question is double jeapordy - it was intended to make you suspect there really was a maze test in 39, had you not seen the video.

42. (A)(B) At least one IQ test controlled for (i) ability to speak English, (ii) inability to speak English, and (iii) testing environment. Yes. If ability to speak English is controlled, then inability to speak English is also controlled. And the testing environment at the zoo included penguins and humans.

43-45. (6 pts) Researchers are attempting to identify the causes of a student getting good grades in college. The variables (factors) being considered are in columns: W, X, Y, Z and M. Each row (option) describes the factors present (+) and absent (-) for a select group of students. Each row also has an associated average grade for the group (not shown). Which statements are correct about the factors being controlled? This question is a simple graphical approach to controls. When comparing two or more options (rows), a factor that is controlled has the same value (+ for both or – for both) across the row. If you are interested in evaluating the effect of factor A when all other variables are controlled, each of the other variables must have the same score for each factor (both be + or both be -), but factor A must differ between the two rows.

		factor				
		W	X	Y	Z	M
Option	(A)	+	+	+	+	+
	(B)	+	+	+	+	-
	(C)	+	-	+	-	+
	(D)	+	-	-	+	-

	(E)	+	-	-	-	-
	(F)	+	-	+	-	-
	(G)	+	+	-	-	+
	(H)	+	-	+	+	-

A = true, B = false

43. (A)(B) The pair of options A & E together control for all factors except W (B). Options A and E differ for X, Y, Z and M, and they actually do control for W. The question is intended to force you to decide whether a factor is controlled if it is the same between the two groups or is different between the two groups.

44. (A) (B) Pair A & B controls for the same set of factors as pair C & F Yes. Here you must both know that a factor is controlled when it is the same between the two groups but also that it can be controlled in either of two ways (both groups are + or both groups are -). Options C&F control for some factors with – in both groups, yet A&B control for those factors with a + in both groups. Those factors are nonetheless controlled in both groups.

45. (A) (B) All possible pairs of options control for W Yes. This statement can be true only if all options have the same value for W, and in this case they do.

Experiments

46-49. (4pts) Which features of ideal data apply to experiments but are not relevant to correlational data? **A = unique to experiments; B = relevant to both** This one is intended to test your understanding of the fundamental difference between an experiment and correlations. The only necessary difference is a manipulation – you can apply controls, replication, blind and randomization (in some ways) to correlational data. So none of these options are unique to experiments.

46. (A)(B) blind

47. (A)(B) randomization

48. (A)(B) controls

49. (A)(B) replication

50-58. Prisoners of Silence video (FC = facilitated communication). *The video showed tests of FC suggesting that the facilitator, not the person with autism (PWA), was the author of the typed responses.*

50-54 (5 pts) Which design features were explicitly included in the experiments? **A = explicitly included, B = not explicitly included**

Gone over in class. The only ambiguous features in the tests were standards and randomization. Note that controls were included, and it is now essential that you understand the difference between controls and standards. Standards are specifically used to assess data quality; controls are used as a baseline for evaluating the effect of a treatment. If this list had included an option for controls, they would have been explicitly included, as per the next set of questions.

50. (A) (B) Explicit protocol

51. (A) (B) replication

52. (A) (B) randomization

53. (A) (B) standards

54. (A) (B) blind

55-58 (5 pts) Which of the following are true about the controls (if any) in the FC experiment – as discussed in class?

55. (A)(B) Controls for the test consisted of objects/photos already familiar to the PWA No. The idea was that all test photos/objects should have been of items already familiar to the PWA.

56. (A)(B) Controls for the photo identification test consisted of the message passing test (shown only for Betsy Wheaton) No. The message passing test was was indeed only shown for Betsy, but it was one of two types of tests (or models) used to assess Facilitated Communication. There was indeed a control used in that test, but the test itself was not a control.

57. (A)(B) Controls established that the FC environment was working normally. Yes. We noted the importance of this in class, although the video did not make a big point of it. I do not remember why the key allowed both options for this question.

58. (A)(B) Use of a facilitator familiar to the PWA represented the control No. Both the control and treatment used the same facilitator (for a PWA).

59-62 . (6 pts). Which of the following studies describe experiments, regardless of whether the experiment was designed well or poorly. **A = experiment, B = not an experiment**

59. (A)(B) To establish the validity of Facilitated Communication, you watch the facilitator carefully and record brain waves on the facilitator and person with autism as responses are being typed under the normal FC conditions. The data are analyzed by neurobiologists who know how to interpret the brain waves. No, there is no manipulation here that changes the 'natural order' of FC.

60. (A)(B) You suspect that tire pressure has a measureable effect on the gas mileage of your car (miles per gallon, or mpg). To quanitify this effect, you undertake car and tire maintenance as usual, but you record tire pressure and mpg at weekly intervals over 6 months. The data show no pattern. No. You are taking new data but not manipulating the system to observe the outcome.

61. (A)(B) A professor worried about student evaluation scores for his class suspects that his usual manner of dress is too casual to impress students. In previous years, before he became suspicious of this possible cause, he dressed casually on every day of the semester. In the first semester that he wondered if his dress style mattered, he wears a suit to impress students on the day that evaluations are done. His evaluations go up Yes. A change in behavior (attire) is being instituted to observe an outcome. Don't expect this to happen in Bio301d.

62. (A)(B) A researcher merely records the diets of a large number of pregnant women. He finds that women who took twice the recommended daily dose of vitamin A have a 1 in 57 chance of a child with birth defects.. No, just observations, no manipulation.

63-66. (6 pts) *Secrets of the Psychics video and our personality survey*. *Several experimental tests of psychic practices were shown in the video, plus most of the class participated in an online survey*. Which options are correct?

63. (A)(B) We concluded from the video that it is possible to test the validity of psychic predictions experimentally BUT that it is not possible to show that there is no (zero) validity to sets of psychic predictions. Yes for both. The first part is true in that several tests were shown that did indeed test the validity of psychic predictions. The second part gets at the fundamental point of science that you cannot 'prove a model.' In this case, proving the model of zero psychic predictability would require rejecting all models in which psychic predictions have any validity – impossible.

64. (A)(B) The horoscope experiment shown in the video was a close parallel to the personality survey exercise that you were asked to do online, in that both used a mock description of a person and students were asked to score the accuracy of the description. Yes, which you will realize if you participated in the survey and were present in class on the day we discussed it (or watched the video).

65. (A)(B) Randomization. In light of the goal, the horoscope experiment would have been improved if the distribution of who got which horoscope had been randomized. No. This goes back to the fact that randomization has no meaning if everyone is given the same form.

66. (A)(B) There was no basis for evaluting the palm reading experiment described in the video because the experimenter had no data from controls. Wrong. There were indeed controls in the palm reading experiment – when the palms were read by the book.

67-70. (4pts) Which options are true about experiments?

67. (A)(B) Experiments are able to control for unwanted variables better than correlational data Yes. That is the point.

68. (A)(B) Only experiments, not correlational data, can be analyzed blindly No, how you got the data does not dictate whether you can analyze them blindly.

69. (A)(B) Experiments can control for hidden variables that have not even been identified. Yes, when using randomization you control for many unknown variables.

70. (A)(B) Two types of experiments were noted, one in which the variables to be controlled for are known in advance Yes..

71-73. (3pts) Which are true of clinical trials with humans?

Gone over briefly in class in 2012.

71. (A)(B) They typically include features of blind, random, and replication, but they often lack controls (for ethical reasons). No, they invariably use controls, although we did mention one case in which a control group was abandoned part way through.

72. (A)(B) If you participate in a study, you will be included all in three phases (I, II, III) No. There are 3 phases, but any individual participates in just one phase.

73. (A)(B) Clinical trials qualify as experiments on humans. Yes, they certainly are experiments and do involve humans (by definition).

74. (3 pts) Key code, name, and ID number. Fill in (**A**) in scantron field 74 to indicate your key for this version of the exam.

Be sure your name and EID number are correctly bubbled in on the scantron.