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

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

   A) A statistical test is a shortcut to replication.

   B) If a statistical test tells us that the observed data would be expected under the null model at P = 0.05, it means that the null model would give similar results in 1 out of 20 trials.

   C) For a model to be deemed falsifiable, it must have been falsified/rejected at least once.

   D) A scientific theory is not considered valid and accepted until all the alternatives have been rejected.

   E) No scientific theory can explain everything

   F) A model is considered 'proven' to be true once we have unambiguously rejected the alternatives being tested.

   G) Data are consistent with a model if they do not reject/refute it.

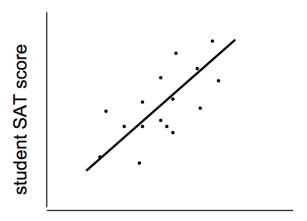**Correlations, Causation & Hidden variables**

2. (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. MTF

   A) Cultures with high dietary levels of red meat have higher rates of colon cancer than other cultures

   B) 1/5 of UT Republicans have cars; 4/5 of UT Democrats do not have cars.

   C) Outdoor temperatures in Austin are cooler in December than in July

   D) Driving and talking on cell phones increases car accident rates, but drivers who talk while driving have lower accident rates than those who do not talk while driving.

   E) UT men have higher car insurance rates than UT women

   F) 35% of UT students have blood type A. 20% of those are A-, 80% are A+.

   G) 65% of the students enrolled in Bio301D are women; 35% are men.

3 (8 pts) Societies with high per capita alcohol consumption have shorter life spans than countries with low alcohol consumption. One causal model is that alcohol reduces lifespan.

Which of the following models instead invoke a third variable to explain the **cause** of this correlation? In answering, recall that, for models that invoke a third variable, reducing alcohol consumption of a society will not, by itself, increase lifespan. MTF

Causal model	Third variable?
Drinking alcohol in excess leads to violent behavior. The alcohol-induced violent behavior is what lowers lifespan.	(A)
The physical environments of societies with high alcohol consumption are stressful. Stress reduces lifespan and causes people to drink in excess.	(B)
Societies vary in the physical activities – exercise levels - of their populations. Those with lots of exercise do not have time to drink excessively; those with little exercise have plenty of time to drink. High levels of exercise increase lifespan.	(C)
High levels of alcohol consumption in a society causes increased social dysfunction. Social dysfunction reduces lifespan.	(D)

4. (6 pts) Which models/statements are **inconsistent** with the following graph? (INCONSISTENT!) That is, circle an answer if it CAN BE RULED OUT using the information in the following graph. Assume you have no data other than what is presented in this graph. MTF

VG activity: hours playing video games/week

which options are inconsistent with the graph?

A) SAT score is correlated with VG activity

B) SAT score is negatively correlated with VG activity

C) SAT score is positively correlated with VG activity

D) Playing video games lowers SAT score

E) Playing video games raises SAT score

F) SAT score is correlated with Family income

G) Parents in wealthier families encourage their children to study more than parents of poorer families

5) (5pts) Consider a correlation between a person's income at age 30 and whether they belonged to a sorority/fraternity when in college: former members of these social organizations have higher income (at age 30) than non-members. This correlation is being used by fraternities and sororities to solicit membership. You think that the cause of correlation is not membership, but instead parental income. If the true cause is social membership, not parental income, what income levels are expected in cells 1 & 2 of the following table? Assume that no other variables are important. (one answer only)

		membership in frat/sorority:	
		no	yes
parental income	high	(1)	high income (age 30)
	low	low income (age 30)	(2)

A) 1 is high, 2 is high

B) 1 is low, 2 is high

C) 1 is high, 2 is low

D) 1 is low, 2 is low

6) (6 pts) The following table gives voting rates of people according to whether they drink coffee and exercise more than 2hr/week. Answer the following options about the possible correlations that could result from this table. MTF

		Coffee drinking	
		yes	no
exercise	yes	vote in 50% of elections	vote in 60% of elections
	no	vote in 50% of elections	vote in 80% of elections

A) If no other 3rd variables apply, the table shows that the combination of no coffee and no exercise has the highest voting rate of the 4 cells.

B) If no other 3rd variables apply, the table shows that coffee drinking will be correlated with higher voting rates no matter what numbers of people go in each of the 4 cells.

C) If no other 3rd variables apply, the table shows that exercise will be correlated with lower voting rates no matter what numbers of people go in each of the 4 cells.

D) Until you get the numbers for each of the cells, you cannot say what per cent of all coffee drinkers votes.

7-9. (3 points each) Researchers have noted that people in countries with high dietary fiber have low colon cancer rates compared to people in countries with low dietary fiber. They have thus suggested that increasing dietary fiber is a way to reduce colon cancer rates.

For each of the following questions, you are given a pair of these variables. You are asked to choose among the following 3 options that best characterizes their relationship in the problem description above.

(A) no correlation or causation is indicated.	(B) a correlation is indicated, but no causation between the variables is suggested	(C) a correlation is indicated and a causal relation between the variables is suggested.

For each pair of variables given below, which option applies (**one answer each**)?

7. High fiber diet & colon cancer rate: (A) (B) (C)

8. High fiber diet & country: (A) (B) (C)

9. Colon cancer rate & country: (A) (B) (C)

10. (5 pts) Consider the example of taking vitamins and general health. How could people who take vitamins <u>have worse health</u> than those who don't take vitamins, yet at the same time, <u>vitamins improve health</u>? MTF

A) This result could only happen if vitamins improve health at some ages and worsen health at other ages.

B) People who take vitamins also eat fewer fruits and vegetables, and their poor diet reduces health

C) There is a higher rate of taking vitamins in parts of the country where lifestyles are unhealthy

D) Taking vitamins aids the growth of bacteria in the gut, and sometimes those bacteria are pathogens, reducing the person's health.

11. (7 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 circle answers that merely describe a correlation, that infer correlation from causation, or that test the causal basis of a correlation. MTF

   A) You read that people who eat fast food have more health problems than average. You have never eaten much fast food, but this information increases your resolve to avoid fast food.

   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. As a consequence, sleepy drivers are involved in auto accidents more often than are awake drivers.

   C) A scientist observed that milk maids tended not to get smallpox. 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.

   D) Quitting the smoking habit reduces a person's lung cancer rate. As a consequence, former smokers who have quit the habit have lower lung cancer rates than those who continue smoking.

   E) People who overeat have high levels of health problems. People who smoke have high levels of health problems. People who both overeat and smoke have the highest levels of health problems.

Controls

12. (5 pts) Researchers are attempting to identify the causes of a student getting good grades in college. The variables (factors) being considered are: W, X, Y, Z and M

Which two rows would you want to compare to determine if **variable W is correlated with differences in grades when all other factors are controlled**? In evaluating possible answers, pick any comparison that controls for **all** unwanted factors, and assume that these treatments differ only in the ways stated. Mark exactly two options, or option J if none apply. Each row (each option) describes a different set of factors. If multiple combinations satisfy the problem, any correct combination will be accepted. (Two answers or J).

		factor				
		W	X	Y	Z	M
Option	(A)	+	+	+	+	+
	(B)	+	+	+	+	-
	(C)	+	-	+	-	+
	(D)	+	-	-	+	-
	(E)	+	-	-	-	-
	(F)	+	-	+	-	-
	(G)	+	+	-	-	+
	(H)	+	+	+	+	-
	(I)	+	-	+	+	-
	(J)	No combination satisfies the request				

13 (6 pts) A professor conducts an experiment to determine how students can improve exam scores. She uses two Sections of the same course (each with different students, each meeting at a different time of day). She lets the students in one section go about their business as usual (= the control group). For the other section (the treatment group), she dictates the students' sleeping, eating, and studying habits for a week. She then gives the same exam to both sections at their usual times and compares the scores between 50 randomly chosen male students of one section to the scores of 50 randomly chosen males from the other section. What factors are explicitly controlled for? Do not infer more than is given. MTF

(A) Section of the class

(B) student gender

(C) student eating habit

(D) student sleeping habit

(E) time and day of exam administration

(F) prior exam performance of the student

14 (5pts) You are hired by the Miracle Grow company to improve marketing. You come up with a plan to show plants that were grown with Miracle Grow versus plants fertilized with a competitor's fertilizer. However, you make the comparison so that the plants fertilized with Miracle Grow are grown in a part of Alaska during a time of year that has 24hr sun, and the plants grown with the competitor's product are grown in a different state at a different time of year, when day length is short. Which variables are controlled for in this comparison? MTF

A) day length   B) fertilizer brand   C) location   D) time of year

15 (6 pts) You are a high school basketball coach. More students want to play than are needed, and you want to find the best combinations of players to score points. So you swap players in and out during the same game to find out which combinations of players generate the most points. For the first half of the game, the 5 players are **A**, **B**, **C**, **D**, and **E**. For the second half, the 5 players are **A**, **B**, **C**, **G**, and **H**. Which players and factors are controlled for in this comparison of the team compositions? MTF

A) The opposing team

B) The stage of the game (first, second half)

C) player A

D) player B

E) player G

F) player H

Experiments

16. (7 pts) Prisoners of Silence video (FC = facilitated communication). *The video showed tests of FC suggesting that the facilitator, not the child, was the author of the typed responses.* One criticism of the tests might be that the test environment was intimidating, so the children could not be expected to answer correctly. Other objections might be raised against the test design or interpretation of the results. Which of the following options are legitimate arguments either in favor of or against the tests and interpretations drawn? Take account of the outcomes shown in the video in choosing your answers. MTF

A) Specifying the protocol in advance of the test would avoid most aspects of intimidation, so intimidation should not have been an issue.

B) Use of a familiar facilitator would eliminate criticisms of the test environment, because the child would be comfortable.

C) The use of blind was unnecessary in assessing communication by the child, yet the blind feature of the study contributed the most to intimidation.

D) The null model for the experiment is that the child cannot communicate (i.e., the experiment is looking for positive responses); use of this null model biases interpretation of the test against communication by neglecting the examples in which valid communication was shown.

E) The controls for the study were the cases in which the child and facilitator were shown the same photo; the fact that the correct response was typed in these cases demonstrated that the FC setting was operating in the usual fashion.

F) Tests were conducted with multiple autistic children, multiple facilitators, and the type of test was even varied. The test outcomes were consistent across these replications. So the results were not specific to one particular test design or one particular facilitator.

17. (8 pts). Which of the following studies describe experiments, regardless of whether the experiment was designed well or poorly. MTF

A) To determine if talking on cell phones increase cancer rates, you do a massive analysis of health records and cell phone use to see if cancers increase with phone use.

B) Your usual method of gardening is to plant in unfertilized soil and merely keep the plants watered until harvest. You suspect there is a way to increase harvest, but you are not sure if fertilizing and tilling will help or hurt. Next summer you thus grow 4 replicate plants of each variety, one of which is grown in the normal way, one of which is fertilized only, one of which is tilled only and one that gets both tilling and fertilizer. At harvest, you compare the amount of produce from each method.

C) You have been told that cars get better mileage when driven at a speed of 55mph than at 70 mph. Although skeptical of this claim, since you normally drive 70, you want to know if the advice is true. For the next 5 road trips, you alternate driving 55mph and 70mph between tanks of fuel. This allows you to calculate the mileage from each speed.

D) The method of collecting homework assignments in class has always posed problems for class management. In the past, homeworks were required to be turned in as hard copy during class, but there were logistical problems in handling so many physical copies. In attempting to alleviate those problems for the current class, the professor changes the protocol to require on-line submission of homework assignments. A whole new set of problems occurs.

E) A scientist in the late 1800s has a theory that malaria is transmitted by mosquitoes. Since mosquitoes are seasonal (they are in high numbers in warm times of the year), he obtains hospital and other medical records to measure the number of new malarial cases in cool versus warm times of the year. There are indeed far more new malarial cases in summer than winter.

18. (6 pts) *Secrets of the Psychics video. Several experimental tests of psychic practices were shown*. Which options are correct? MTF

A) The scientific tests were inconclusive because it is not possible to reject/disprove all the psychic statements and predictions.

B) The video illustrated four different psychic methods that were evaluated scientifically: horoscopes, palm reading, describing characteristics of a person from a photograph, and tarot card readings.

C) The horoscope experiment consisted of creating individualized horoscopes based on birthdate but then randomizing which student got whose horoscope.

D) A null model approach to these experiments could not be used because psychic phenomena and predictions are so detailed and specific that there is no clear null model.

E) The ideal data features present in both the horoscope and palm reading experiments included blind and replication. However, although controls were clearly present for the palm reading test, it was not clear whether controls existed for the horoscope test.

19. (4 pts) Key code, name, and ID number. Fill in (**A B**) in scantron field 19 to indicate your key for this version of the exam.

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

Your name is required on this exam form and the scantron form to receive credit for this test.