

**1. (4 pts) Key code (AB), EID , and name.** To get credit for taking this exam, be sure your name and EID number are correctly bubbled in on the scantron and that you have put your name on this exam copy. To indicate which version of the exam you have, do the following:

(A) Fill in A

(B) Fill in B

leave the others blank

### Current Events, Miscellaneous, Overview

**2. (4 pts).** The following options pertain to articles we covered in class but were not topics in the book per se. Which statements are true? If a topic was not covered, do not mark it. The first phrase in each option gives the topic. MTF

- A) Pedestrian deaths by autos in Austin: The data figured in the news article showed a correlation spanning several years in which the number of pedestrian deaths increased consistently as the number of (pedestrian) citations went down.
- B) Pedestrian deaths by autos in Austin: We suggested that differences in the annual number of pedestrian deaths over the last 4 years was consistent with random variation (sampling error).
- C) White House stance on extraterrestrial aliens: The White House statement reflected an ignorance of scientific principles – it claimed that extraterrestrial aliens do not exist on earth, rather than merely claiming a lack of evidence for extraterrestrial aliens.

**3 (4pts)** Overview of this last section of the course. Which are valid reasons why it may be difficult to obtain or recognize scientific 'truth?' MTF

- A) Nature works against us. Some problems are not easily attacked/approached with the scientific method because they have properties that slow or thwart the scientific method.
- B) Our brains work against us so that we often do not objectively look at evidence in making decisions.
- C) The scientific method works against us because (as before) all models are false.
- D) Other people work against us – conflict.

### Intrinsic Difficulties

**4. (5pts)** Which of the following options accurately explains one of the intrinsic difficulties and/or correctly explains why it constitutes a special difficulty for the scientific method? MTF

- A) Intrinsic difficulties: These problems were said to arise mostly from poor study designs, because the researcher has a poor understanding of the scientific method.
- B) Rare events: They are considered a problem when 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.
- C) Interactions: the scientific method is poor at addressing this problem because the relationships among the different elements of the scientific method (goal, model, data ...) interact in a different way than normal.
- D) Interactions: the decades-long use of the drug DES was given as an example.
- E) Time lags: was given as the reason why several (5) patients died in a hepatitis drug trial in the 1990s

**5-10 (3 pts each).** 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. At least one answer per question.

(A)	(B)	(C)	(D)	(E)
Rare events are difficult to quantify	Time lags slow progress	Complexity (interactions)	Humans make difficult experimental subjects	None

**5. (3pts)** A group of 1000 people is exposed to a toxic chemical, causing the rate of brain cancer to be elevated 100-fold above its background rate of 1 in 100,000. One of the 1000 develops brain cancer as a result of the exposure. However, statistically, it is not possible to establish or demonstrate that there is a 'significant' elevation of cancer in the group because there is only one person with brain cancer. Which difficulty (difficulties) explains why the elevation is not demonstrable in this group of 1000?

(A) (B) (C) (D) (E) (at least one)

**6. (3pts)** Car manufacturers face several challenges in satisfying consumer demand with an appealing product line that is also profitable for the company. Consumer attitudes towards car design can change rapidly, and although it is possible to detect those changed attitudes soon after they happen, it takes several years before new designs can be implemented at the factory and the existing inventory be sold to make way for a new car line. It is also not easy to predict consumer preferences for a new model because preferences depend on the entire suite of a car's characteristics taken together – the preference for one property of a model depends on what other model properties are included. Unfortunately, none of these problems would go away with better – or easier – research on humans; the problems have nothing to do with our limited knowledge of people but are merely intrinsic to the business of manufacturing and selling something as complicated as a car. Which intrinsic difficulty (difficulties) explains the challenges in satisfying consumer demand?

(A) (B) (C) (D) (E) (at least one)

**7. (3pts)** A researcher testing two different drugs (Primacon, Levicon) which were both developed to alleviate symptoms of ulcers finds adverse effects in 5% of patients when only one drug is given; it does not matter which drug is given – the adverse effects are found in 5% for each, and the samples are large. However, after approval, the drug manufacturer that owns the rights to both drugs encourages patients to take both at the same time. When both drugs are taken together, none of the patients develop adverse reactions; again the samples are large. Which difficulty (difficulties) applies to the adverse effects in these different contexts?

(A) (B) (C) (D) (E) (at least one, possibly difficult)

**8. (3pts)** People trying to get the best drug for their condition face two challenges. First, information they obtain about drug efficacy may be biased by company interests. Second, advice from their physician may be influenced by factors other than what is in their best interest. Which difficulty (difficulties) explain(s) why it is difficult for them to get the advice they need?

(A) (B) (C) (D) (E) (at least one)

**9. (3pts)** DNA typing is probably the most reliable forensic tool now. However, mistakes are still made, such as sample mixup. Most of these problems could be eliminated by using better protocols – splitting samples, storing and processing suspect samples separately of crime scene samples. Which intrinsic difficulty (difficulties) underlies this cause of error in DNA typing?

(A) (B) (C) (D) (E) (at least one)

**10. (3pts)** Initial attempts to adjust a shower temperature are often met with mistakes. Which difficulty (difficulties) explain this phenomenon (as per lecture)?

(A) (B) (C) (D) (E) (at least one)

**11. (4 pts)** Which of the following constitute an unambiguous example of an interaction ("complexity")? MTF

- (A) The old adage "Two wrongs make a right" describes an interaction (do not worry about whether the adage is true).
- (B) Answering 20 questions on an exam gives you twice as many points as answering only 10 questions on the exam.
- (C) Drinking alcohol and driving a car is hazardous to your health, whereas either of these activities alone is relatively safe
- (D) Silver nitrate mixed with magnesium powder "flashes" when misted with water

### **Biological Determinism**

**12. (4 pts)** Sexual preference in humans: which are true? MTF

- A) Studies of inheritance in humans suggest a partial genetic basis to sexual preference. The results also indicate a non-genetic influence.
- B) Correlations have been observed between sexual preference and anatomy
- C) Sexual preference refers to whether a person thinks of themselves as male or female.
- D) Correlates of sexual preference all suggest that gay behavior is associated with under-masculinization

**13. (4 pts)** Besides sexual preference, in what contexts has the question of biological determinism been considered or been applied to humans (as noted in class)? MTF

- A) intelligence/IQ
- B) Susceptibility to polio
- C) Gender roles in society
- D) in specific cases, the biological basis of behavior has been used as a factor in a person's legal accountability for criminal behavior (e.g., sentencing of rapists)

**14 (5 pts).** Which are true about biological determinism and its history (as covered in class)?

- A) The 'eugenics' movement of the early-mid 1900s espoused an attitude that much of human behavior had a genetic basis.
- B) The Nazi's views on biological determinism were obtained from the U.S.
- C) Forced sterilization of people deemed of low intelligence or of other mental "inferiority" occurred in the US throughout much of the 1900s
- D) The topic was relevant to 2 major class themes: (i) Humans make difficult subjects, and (ii) correlation does not imply causation
- E) Current advances in the science of genomics has confirmed that most of human behavior has a genetic basis.

### The Money Game

15. (5 pts) Which of the following are true about the demonstration involving money and conflict? MTF

- A) The purpose of the game was to illustrate a form of conflict
- B) The purpose of the game was to illustrate the tragedy of the commons
- C) The purpose of the game was to illustrate *bias* in the scientific method
- D) In the game, the most a person could 'win' was \$30
- E) The game relied on some individuals being given a different choice than others. Had everyone been given the same choice, there would have been no point to the game

### Tragedy of the Common (ToC)

16 (4pts) Which of the following options describes a property that facilitates or allows for a ToC conflict?. MTF

- A) Selfish interests of the individual work in favor of a group benefit
- B) A single individual owns a resource that a group of individuals wishes to acquire
- C) A group of individuals owns a resource that is beneficial to all.
- D) Individuals own a common resource but the resource is structured so that no one individual can take more than his/her share.

17. (8pts) Which of the following explicitly describes a ToC conflict or outcome? MTF

- A) 3 students rent a house together, each responsible for an equal share of the bills. The benefit of renting together is that the per-individual cost is cheaper than if living separately. The most responsible of the 3 individuals puts all utilities in her name but then gets stuck with all the bills – everyone's share – at the end of the lease because the other two leave without paying. As a consequence, they do not live together in the following year and each pays more for rent.
- B) Ten professors purchase a company in which they all own equal shares. The goal of each is the same, to make money. These professors have different backgrounds – science, law, business – and thus have different management styles, and the company is set up so that they each have an equal say in management. Because of the differences of opinion, the company is never able to settle on a consistent management plan, and as a consequence, the company does not survive.
- C) Twenty students of a large class (400) are told information about questions that will be part of an upcoming exam. The class grading is curved, so those 20 will benefit the most from this information if they keep it to themselves; if the entire class knows the information, it merely shifts the curve, and the twenty students would lose the benefit. However, for selfless reasons, each of those twenty students tells so many friends in the class about the questions that the advantage the 20 had at the beginning is now gone.
- D) Ten countries join an economic union to gain economic clout in the global market; by contributing to a common currency, a collective economy gives each of the 10 countries a benefit over what they would get separately. However, the coordination of 10 countries is difficult, and although each country behaves according to the collective agreement, inefficiencies in the system are costly and destroy any benefit of the collective economy.

### Other conflict and Bias

18 (4pts). (none, one, or many) To bias a scientific process by "controlling the null model" means that (MTF)

- (A) The experimental design is chosen to bias the outcome of the study.
- (B) The data analysis is conducted in such a way to bias the evaluation.
- (C) The model that is accepted until proven wrong is chosen by the individual according to his/her goals. This choice precedes the experimental design and data analysis stages.
- (D) Controls (as opposed to treatments) are chosen to favor one particular model.

Use the following options in questions 19-26.

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

**19-26 (2 pts each)** In the questions below, match the example to the list above. Everything in the list pertains to bias, but some are ways to bias a study and others are arguments/statements indicative of a person's bias. The underlined part is that which must be matched to the list above. One for each question.

**19.** The video of Facilitated Communication part II interviewed two parents who defended the legitimacy of FC for their child. Which method in the above list did they use to support FC? A B C D E F G H I J (one)

**20.** The video on Facilitated Communication part II showed a segment with Doug Biklen in which he defended FC by claiming that it did not matter how many failed attempts there were. A B C D E F G H I J (one)

**21.** Although the NOVA video on Secrets of the Psychics was shown before exam 3, we recently recalled the individual at the end of the horoscope experiment who appeared willing to accept much of astrology despite the experiment because the experiment had not shown there was 'nothing to' astrology. A B C D E F G H I J (one)

**22.** A drug company conducts and publishes a study in which an inappropriate control group was used. The publication accurately describes the design. A B C D E F G H I J (one)

**23.** In assessing whether a psychic's predictions are accurate, a scientist tests those predictions against a null model. A B C D E F G H I J (one)

**24.** A politician running for office claims that his opponent, the incumbent, was responsible for the economic downturn during the previous term. A B C D E F G H I J (one)

**25.** A company testing its drug writes the methods as double-blind but makes sure the patients are given subtle hints to know whether they indeed received the placebo. A B C D E F G H I J (one)

**26. (6 pts)** Mark all of the following statements that are correct about bias, as covered in lecture or the Book. MTF

- A) When rigorous statistical tests are used for analyzing data, nearly all possibility of biasing data analysis is avoided.
- (B) When protocols are published in advance of a study, it is an indication of a biased analysis.
- (C) All scientific models are incorrect (false); consequently it is a sure sign of bias when someone claims that their model is supported by a full analysis of the data.
- (D) There is little opportunity for bias to creep into a scientific study during data analysis (i.e. model evaluation), so most of the concern over bias is about preventing bias during data gathering.
- (E) A major step in identifying deliberate bias is to identify conflicts of interest.
- (F) Bias usually appears in the evaluation stage of a study. Conflict usually appears in the design.

**27. (5 pts)** The lecture and notes mentioned that pharmaceutical manufacturers use (or have used) which of the following methods to influence doctors and research programs with the goal of enhancing drug sales? MTF

- (A) Sponsored Continuing Medical Education (CME) classes
- (B) Given the doctors gifts and free samples (such as cups, posters, pens and note pads) with the pharmaceutical company logo written on them to increase awareness of the company
- (C) Inflated the cost of developing new drugs to facilitate getting more government grants
- (D) Published advertisements that look like real scientific articles
- (E) Hired drug representatives to take physicians to free lunches.
- (F) Falsified data from clinical trials to make their products look good.

**28 (3 pts).** The short article describing an interview with a former drug company employee made which of the following points? This article was shown on the overhead and much of it read aloud. MTF

- A) Newly approved drugs should be avoided until older drugs (for treating the same condition) have been tried.
- B) Newly approved drugs are generally superior to older drugs because the new drugs have been tested more thoroughly and with better technologies.

### Brain 'Flaws'

**29. (5pts)** Lecture listed and explained several ways in which our brains are prone to mislead us (away from the scientific truth). Which of the following are true? The underlined portions indicate specific topics addressed. MTF

- A) Searching for confirmatory evidence while neglecting contrary evidence is reinforcement.
- B) Lotto advertisements that show actual winners but not the millions of losers was said to take advantage of our tendency to respond to perceived risks rather than actual risks.
- C) Build causation from correlation, memory reconstruction, and optical illusions were all included in the list of ways our brains mislead us.
- D) A major theme of this chapter is that humans deliberately/consciously act in ways that work against rational decision-making
- E) Urban legends were given as an example of our tendency to evaluate a model in its relative context rather than absolute context.