

Motivation (day-1 survey and discussion of it)

1. (4 pts) The following options pertain to the survey given on day 1 and the lecture on day 2, in which we discussed how people and society make decisions. The survey results were graphed as histograms with 7 categories per statement. Which are correct? **MTF**

- A) It was suggested that much of the public uses different criteria than our government for what to accept.
- B) All of the following factors (and perhaps others) were listed in class as possibly contributing to Individual decisions: cost/benefit analysis, experience and evidence, emotional factors, views of others, and a person's 'world view'.
- C) In the survey results, strong bimodality was rare or non-existent.
- D) In the survey results, many statements had a lot of scatter, but a clear peak toward the middle (consensus uncertainty) was not observed.

2. (4 pts) More about motivation. Which of the following points are true? **MTF**

- A) A theme of this class is that the scientific method can be used to address many everyday problems that are not considered traditional science.
- B) In contrast to previous years, your class had fewer people considering it likely or somewhat likely that governments have covered up an event than considered it likely the event ever happened.
- C) In contrast to responses of the public (listed in class), the overall class responses were usually not accepting of phenomena for which there is no scientific evidence.

Scientific method

3. (5pts) The use of evidence to evaluate a model is part of what we are calling the scientific method. Which of the following questions/problems could be addressed with evidence-based evaluation of models (or more generally, could be studied with the scientific method as we are using it in this class)? **MTF**

- A) Does drinking tea increase lifespan?
- B) Does drinking tea shorten lifespan?
- C) Do vaccines reduce infections?
- D) Does one form of resume lead to more interviews than another form?
- E) Is it morally acceptable to help someone die?

4. (6 pts) Which of the following statements apply to our teachings of the scientific method (SM) or were given in class/book as illustrations of a failure to adopt scientific evidence? **MTF**

- A) In the U.S. criminal justice system, where the goal is to identify perpetrators of crimes, the constitutional rule that a person cannot be tried twice for the same crime (short of a hung jury) is a violation of the revision part of the SM.
- B) An athletic team that intends to win but never changes its game plan despite losing is lacking in Evaluation.
- C) A student who hopes to graduate but as yet has no degree plan is lacking in Goals..
- D) The main difference between 'trial and error' and our version of the SM is that trial and error does not involve Revision
- E) The SM is a method that enables progress toward a goal. In the lamp demo, we kept rejecting our models of how the lamp worked, but we never found one that worked. Thus, there was no revision and no progress.

5 (4 pts). Which institutions or processes were described as (usually) lacking or weak in *at least* EVALUATION as a deficiency in the scientific method? Some of these were covered only in the book. **MTF**

(A) religion	(B) evolutionary biology	(C) astrology	(D) a criminal trial	(E) car repair
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6-10 (5 pts total, 1pt each). In the class book, the process of writing a news article was said to resemble the scientific method. Which steps from that example illustrate each of the five elements of the scientific method?

Use these 5 answers as your list
of choices in 6-10 below:

- (A) the current draft of the document
- (B) reactions of you and others to the draft
- (C) new drafts
- (D) whether the reactions to the draft meets your expectations
- (E) writing a stimulating article

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| 6. Goal: | (A) (B) (C) (D) (E) | <u>(one answer only)</u> |
| 7. Model: | (A) (B) (C) (D) (E) | <u>(one answer only)</u> |
| 8. Data: | (A) (B) (C) (D) (E) | <u>(one answer only)</u> |
| 9. Evaluation: | (A) (B) (C) (D) (E) | <u>(one answer only)</u> |
| 10. Revision: | (A) (B) (C) (D) (E) | <u>(one answer only)</u> |

The goal is underlined in 11-13

11 (5 pts) Preti-Green claims that its goal is to provide customers with a low-maintenance, low water lawn. To do this, it has its own variety of grass and mix of soil microbes that it plants after killing the customer's existing vegetation cover. However, Preti-Green requires payment immediately after getting the new lawn established, and the company never returns to former customers to find out if the lawn is indeed low-maintenance, low water, nor does it ever change its grass variety or mix of microbes.

Which elements of the scientific method are indicated in the company's practices relative to its stated goal? (The goal is underlined.) **MTF**

- A) model B) data C) evaluation D) revision

12 (4 pts) Facilitated Communication (FC) is a practice for working with autistic individuals that purports to enable autistic individuals to communicate by having a non-autistic adult hold their arm while the autistic individual types on a keyboard; the autistic individuals are otherwise fully non-communicative. People are trained in FC methods by taking classes that provide the basic concepts and skills, and this training enables them to use FC on their own clients. Practitioners refuse to subject their methods to rigorous tests that would show whether their clients are actually communicating, so we don't know if FC has any validity.

"Evaluation" is absent from the problem description; the goal is underlined. Which of the following options gives a valid reason why evaluation is absent? **MTF**

- (A) Data are absent, and without data, there can be no evaluation from the perspective of the scientific method.
- (B) There is no description of people comparing observations of FC to what is expected from the model of communication. This lack of comparison is a lack of evaluation.
- (C) There are no models indicated for FC, and without models, there can be no evaluation of models.

13 (6 pts) You want to maximize your exam scores by adopting habits that work well for you. One model you consider is that partying the night before an exam lowers your exam score compared to the score you would get if you did not party. If this model is supported, you would avoid partying before an exam. Given this goal (underlined), which options, by themselves or in combination, would be considered **data** to evaluate this particular model? (**MTF**)?

- A) Your decision whether to accept or reject the model
- B) The amount of time you studied
- C) Your exam scores when you did **not** party the night before
- D) Your exam scores when you did party the night before
- E) Astrology forecasts of how well you will perform on a test
- F) The class average score on the exam (excluding yours)

Models

14. (6pts) For which options is the “How false” of the model likely important to the goal? **MTF**

Option	Model	Goal	How false
(A)	street map of Austin as a model of Austin streets	find a route between two houses that involves a minimum of stops because your brakes are bad	the map does not indicate where stop lights and stop signs are
(B)	street map of Austin as a model of Austin streets	find shady streets for biking on hot, sunny days	the map does not indicate vegetation levels
(C)	your friend's notes from Bio 301D on a day you missed	obtain a full understanding of lecture to prepare for test	the notes do not include the demonstrations and videos presented in class
(D)	DNA from a cigarette butt at a crime scene as a model of the perpetrator	to identify the perpetrator	the butt is highly portable and could have been planted there; the butt could have been left there before the crime

15 (8 pts) Consider the following goal-model-data combinations. For which goal-model pairs would the ‘data’ enable someone to evaluate the model? Do not worry about whether appropriate controls exist or not. **MTF**

- A) In the context of astrology,
 - a. goal: to predict an individual's future
 - b. model: rules for making predictions based on birthdate
 - c. data: the individual's birthday
- B) In the context of condom use
 - a. goal: to prevent STD transmission
 - b. model: using a condom during sex
 - c. data: volunteer studies on the rates of STD transmission among people who do and do not use condoms during sex
- C) In the context of a business
 - a. goal: improve sales
 - b. model: an advertisement
 - c. data: sales before and after releasing the ad
- D) In the context of condom use
 - a. goal: maintain sensitivity while using a condom
 - b. model: an new, thinner condom
 - c. data: rates at which the new condoms pass the airburst test

16. (5 pts) Each of the following options compares two models for a particular goal. Bubble options in which the **first model (in bold)** is more *accurate* than the second model (underlined) for the goal. **MTF**

- (A) The **airburst test** instead of Marioposa CSI in tests of condom integrity during sex.
- (B) **Yeast** instead of mice in tests of whether chemicals inhibit beer cultures (which uses yeast)
- (C) **Humans accidentally exposed to dioxin** instead of guinea pigs deliberately exposed to dioxin in testing the toxicity of dioxin for humans
- (D) **High doses** of a pesticide versus low doses of it fed to rats for testing whether traces of the pesticide in food cause cancer.
- (E) **Toxicity** measures (LD₅₀) versus assays of tumor formation in rats as a measure of a chemical's ability to cause cancer in rats.

17 (5 pts) Which of the following were given in lecture/book as prominent model failures? MTF

(A) airburst test of condoms	(B) Semmelweis and his advice on physician hygiene	(C) Hubble telescope	(D) infectious disease models	(E) the first Space Shuttle launch	(F) <i>Newsweek</i> article on Christine Maggiore
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Condom testing

18 (4 pts) Which models in condom testing (real or hypothetical) were said to be strong on uniformity (we indicated these with + or ++)? MTF

- A) Trained technicians
- B) Volunteers
- C) Mechanical tests
- D) Airburst test

19. (4 pts). For which goals are the limitations of the airburst test so serious that we would consider the test not useful? MTF

- A) do viruses and bacteria pass through an intact condom?
- B) do condoms break during sex?
- C) do condoms reduce sensitivity?
- D) is latex irritating or abrasive to either partner?

20. (4 pts) Which of the following are true about the airburst test? MTF

- A) Airburst test results of a batch often don't match breakage during sex
- B) Its most serious limitation was considered to be its accuracy (instead of uniformity or convenience).
- C) It was used in class to show that baby oil causes deterioration of a condom.
- D) The airburst test is a model of sex between people.

DWI testing

(BAC = blood alcohol concentration; SFST = standardized field sobriety test)

21. (5pts) (MTF) Which of the following options are true about the SFST? MTF

- A) The fact that officers provide the same instructions each time the SFST is administered renders it a *convenient* model (among the three ACU properties).
- B) The horizontal gaze nystagmus (HGN) test is administered to test mental faculties, whereas the other two tests (walk and turn, one leg stand) are administered to assess just physical faculties (coordination).
- C) For the goal of assessing whether a driver is actually impaired (as opposed to legally impaired), the SFST is a more accurate model of performance than is the BAC.
- D) Starting 'walk and turn' test before being instructed to do so is considered evidence of impairment.
- E) The SFST includes such tasks as counting backwards and touching one's nose while eyes are closed.

22 (5 pts) Which limitations (or other considerations) are relevant to 'back calculations' of blood alcohol concentration (BAC) as a model to determine whether a driver exceeded 0.08% when stopped by the police. (The goal here is to determine whether someone exceeded the 0.08% limit at the time they were stopped driving)? **MTF**

- A) The main data on how fast alcohol is cleared from the body come from computer models rather than from people.
- B) The back calculation accounts for many factors that may affect alcohol clearance, including food in stomach, male-female differences and body size differences.
- C) Different people may be differently impaired at the same level of BAC.
- D) The BAC of a person whose actual BAC increased between the time stopped on the road and the time the BAC was read would **definitely** be miscalculated by the back calculation method in use today.
- E) The back calculation is not a convenient model because it requires several additional measurements from the person besides the BAC.

Infectious Disease

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

β – infection rate parameter

S – number of susceptible individuals in population

r – recovery rate of infected individuals

d – death rate of infected individuals

23. (5pts) The basic reproductive number (R_0) is a model of the spread of an infectious agent. Which of the following are true? If needed, use the formula given above. **MTF**

- A) A drug that sped recovery would increase β and thus reduce R_0 .
- B) If the R_0 value of a disease was 5 before vaccination, we would need to vaccinate 1/5 of the population to eradicate the disease.
- C) The epidemic threshold is the value of R_0 for which the number of individuals with the disease doubles every year.
- D) Recalling the table of R_0 values given in class, the R_0 for many infectious diseases was in the range of 2-20.
- E) If R_0 exceeds 0, it means that the disease can expand epidemically in the human population.

24 (4 pts) Which points about infectious diseases were covered in class or the book? **MTF**

- A) The R_0 model was used in class for illustration. It is not taken seriously by epidemiologists or public health officials.
- B) The larger the value of R_0 , the more likely you are to be seriously ill if you get the disease. Diseases whose R_0 is 3 or less tend not to cause much illness or death.
- C) The basic model used to derive R_0 can be applied to STDs and diseases acquired from animals.

25 (4 pts) Key code AB. Bubble A and B on #25 of your scantron to indicate which version of the test you have; do not fill in any other bubbles. Correctly bubble in your EID and name in the appropriate blanks, and put your name on this form.