

You must turn in 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.

Where relevant, the goal is underlined. *Italicized phrases are true*. Do not assume more than is given in a question.

**A = True, B = False** unless indicated otherwise. If any part of an answer is incorrect, treat all of it as incorrect.

### Data Quality: Errors and fixes

**1-4. (6 pts)** Using the following paragraph, answer the questions about types of error and why.

A firm conducts 3 surveys each in Austin and Lufkin, TX to measure the response of the average Texan to attitudes on marijuana legalizaton. Although the goal is to understand the average response of all TX residents, the survey uses 100 randomly chosen people from voter registration rolls in each city. Voter registration rolls omit many residents in the city. Results are that 49%, 44% and 52% of Austin residents polled approve of legalization, but the corresponding numbers in the Lufkin polls are 22%, 25% and 23%. The difference among polls within each city is not statistically significant, but the difference between cities is statistically significant.

**(A) = TRUE (B) = FALSE**

- 1. (A)(B)** The big difference between the cities cannot be attributed purely to sampling error.
- 2. (A)(B)** The differences among surveys within cities can be attributed purely to sampling error.
- 3. (A)(B)** For the goal, the difference in response between cities is not considered bias because the goal of the study is to compare the two cities; the difference is what is being measured.
- 4. (A)(B)** The random choice of 100 registered Lufkin voters ensures against bias in which Lufkin residents were surveyed.

**5-8. (6 pts)** Which of the following would be a STANDARD for exposing some form of H&T error?

**(A) is a standard (B) is not**

- 5. (A)(B)** A thermometer is used to measure two different warm solutions whose temperatures are unknown.
- 6. (A)(B)** A single blood sample is divided into two tubes, each tube coded differently (no names), and sent to the same lab for testing.
- 7. (A)(B)** A machine for DNA typing is turned on and prepped for runs using the same protocol each day.
- 8. (A)(B)** Two different TAs grade the same homeworks without knowing what scores the other has assigned. The scores are compared

**9-11. (3pts each)** Which type of error is indicated in each of the following 3 paragraphs?

**9.** Your boss runs a candy shop and tells you to package exactly 100 pieces of candy in each of 50 boxes. To save time, you weigh the candy instead of counting it. Using a scale that measures only to the nearest gram, you observe that each of 10 separate pieces weighs 1 gram. Using a known 1 gram weight, you confirm that the scale is accurate. You then add 100 grams of candy to each box. Only later do you find out that most boxes had only 92 pieces of candy. Which type of error accounts for the 92 instead of 100 pieces per box? (one answer only)

(A) Sampling (B) Bias (C) H&T (D) RPA (E) None

**10.** Middle school teacher Ms. Schomberg is very disapproving of the behavior of adolescent males in her class. She is worried that her attitude might unfairly influence her grading of assignments. She grades a written assignment knowing the identities of the students but then asks a female colleague to regrade the same assignment with student names and her grades removed. Comparing the two sets of scores, she finds that she has consistently assigned lower scores to the males than did her colleague, but there is no meaningful difference for scores assigned to the female students. To what type of error can we likely attribute the difference in scores of males between the two teachers? (one only)

(A) Sampling (B) Bias (C) H&T (D) RPA (E) None

11. A firm uses two methods to assess customer satisfaction of its products. One method uses a postcard included with each product that the customer voluntarily returns anonymously. The other method uses a phone survey of a random sample of customers. The two methods yield the same level of customer satisfaction. What type of error is indicated by the agreement between both sampling methods?

- (A) Sampling    (B) Bias    (C) H&T    (D) RPA    (E) None

12-19. Do-it-yourself protocol. You are conducting an external review/test of a genotyping lab. Your job is to send **two tubes** to the lab, with labels. Several options are given for the content of and label on a tube. You must decide which contents to send and how to label the tubes so that the features of ideal data requested in the question are present. If a tube has a person's name on it, the lab can assume that the tube contents belong to the name of the person on the label and can infer gender but nothing else. If a tube is labeled with a number, the contents are unknown to the lab but known to you. Your options for tube contents and tube labels are:

<u>tube</u>	<u>tube label</u>	<u>Contents are from</u>	<u>Blood type</u>	<u>Gender</u>	<u>Marker type</u>
(1)	Laura Baker	Laura Baker	A	Female	negative
(2)	Oz Wichman	Oz Wichman	AB	Male	+
(3)	Rachael Springman	Rachael Springman	AB	Female	negative
(4)	#101	Harold Zakon	O	Male	negative
(5)	#218	Judy Timmins	A	Female	+
(6)	#10	Pat Hines	AB	Male	+
(7)	Jerry Allison	Jerry Allison	B	Male	negative
(8)	Brenda Iverson	Brenda Iverson	B	Female	negative

In the following questions, indicate which pairs of tubes (if any) satisfy the specified criteria.

(A) = criteria are satisfied (B) – not satisfied

12-15 (6pts). Which tubes achieve replication of blood type and gender but marker type is not replicated? It does not matter if the gender replication is known to the lab.

12. (A)(B) tubes 2 & 6  
 13. (A)(B) tubes 2 & 4  
 14. (A)(B) tube 5 & at least one of the others  
 15. (A)(B) tubes 4 & 7

16-19 (6pts). Choose two tubes so that you are certain that none of blood type, gender, marker status is replicated. The lack of replication for gender should be unknown to the lab. Assume that the lab will know gender from a name on the tube.

16. (A)(B) tubes 1 & 4  
 17. (A)(B) tubes 4 & 5  
 18. (A)(B) tubes 5 & 7  
 19. (A)(B) tubes 1 & 8

20 -27. Which ideal data features are explicitly present?

20-23. (5pts) 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 on grades 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.

20. (A)(B) Replication  
 21. (A)(B) Standards  
 22. (A)(B) Randomization  
 23. (A)(B) Blind (at least one way)

24-27. (5pts) 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 your next 6 road trips, you alternate driving 55mph and 70mph (55, 70, 55, 70, 55, 70). You also use a different car for road trips at 55 than for road trips at 70.

24. (A)(B) Replication  
 25. (A)(B) Standards  
 26. (A)(B) Randomization  
 27. (A)(B) Blind

**28-30 (4pts).** The following paragraph is a description of a design. In the questions below the paragraph, mark whether the quoted text correctly indicates the data feature is present.

A professor wants to know whether ending a lecture with an unsolved problem increases attendance for the following lecture. On ten odd-numbered class days, she ends lecture with an unsolved question, on 12 even-numbered days does not; attendance is recorded for each following lecture. Her class is not told the purpose of this study, or even that the study is being conducted.

**A = the quote indicates the feature, B = the quote does not**

**28 (A) (B)** Replication: "on ten odd-numbered class days"

**29 (A) (B)** Random: "Her class is not told the purpose"

**30 (A) (B)** Blind: "an unsolved problem"

### **Criminal Justice**

*We mentioned 4 features of an 'ideal' forensic method for matching a suspect with a forensic sample: (i) reference database, (ii) discrete characteristics, (iii) independent verification possible, (iv) labs/experts pass blind proficiency tests (95% or better).*

**31-35. (7 pts)** Which of the following points correctly identify the main purpose, utility or error reduction principle of the method?  
**(A) = true, (B) = false**

**31. (A)(B)** Discrete characters: reduces RPA error in scoring

**32. (A)(B)** Uniform/universal protocol: allows others to replicate or challenge the results

**33. (A)(B)** Permanent characteristics: reduces H&T error

**34. (A)(B)** Reference database: needed to calculate the chance of a coincidental or random match

**35. (A)(B)** Passing a blind proficiency test: assures that the lab is using a universal protocol

**36-41. (7 pts)** For which types of matching method was it claimed (in the book and/or lecture) that the procedure satisfied at least 2 of the 4 features of an ideal forensic method? For a reference database to exist, it needs to have been used correctly.

**36. (A)(B)** Fingerprinting (before 1990)

**(A) = 2 or more present (B) = Not**

**37. (A)(B)** DNA typing

**38. (A)(B)** Dog sniffing

**39. (A)(B)** Hair matching (not DNA based)

**40. (A)(B)** Bite mark identification

**41. (A)(B)** Eye witness identification

**42-44. (4pts)** The book has letters from the Chicago Police Dept to the FBI requesting DNA typing of samples. Which properties of ideal data were specifically evident in those letters? **A = evident B = not evident**

**42. (A)(B)** Standards

**43. (A)(B)** Blind (in at least one respect)

**44. (A)(B)** Replication of the same sample

**45-48 (6 pts)** An eyewitness video was shown in class in which a single young male was observed. Following that video, the class was asked to identify the person in a line-up. Which of the following is/are true as pertains to the purpose or content or outcome of that demo? **A = true B = false**

**45. (A)(B)** Bias: the demo showed how the order of suspects in a line-up matter – that you are likely to choose someone in the middle.

**46. (A)(B)** Bias: the demo showed how instructions about who may be present in the line-up could influence whether you identify the wrong person

**47. (A)(B)** Accuracy of eyewitness ID: at least 1/4 of the class identified the wrong person

**48. (A)(B)** Instructions were given in both classes to implicate the second person in the lineup as 'the individual,' but the third person in the lineup nonetheless received more choices than did the second.

**49-52. (6pts)** Combining sources of error in forensic matches. In a court case, the forensic lab has declared a match between suspect and sample. The RMP is stated to be 1 in a million. The defense reveals that there are two steps in the lab protocol where the lab is known to sometimes make a mistake. At one of those steps, it makes a mistake 1 in 1,000 times. At a later step, and regardless of whether the lab made a mistake at the early step, it makes a mistake 1 in 200 times. The defense asks you for the overall chance of the match being in error – that the suspect is not the source of the forensic sample for any combination of the errors and the RMP. Which of the following are true? **(A) = TRUE (B) = false**

The overall chance that the suspect is not the source of the sample:

- 49. **(A)(B)** Is the product of the 2 lab error rates
- 50. **(A)(B)** Cannot be smaller than 1 in 200
- 51. **(A)(B)** Would change only slightly if the 1 in a million RMP was increased to 2 in a million
- 52. **(A)(B)** Is approximately the sum  $1/200 + 1/1,000 + 1/\text{million}$

**53-57 (8pts).** Which of the following are true about the 4 features of 'ideal forensics?'

A new method matches a knife blade to a stab wound. The blade and wound are each scored for 12 unambiguous (all-or-none) characteristics. The person who has developed the method, Jerry Coyne, has published a protocol for scoring, but no one else is able to repeat the scoring. Jerry defends his method in court, pointing out that since the trial is the first use of his method, no one has identified anything wrong with it.

**A = TRUE (present or indicated)**

**B= false (absent, incomplete or not indicated)**

- 53. **(A) (B)** a reference database that can be screened for a RMP is indicated
- 54. **(A) (B)** at least some of the characteristics used are discrete
- 55. **(A) (B)** at least some of the characteristics used are not discrete
- 56. **(A) (B)** The lab personnel were able to pass blind proficiency tests
- 57. **(A) (B)** Independent verification of a declared match is indicated or is described as being straightforward

#### **Data Presentation and Numbers**

**58-62. (8 pts).** Based on the Data Presentation lecture and chapter, which of the following points are true?

**(A) = TRUE (B) = FALSE**

- 58 **(A) (B)** A drug test uses a method that gives the correct answer 99% of the time. With this information alone, it is not possible to determine how often a positive result from the test is false (is wrong).
- 59 **(A) (B)** The following statement gives an absolute risk: A drug reduces heart attacks from 4 in 100,000 patients to 1 in 100,000 patients. The corresponding relative risk would be that the drug causes a 75% reduction in heart attacks.
- 60 **(A) (B)** Data presented as natural frequencies are harder for most people to understand than data presented as conditional probabilities
- 61 **(A) (B)** Data presented as relative risks are often more impressive than data presented as absolute risks.
- 62 **(A) (B)** Graphs can change the perception of information merely by changing the scale on the axes.

**63-66. (2 pts each)** We described 4 types of data/numbers regarding their similarity to what they represent. Which type of number is indicated by each question below?

A) total counts    B) an extrapolation    C) data translations (conversions)    D) fabrications

- 63. The type of number that would result from a determination of alcohol consumed by UT students based on amounts of alcohol sold within 1 mile of UT: **A B C D**
- 64. The frequent use of the number 50,000 in the media: **A B C D**
- 65. The numbers that go into athletic statistics such as win-loss records: **A B C D**
- 66. "There are exactly 57 card carrying communists ...". (Manchurian Candidate clip) **A B C D**

**67. (4 pts.)** Exam Key Code **A:** **Fill in** bubble **(A)** on question 67 to indicate your exam code; leave the other bubbles blank. Also, fill in the correct bubbles for your name and EID on the scantron form.