name (required) _____

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.

A = True, B = False   unless indicated otherwise

Data Quality: Errors and fixes

1-4. (4 pts) There are two phases in most instances of data collection. The first (phase A) involves acquiring the subjects or objects that will be measured. Phase B involves taking the measurements themselves. Which of the following would usually be associated with phase A only, which with phase B only, both, or neither?

Answer as follows: (A) phase A only (acquisition)
                        (B) phase B only (making the measurements)
                        (C) both phase A and B
                        (D) none of the above

   1. (A) (B) (C) (D) The decision of which individuals to include in a clinical trial

   2. (A) (B) (C) (D) Data from a machine that determines the DNA profile of a sample loaded into it.

   3. (A) (B) (C) (D) Bias of any type

   4. (A) (B) (C) (D) RPA error

5-11 (3pts each). In the following questions, indicate which type of error is indicated.

5. Gardens in East Austin yield better produce than those in West Austin. A scientist compares soil samples between the two locations to isolate the cause. Seven different soil components are tested. Each of 5 samples taken from East Austin shows higher levels of all nutrients than the 3 samples taken from West Austin, and the difference between East and West Austin samples is statistically significant.   What type of error in data accounts for the consistent difference between the two locations?

        A) Sampling   B) Bias   C) RPA   D) Human and technical   E) None

6. A clinical trial of a new drug is careful to ensure that neither its subjects nor its observers know which group a subject is assigned to. Unknown to them, the first subjects to enroll were assigned to the treatment group until that group filled, then the last subjects to enroll were all assigned to the control group. The study results indicated that the drug had a significant effect when compared to the control group, even though in reality there is no effect of the drug. What type of error accounts for the finding of an effect of the drug when there really is none?

        A) Sampling   B) Bias   C) RPA   D) Human and technical   E) None

7. A policeman with radar clocks you at 75.2 mph when your speedometer indicated that you were going 66, and your speedometer reads out in units of 1 mph. What type of error is indicated by the difference between the these two data of the same speed?

          A) Sampling   B) Bias   C) RPA   D) Human and technical   E) None

8. You are asked to determine the exact number of copies of Time magazine in a container; all copies are of the same issue and weigh the same. Your scale reads to the nearest 0.1 pound. After calibrating your scale with known weights of 0.1 and 1000 pounds, you first weigh the total contents of the container at 1,351.8 pounds. You then separaely weigh 20 individual copies, and each weighs 0.3 pounds. Dividing 1351.8 by 0.3 you obtain 4506.00 copies (assume that this division calculation is correct), and you report the number. However two direct counts of the contents by two different employees finds just over 5000 copies. What type of error likely underlies your miscalculation of 4506?

          A) Sampling   B) Bias   C) RPA   D) Human and technical   E) None

9. Two students set out to calculate the average price of gasoline in Austin. It is already known that gas stations differ by as much as $0.20 per gallon. Each student chooses 10 stations randomly from the same list of stations. Each student then goes out to obtain the current prices for each of the 10 stations on their list. When done, the two averages differ by $0.11 per gallon. What type of error plausibly explains the difference in the two averages?

          A) Sampling   B) Bias   C) RPA   D) Human and technical   E) None

10. (3 pts) 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 data error is indicated by the agreement between both sampling methods?

      A) Sampling   B) Bias   C) RPA   D) Human and technical   E) None

11. (3pts) When two samples of the same population provide different results, but the results are similar enough to be explained by statistical error, to what form of error do we attribute the difference?

      A) Sampling   B) Bias   C) RPA   D) Human and technical   E) None

12-13. (4pts) *The exercise of mentally choosing a supposed random odd number between 1 and 10 was used in class. The number of selections made by the class were not equal among 1, 3, 5, 7, and 9.* Which options are correct about this study? (A) = true, (B) = false

    12. (A) (B) The mere fact that the class chose some numbers more than others could have, in the absence of further information, been due to sampling error.

    13. (A)(B) Bias is suggested by the observation that previous classes have exhibited many of the same deviations from equal choices (such as 7 being chosen more often and 1 less often than the others).

14-15. (4pts) Stradivarius violins have a reputation for generating the best sound. To test this model, an experiment is set up in which blind observers listen to and score the quality of music played on a Stradivarius violin versus on an alternative violin of high quality; the listeners do not know which violin is being played. The same performer plays the same music twice, once on a Stradivarius and once on the other violin, then another music is chosen and played on each violin. The order of which violin is played first is determined randomly for each music. Which options are true about the types of errors that may be present in this test. (A) = true (B) = false

    14. (A) (B) <u>Sampling error may be present</u>: if the quality of sound depends on the performer and if the performer varies randomly in how well she/he plays each time, the violin rated highest could be affected by sampling error in which violin received the better playing

    15. (A) (B) <u>Bias may be present</u>: the randomization of violin order and use of blind listeners does not avoid all main sources of bias that are known in human studies.

16-19. (**4pts**) For which of the following is RPA absent? (A) = true (B) = false

    16. (A)(B) When data are randomized

    17. (A)(B) For discrete characters (present/absent)

    18. (A)(B) Measuring something quantitative (length, weight) to 4 decimal places when you don't need any decimals

    19. (A)(B) When taking two or more measurements of the same object twice

20-22. (5 pts) A farmer wishes to know which of two melon strains produces the highest yield. He/she notes that all plants of strain X have 3 melons, but that different individual plants of strain Y have 2, 3 or 4 melons. The goal is to determine whether the average number of melon per plant is higher for strain X or Y. Which are true about making this calculation? (A) = true, (B) = false

    20. (A) (B) Sampling error may affect the calculated average number of melon per plant on strain Y but not X.

    21. (A) (B) Measuring the number of melons per plant of strain Y will be affected by RPA error.

    22. (A) (B) Once the plants have been chosen for counting, precautions are needed to avoid bias in the actual counting (such as by counting melons of the different plants without knowing the strain of the plant).

23-26. (6pts) Which options identify a valid "fix" for the type of error indicated; a "fix" may either reduce that error or allow you to measure that error. **A = the fix is valid; B = the fix is not valid**

    23. (A) (B) <u>error</u>: unintentional sample mixup during testing. **<u>Fix</u>**: submit samples of known status to the lab

    24. (A) (B) <u>error</u>: dog sniffing tests are biased by the dog handler's prior knowledge of the right answer **<u>Fix</u>**: when giving the dog and trainer a new set of samples to be tested, require the trainer to randomize the presentation of the samples to the dog so that the dog cannot anticipate which samples are being presented first.

    25. (A) (B) <u>error</u>: H&T error in a lab's test results **<u>Fix</u>**: send portions of the same sample to different labs

    26. (A) (B) <u>error:</u> a breathalyzer that reads 0.040% when it should read 0.011%. **<u>Fix</u>**: anything that reduces RPA error

(**27-36).** For each of the following statements, mark the appropriate letters that describe the data design features present. Mark a data feature only if it is explicitly present at some level in the problem description. **A = present, B = absent or ambiguous**

27-31 (5 pts). Julie, a city employee, is responsible for determining whether traffic lights are needed at Guadalupe and 20th St. because of heavy weekday traffic. Julie installs an automatic traffic device that counts cars passing by a specific point in the road. The counter runs Monday through Friday for 6 consecutive weeks. On the first Tuesday, Julie goes and physically counts the cars to confirm that the counter is working correctly. The data are then used to make a decision about whether a traffic light is needed.

    27 (A) (B) Explicit protocol
    28 (A) (B) Replication
    29 (A) (B) Standards
    30 (A) (B) Random
    31 (A) (B) Blind

32-36. (5 pts) Before subjecting your employees to drug tests, you decide to assess the accuracy of the testing lab. Following the recommendations you receive from a consulting firm, you do the following test on two separate occasions. You take a sample from yourself, split it into 3 tubes, each with completely different identifying information, and send all three tubes for testing to the same lab.

    32 (A) (B) Explicit protocol
    33 (A) (B) Replication
    34 (A) (B) Standards
    35 (A) (B) Random
    36 (A) (B) Blind

Criminal Justice

37-40. (6 pts) Which of the following constitutes a <u>blind standard</u> to evaluate whether a drug testing lab is making mistakes. You want to know if the results could possibly tell you if a mistake has been made without further testing on your part and without the lab being able to anticipate the results (hence 'blind'). [Assume (i) the source of a 'coded' sample is unknown to the lab; "labeled" means that the sample is labeled with the person's identity; (ii) you are the one obtaining and sending the standards to the lab for testing, but that you do not know the drug status of any sample that has not been checked in advance or that is not from yourself; (iii) the lab is unaware of work done by a different lab.] A blind standard in this case is

    37. (A)(B) a labeled sample whose drug content was first determined by another lab

    38. (A)(B) a coded sample whose drug content has not been determined by another lab

    39. (A)(B) two samples of the same source that are both coded differently

    40. (A)(B) two samples of the same source that are both labeled but with different names

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.

41-44. (6 pts) Which of the following points correctly identify the main purpose, utility or error reduction principle of the method? (A) = true, (B) = false

41. (A)(B) <u>Discrete characters</u>: reduces H&T error in scoring

42. (A)(B) <u>Uniform/universal protocol</u>: allows others to replicate or challenge the results

43. (A)(B) <u>Permanent characteristics:</u> reduces RPA error

44. (A)(B) <u>Reference database</u>: needed to calculate the chance of an accidental match

45-51. (7 pts) For which types of matching method was it claimed (in the book, web page and/or lecture) that the method clearly satisfied/satisfies the criterion of discrete characteristics?

A = discrete characteristics exist B = do not exist or were not used

45. (A) (B) Fingerprinting (before 1990)

46. (A) (B) Fingerprinting (after 2000)

47. (A) (B) DNA typing

48. (A) (B) Dog sniffing

49. (A) (B) Hair matching (not DNA based)

50. (A) (B) Bullet lead analysis

51. (A) (B) Bite mark identification

52-55. (**4pts**) The book has letters from the Chicago Police Dept to the FBI requesting DNA typing of samples. Which aspects (or violations) of ideal data were specifically described in those letters (were specifically included in those requests)? A = included B = not included

52. (A) (B) Samples labeled with codes instead of names of the sources

53. (A) (B) Samples from individuals whose DNA types are known in advance

54. (A) (B) Incriminating information about the suspects

55. (A) (B) Samples deliberately split (divided into multiple tubes) as a way of detecting H&T error

56-58 (**4pts**) An eyewitness video was shown in class in which a single young male was observed ('the individual'). Following that video, the class was asked to identify that individual in a line-up. Which of the following is true as pertains to the purpose or content of that demo? You may use results from 2010 or 2011 to answer some of these questions. **A = true B = false**

56. (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.

57. (A) (B) The two classes gave substantially different responses about whether they thought 'the individual' was present in the lineup

58. (A) (B) The purpose of the demo was to measure the effect of instructions on the rate of eyewitness mis-identification.

59-67. Which of the 4 features of 'ideal forensics' are indicated as being present? For all but 'independent verification', the problem must specifically describe their presence for it to be present. For 'independent verification' the problem must specifically describe it or describe a means by which independent verification could feasibly be performed by different labs.

59-62 (6 pts). The method matches shoe prints found at a crime scene with shoes owned by the suspect. Shoes and shoe prints are each measured by the lenth, width and shape of the entire sole (bottom). Shoe prints are taken from the crimescene from a liquid plastic that is poured into the depression and which hardens before it is removed. Only some types of shoe prints are complete enough for the method. Matching is based on a computer program that is publicly available and widely known for this purposes, and the program uses size measurements taken from the plastic cast and from shoes owned by the victim. A database of thousands of 'random' shoe prints shows that most crimescene prints are not unique but match tens to hundreds of shoes found in a city of 20,000.

A = present B= absent, incomplete or not used

    59. (A) (B) reference database

    60. (A) (B) discrete characteristics

    61. (A) (B) pass blind proficiency tests

    62. (A) (B) Independent verification (explicitly present or the means for doing it is described)

63-67 (8 pts). Traditional ballistics methods use several characteristics of the surface of a fired bullet to match the bullet to a pistol or rifle barrel. Examiners count the number of rifling marks and also measure their direction and degree of twist as accurately as possible. Crime scene bullets are compared to bullets fired in the lab in deciding a match. Databases such as the ATF's National Integrated Ballistic Information Network provide characteristics of bullets fired from thousands of barrels under controlled conditions, but examiners always rely on their own visual inspection to make the final call. Last September the Detroit Police Department's crime lab was shut down after an audit by the state of Michigan found a 10 percent error rate in ballistics identification.

A = present B= absent, incomplete or not used

    63. (A) (B) a reference database is indicated

    64. (A) (B) some of the characteristics used are discrete

    65. (A) (B) some of the characteristics used are not discrete

    66. (A) (B) The labs mentioned were able to pass blind proficiency tests

    67. (A) (B) Independent verification of a declared match is possible (explicitly present or the means for doing it is described)

68. (4 pts.) Exam Key Code: **Fill in** bubble **(A)** on question 68 to indicate your exam code; leave the other bubbles blank. Also, fill in the correct <u>bubbles</u> for your name and EID on the scantron form.