

Probability & Statistics 40: Midterm Exam Review

Chapter 1:

3. A psychologist says that scores on a test for "authoritarian personality" can't be trusted because the test counts religious belief as authoritarian. The psychologist is attacking the test's  
(a) validity                      (b) reliability                      (c) bias                      (d) accuracy
4. In one of the first attempts to discover the speed of light, Simon Newcomb in 1882 made 66 measurements of the time light takes to travel between the Washington Monument and his laboratory on the Potomac River. Why did Newcomb repeat his measurement 66 times and then take the average of the 66 as his final result?  
(a) Averaging several measurements reduces any bias that is present in his instruments.  
(b) The average of several measurements is more reliable (less variable) than a single measurement.  
(c) Even if a measuring process is not valid, averaging several measurements made by this process will be valid.  
(d) Both (a) and (b) but not (c).  
(e) All of (a), (b), and (c).
5. Professor Iconu has developed a new college entrance test. Any such test must have several versions because some people take the test more than once. Unfortunately, it turns out that the same person often gets very different scores depending on which version of the test is offered. The test suffers from  
(a) large bias.      (b) confounding.                      (c) low accuracy.                      (d) low reliability
7. During a visit to the doctor, you are weighed on a very accurate scale. You are weighed five times and the five readings are essentially the same. When being weighed, you are wearing all of your clothes and a pair of hiking boots. As a measure of your weight without clothes, the reading on the scale is  
(a) unbiased and reliable  
(b) unbiased and unreliable  
(c) accurate  
(d) biased and unreliable  
(e) biased and reliable
8. Which of the following statements do you think could possibly be true?  
(a) The number of students enrolled at Ohio State University is about 2 million.  
(b) A basketball team made 110% of its free throws in a game last week.  
(c) The temperature will be 195 degrees (Fahrenheit) tomorrow in Chicago.  
(d) More than 30 million people live in California.  
(e) The text book for this class weighs 250 pounds.
9. When I set my alarm clock to ring at 6:30, it rings 10 minutes late every day. My alarm clock is  
(a) biased.                      (b) invalid.                      (c) imprecise.                      (d) unreliable.  
(e) Both (a) and (d).
11. A company used to give IQ tests to all job applicants. This is now illegal because IQ is not related to the performance of workers in all the company's jobs. That is, IQ as a measure of future performance on the job is  
(a) biased.      (b) invalid.      (c) inaccurate.      (d) unreliable.      (e) accurate.
14. You measure the age (years), weight (pounds), and marital status (single, married, divorced, or widowed) of 1400 women. How many variables did you measure?  
(a) 1400                      (b) one                      (c) two                      (d) three                      (e) 1403
16. "In American History, 20 students failed. Only 11 students failed World History. American History must be a more difficult course than World History." This statement is misleading because the measurement "number of students who fail" used as a surrogate for "difficulty of course" is  
(a) inaccurate.                      (b) unreliable.                      (c) invalid.                      (d) confounded.

17. Following are data on the populations and numbers of death row prisoners for several states.

State	Population (thousands)	Death Row Prisoners
California	28,168	247
Florida	12,377	294
Illinois	11,544	120
Nevada	1,060	45

Which state has the highest number of death row prisoners *relative to the size of its population*?

- (a) California                      (b) Florida                      (c) Illinois                      (d) Nevada

18. It is hard to measure "intelligence." Let's do it the easy way: measure height in inches, and call the result "intelligence." Not only is this method easy, it gives the same number every time we repeat the measurement on the same person. Measuring intelligence this way is

- (a) not reliable and not valid.  
(b) highly reliable but not valid.  
(c) valid, but not reliable.  
(d) both valid and highly reliable.

19. A measurement process that does not systematically overstate or understate the true value of the quantity being measured is called

- (a) valid.                      (b) reliable.                      (c) random.                      (d) unbiased.

20. The Dow Jones Industrial Average (DJIA) is the most common measure of stock market prices.

Suppose that the DJIA starts at 9000 points and drops 300 points. This is a decrease of

- (a) 0.033%                      (b) 3.3%                      (c) 33.3%                      (d) 333%

21. A 300 point drop in the DJIA was a big drop when the DJIA was at 2000 and a much smaller drop when the DJIA reached 9000. The percent by which stock prices fall is a more meaningful measure. The lesson here is that

- (a) rates are often more meaningful than counts  
(b) it is easy to make a mistake calculating a percent  
(c) you have to beware of roundoff error.  
(d) there are lies, damned lies, and statistics.

25. The net asset value of a mutual fund has increased from \$27 on December 31 to \$33 now. The percent increase in value is about

- (a) 22%.                      (b) 18%.                      (c) 1.2%.                      (d) 122%.                      (e) 82%

26. The price of gold was \$350 per ounce on December 31, and has dropped 20% since that time. What is the price per ounce now?

- (a) \$280                      (b) \$420                      (c) \$330                      (d) \$370                      (e) \$70.

31. Professor Ziegenfuss of the Geology Department has ordered a new instrument which is supposed to measure the iron content of iron ore. After the instrument arrives, he uses it to measure the iron content of five test samples of ore, all of which are known to be exactly 16% iron. The numbers given by the machine on these five test samples are 5%, 3%, 28%, 16%, and 25%. Based on these measurements, one can conclude that the new instrument

- (a) is biased.  
(b) is not reliable.  
(c) is broken.  
(d) is confounded.  
(e) Both (b) and (c).

32. A local police department gives everyone who applies for a job a test in American history. However, experience shows that these test scores are unrelated to future job performance.

As a measure of ability to do police work, the history test scores

- (a) are not reliable.
- (b) are biased.
- (c) are confounded.
- (d) are invalid.
- (e) have predictive validity.

33. The same police department also gives job applicants a test of their knowledge of modern popular music. Experience shows that those who score well on this test tend to become lousy police officers. As a measure of future job performance, the music test scores

- (a) are not reliable.
- (b) are biased.
- (c) are confounded.
- (d) are invalid.
- (e) have predictive validity.

36. A dishonest butcher has a scale on which he weighs the meat his customers buy. In order to increase his profits, he has doctored the scale so that it always reads very close to 10 percent more than the actual weight. The measurements from this scale are

- (a) biased and unreliable
- (b) biased and reliable
- (c) unbiased and unreliable
- (d) unbiased and reliable

#### Chapter 2:

1. Scotland is considering independence from England. An opinion poll showed that 51% of Scots favor "independence." Another poll taken at the same time showed that only 34% favored being "separate" from England. The reason these results differ by so much is that

- (a) samples will usually differ just by chance due to random sampling.
- (b) the wording of questions has a big effect on poll results.
- (c) more follow-up efforts reduced the nonresponse rate of the second poll.
- (d) the sample sizes are different, so the margins of error are different.

2. The Census Bureau proposed to use statistical sampling to supplement the door to door count for the 2000 Census. The Supreme Court ruled that

- (a) sampling would reduce bias, so it can be used in the Census
- (b) sampling is against the law, so it cannot be used at all in the Census
- (c) sampling is not an accepted scientific method, so it cannot be used at all in the Census
- (d) sampling cannot be used to say how many seats in Congress each state has, but can be used for all other Census purposes

3. The telephone company says that 62% of all residential phone numbers in Los Angeles are unlisted. A telephone survey contacts a random sample of 1000 Los Angeles telephone numbers, of which 58% are unlisted. In this setting,

- (a) 62% is a parameter and 58% is a statistic
- (b) 58% is a parameter and 62% is a statistic
- (c) 62% and 58% are both parameters
- (d) 58% and 62% are both statistics

4. The student newspaper runs a weekly question that readers can answer online or by campus mail. One question was "Do you think the college is doing enough to provide student parking?" Of the 136 people who responded, 79% said "No." The number 79% is a

- (a) margin of error
- (b) parameter
- (c) reliability
- (d) statistic

5. If we applied the quick method to the poll in the previous question, we would obtain this 95% confidence interval:

- (a)  $79\% \pm 11.7\%$       (b)  $79\% \pm 7.3\%$  (c)  $136 \pm 79$       (d)  $79\% \pm 8.6\%$

6. The newspaper poll in the previous problem does not give a trustworthy estimate of student opinion because of

- (a) bias due to nonresponse  
(b) bias due to undercoverage  
(c) bias due to the suggestive wording of the question  
(d) bias due to relying on voluntary response

11. On January 6, just after the National Basketball Association labor dispute was settled, the Gallup Poll asked a random sample of 671 adults "How much have you missed watching NBA basketball since the dispute started?" 60% answered "Not at all." Gallup says that the margin of error for this result is plus or minus 4 percentage points. This means that

- (a) we can be 95% confident that between 56% and 64% of all adults did not miss watching NBA games  
(b) we can be certain that between 56% and 64% of all adults did not miss watching NBA games  
(c) in many samples, all the results would fall between 56% and 64%  
(d) we are 95% confident that if we take one more sample the result will fall between 56% and 64%

A recent Gallup poll asked "Do you consider pro wrestling to be a sport, or not?" Of the people asked, 81% said "No." Here is what Gallup says about the accuracy of this poll:

The results below are based on telephone interviews with a randomly selected national sample of 1,028 adults, 18 years and older, conducted August 16-18, 1999. For results based on this sample, one can say with 95 percent confidence that the maximum error attributable to sampling and other random effects is plus or minus 3 percentage points. In addition to sampling error, question wording and practical difficulties in conducting surveys can introduce error or bias into the findings of public opinion polls.

**The next eight questions** concern this situation.

14. The population for this poll appears to be

- (a) all adults, 18 years and older.  
(b) 95% of adults, 18 years and older.  
(c) the 1028 adults who were interviewed.  
(d) 95% of the 1028 adults who were interviewed.

15. The sample for this poll is

- (a) all adults, 18 years and older.  
(b) 95% of adults, 18 years and older.  
(c) the 1028 adults who were interviewed.  
(d) 95% of the 1028 adults who were interviewed.

16. In Gallup's statement, "95% confidence" means

- (a) We know that 95% of all adults would give the same answer that this poll found.  
(b) If Gallup repeated this poll many times, 95% of all the polls would find that 81% of the people interviewed think pro wrestling is not a sport.  
(c) This poll is one of the 95% of all Gallup polls that give correct results.  
(d) If Gallup repeated this poll many times, 95% of the results would be within plus or minus three percentage points of the truth about the population.

17. Which of these sources of possible errors in the poll result are covered by the margin of error of plus or minus three points?

- (a) The poll left out people without telephones.  
(b) Some people chosen for the sample refused to answer.  
(c) Some people did not tell the truth because they were embarrassed to admit they like pro wrestling.  
(d) None of these.

18. Which of these sources of possible errors in the poll result are examples of nonsampling errors?
- (a) The poll left out people without telephones.
  - (b) Some people chosen for the sample refused to answer.
  - (c) Some people did not tell the truth because they were embarrassed to admit they like pro wrestling.
  - (d) None of these.
  - (e) (b) and (c) but not (a).

19. Which of these is a correct confidence statement based on this Gallup poll?
- (a) We are 95% confident that between 78% and 84% of all adults think that pro wrestling is not a sport.
  - (b) We are 95% confident that between 78% and 84% of the 1028 people interviewed think that pro wrestling is not a sport.
  - (c) There is a 95% chance that the opinions of the 1028 people interviewed fairly represent the opinions of all adults.
  - (d) In many samples, 95% will find that 81% of the people interviewed think pro wrestling is not a sport.

20. In all, 151 people in the sample of 1028 adults said they were fans of pro wrestling. Gallup asked these 151 people, "Who is your favorite pro wrestler?" Twenty-four percent said Steve Austin was their favorite. Gallup gave a margin of error for this result. This margin of error is
- (a) plus or minus three percentage points, just as for the overall poll.
  - (b) less than plus or minus three points because the sample for this question is smaller.
  - (c) greater than plus or minus three points because the sample for this question is smaller.
  - (d) less than plus or minus three points because the population of wrestling fans is smaller than the population of all adults.

21. Applying the quick method, we find that the margin of error for 95% confidence changes as follows when the sample size drops from 1028 to 151:
- (a) 8.1% to 3.1%.
  - (b) 3.1% to 8.1%.
  - (c) 3% to 2%.
  - (d) 3% to 5%.

28. When you drop your pencil point blindly into the middle of a table of random digits, what is the chance that the three digits to the right of where you land will be 999?
- (a) 1 in 100, because every three-digit group has the same chance to come up.
  - (b) 1 in 1000, because every three-digit group has the same chance to come up.
  - (c) no chance, because 999 is not a random group of digits.
  - (d) can't say -- it is completely random.

29. Your statistics class has 30 students. You want to call an SRS of 5 students from your class to ask where they use a computer for the online exercises. You label the students 01, 02, . . . , 30. You enter the table of random digits at this line:

14459 26056 31424 80371 65103 62253 22490 61181

Your SRS contains the students labeled

- (a) 14, 45, 92, 60, 56
- (b) 14, 31, 03, 10, 22
- (c) 14, 03, 10, 22, 22
- (d) 14, 03, 10, 22, 06
- (e) 14, 03, 10, 22, 11

30. You take an SRS of size 500 from the 37,000 students at Purdue University. You then take an SRS of size 500 from the 4,400,000 adults in the state of Indiana. The margin of error in a 95% confidence statement for the Indiana sample is
- (a) the same as for the Purdue sample because both are samples of size 500.
  - (b) smaller than for the Purdue sample because the population is much larger.
  - (c) larger than for the Purdue sample because the population is much larger.
  - (d) either larger or smaller than for the Purdue sample because it changes at random when we take a sample.

31. Increasing the size of an SRS has these beneficial effects:
- (a) the bias of the sample is reduced relative to smaller SRSs.
  - (b) the margin of error is smaller than it is for smaller SRSs.
  - (c) nonsampling errors become less important
  - (d) (a) and (b) but not (c).
  - (e) all of (a), (b), and (c).
32. When we take a census, we attempt to collect data from
- (a) a stratified random sample
  - (b) every individual selected in a simple random sample
  - (c) every individual in the population
  - (d) a voluntary response sample
  - (e) a convenience sample
43. To reduce the variability of estimates from a simple random sample, you should
- (a) use a smaller sample.
  - (b) increase the bias.
  - (c) use a count, not a percent.
  - (d) use a larger sample.
  - (e) use a percent, not a count.
44. The margin of error for a poll is 4%. This means that
- (a) 4% of those sampled did not answer the question asked
  - (b) we have 95% confidence that the sample statistic is within 4% of the population parameter
  - (c) 4% of those sampled gave the wrong answer to the question asked
  - (d) 4% of the population were in the sample
  - (e) the confidence we have in the statistic is 4%
45. Which of the following sources of error is included in the margin of error
- (a) chance variation in choosing a random sample.
  - (b) errors in entering the data into the computer.
  - (c) some of the subjects did not understand the questions.
  - (d) voluntary response.
  - (e) all of the above.
48. We divide the class into two groups: first year students and others. We then take random samples from each group. This is an example of
- (a) simple random sampling
  - (b) clustered sampling
  - (c) multistage sampling
  - (d) stratified random sampling
  - (e) systematic random sampling
56. A possible source of nonsampling error in this sample survey is
- (a) some people chosen for the sample refused to answer questions.
  - (b) people without telephones could not be in the sample.
  - (c) some people never answered the phone in several calls.
  - (d) Both (a) and (c).
  - (e) All of (a), (b), and (c).
59. You want to take an SRS of 50 of the 816 students who live in a college dormitory. You label the students 001 to 816 in alphabetical order. In the table of random digits you read the entries
- 96746 12149 37823 71868 18442 35119 62103 39244
- The first three students in your sample have labels
- (a) 967, 461, 214
  - (b) 967, 121, 378
  - (c) 461, 214, 937
  - (d) 461, 214, 718
  - (e) 674, 612, 149

60. Another correct choice of labels for the 816 students in the previous question is

- (a) 000 to 816 in alphabetical order.
- (b) 001 to 816 in order of the student ID numbers.
- (c) 000 to 815 in alphabetical order.
- (d) Both (b) and (c) are correct.
- (e) All of (a), (b), and (c) are correct.

82. An example of a nonsampling error that can reduce the accuracy of a sample survey is:

- (a) Using voluntary response to choose the sample.
- (b) Using the telephone directory as the sampling frame.
- (c) Interviewing people at shopping malls to obtain a sample.
- (d) Variation due to chance in choosing a sample at random.
- (e) Many members of the sample cannot be contacted.

89. When an opinion poll says that "with 95% confidence" the margin of error for its results is plus or minus 3 percentage points, this means that

- (a) 95% of the people chosen for the sample were contacted.
- (b) between 92% and 98% of the people chosen for the sample were contacted.
- (c) the percent of people who said "Yes" to the question was between 92% and 98%.
- (d) we can be certain that the true population value is within  $\pm 3$  points of 95%.
- (e) 95% of all samples chosen as this one was give results within  $\pm 3$  points of the true population value.

90. An opinion poll asks a sample of 1100 people whether they support reducing the number of legal immigrants to the U.S.; 53% of these 1100 people say "Yes." The number 53% is a

- (a) margin of error.
- (b) statistic.
- (c) bias.
- (d) parameter.
- (e) reliability.

96. Which of these statements about a random number table is true?

- (a) Each line contains exactly the same number of 0's and 1's.
- (b) The chance that any pair of adjacent digits is 88 is 1/100.
- (c) The chance that any pair of adjacent digits is 89 is 1/99.
- (d) No row of the table can consist of all 9's.

104. The United Presbyterian Church recently took a sample of opinion in the church. The overall sample "contains independent random samples of 1537 members, 1400 elders, 1513 pastors and 714 other clergy." This sampling design is a

- (a) multistage sample.
- (b) voluntary response sample.
- (c) simple random sample.
- (d) stratified sample.

105. The sample survey of Presbyterians in the previous question found that 70% of pastors and 53% of other clergy had served in an ecumenical organization in the past year. Which of the following statements is true?

- (a) Both results are free of bias. The result for pastors is less variable because the sample of pastors is larger.
- (b) Both results are equally variable. The result for pastors has less bias because the sample of pastors is larger.
- (c) Both results have the same bias and the same variability.
- (d) The result for pastors has both less bias and less variability because the sample of pastors is larger.

106. Some common sources of nonsampling error in samples of human populations are

- (a) using voluntary response samples; some subjects lie.
- (b) some subjects lie; some subjects can't be contacted.
- (c) some subjects can't be contacted; drawing a sample from names in a telephone directory.
- (d) Both (b) and (c).
- (e) All of (a), (b), and (c).

130. A Gallup poll reports that of a sample of 1500 randomly selected U.S. adults, 63% think that Jesse Ventura is unfit to be president. They also report that the margin of error is  $\pm 4\%$ , and that the confidence level is 95%. You can conclude that

- (a) exactly 63% of all U.S. adults think Ventura is unfit.
- (b) with 95% confidence, between 59% and 67% of all U.S. adults think Ventura is unfit.
- (c) it is certain that between 59% and 67% of all U.S. adults think Ventura is unfit.
- (d) if 100 other pollsters were to duplicate this poll, 95 would get a sample percentage somewhat closer to 50% than to 63%.

131. In the situation described in the previous question, the parameter of interest is

- (a) the unknown percentage of all U.S. adults who think Ventura is unfit to be president.
- (b) 63%.
- (c) 1500.
- (d) 95%.
- (e)  $\pm 4\%$ .

Chapter 3:

**The next three questions** concern this situation: Does using a cell phone while driving make an accident more likely? Researchers compared telephone company and police records to find 699 people who had cell phones and were also involved in an auto accident. Using phone billing records, they compared cell phone use in the period of the accident with cell phone use the same period on a previous day. Result: the risk of an accident was 4 times higher when using a cell phone.

1. This study is

- (a) a randomized comparative experiment.
- (b) an experiment, but without randomization.
- (c) a simple random sample.
- (d) an observational study, but not a simple random sample.

2. The explanatory variable in this study is

- (a) whether or not the subject had an auto accident.
- (b) whether or not the subject was using a cell phone.
- (c) the risk of an accident.
- (d) whether or not the subject owned a cell phone.

3. An example of a lurking variable that might affect the results of this study is:

- (a) whether or not the subject had an auto accident.
- (b) whether or not the subject was using a cell phone.
- (c) whether or not the subject was talking to a passenger in the car.
- (d) whether or not the subject owned a cell phone.

10. A study of a drug to prevent hair loss showed that 86% of the men who took it maintained or increased the amount of hair on their heads. But so did 42% of the men in the same study who took a placebo instead of the drug. This is an example of

- (a) a sampling error: the study should not have included men whose hair grew without the drug
- (b) the placebo effect: a treatment often works if you believe that it will work
- (c) an error in calculating percentages
- (d) failure to use the double-blind idea

11. Confounding often defeats attempts to show that one variable causes changes in another variable.

Confounding means that

- (a) this was an observational study, so cause and effect conclusions are not possible
- (b) the effects of several variables are mixed up, so we cannot say which is causing the response
- (c) we don't know which is the response variable and which is the explanatory variable
- (d) we would get widely varied results if we repeated the study many times



16. An article in *USA Today* on August 9, 1999 said that "a nationally representative survey of 3,617 Americans" shows that "People who attend religious services at least once a month live significantly longer than those who don't." But churchgoers are more likely to be nonsmokers and to have good health habits. Does attending religious services cause longer life?

- (a) Yes, because this study is a comparative experiment.
- (b) We can't say: the effects of going to church are confounded with the effects of other behavior such as not smoking.
- (c) Yes, because a sample survey with a large sample size will have a small margin of error.
- (d) No, we can be sure that only physical habits like not smoking can affect how long we live.

**The next six questions** concern this situation: Want to stop smoking? Nicotine patches may help, and so may taking a drug that fights depression. A report in a recent issue of the *New England Journal of Medicine* describes a study of what works best. Here is part of the summary:

Use of nicotine replacement therapies and the antidepressant bupropion helps people stop smoking. We conducted a double-blind, placebo-controlled comparison of sustained-release bupropion (244 subjects), a nicotine patch (244 subjects), bupropion and a nicotine patch (245 subjects), and placebo (160 subjects) for smoking cessation.

**Results.** The abstinence rates at 12 months were 15.6 percent in the placebo group, as compared with 16.4 percent in the nicotine patch group, 30.3 percent in the bupropion group, and 35.5 percent in the group given bupropion and the nicotine patch.

17. How many treatments did this experiment compare?

- (a) two.
- (b) three.
- (c) four.
- (d) can't tell from the information given.

18. The response variable in this experiment is

- (a) the combination of drug (bupropion or placebo) and nicotine patch.
- (b) 893 people who want to quit smoking.
- (c) bupropion.
- (d) whether or not a subject was able to abstain from smoking for a year.

19. One group received a placebo. Why not just give this group no treatment at all?

- (a) It is not ethical to give no treatment at all in this setting.
- (b) Just thinking you are getting a treatment may have an effect, and we want to see if the real treatments do better than this.
- (c) A placebo is the same thing as no treatment at all.
- (d) Subjects would be disappointed if not given a pill.

20. The experiment was "double-blind." This means that

- (a) neither the subjects nor the people who worked with them knew whether they were taking bupropion or placebo.
- (b) the subjects did not know that the treatments were intended to reduce their smoking.
- (c) the subjects did not know whether they were taking bupropion or placebo.
- (d) subjects were not allowed to see cigarette ads.

21. The subjects of the study included both men and women. All of the subjects were randomly assigned among all the treatments with one use of the table of random digits. This design is called

- (a) a simple random sample
- (b) a completely randomized design.
- (c) a matched pairs design.
- (d) a block design.

22. The subjects of the study included both men and women. If the men and women were separately assigned to treatments, using the table of random digits twice, the design would be

- (a) a simple random sample
- (b) a completely randomized design.
- (c) a matched pairs design.
- (d) a block design.

23. A study of the effect of government job training programs finds that the pay of workers after training is higher than it was before training. A critic points out that workers often enroll for training when their pay has recently dipped. So the effect of training in raising pay is mixed up with the fact that pay would often rise when we measure from a low point. The statistical term for this effect is

- (a) confounding (b) control (c) nonresponse (d) stratification

27. The most important advantage of experiments over observational studies is

- (a) a well designed experiment can give good evidence that the treatments actually cause the response.  
(b) an experiment can compare two or more groups.  
(c) we can use randomization to avoid bias in designing an experiment.  
(d) we can study the relationship between two or more explanatory variables.

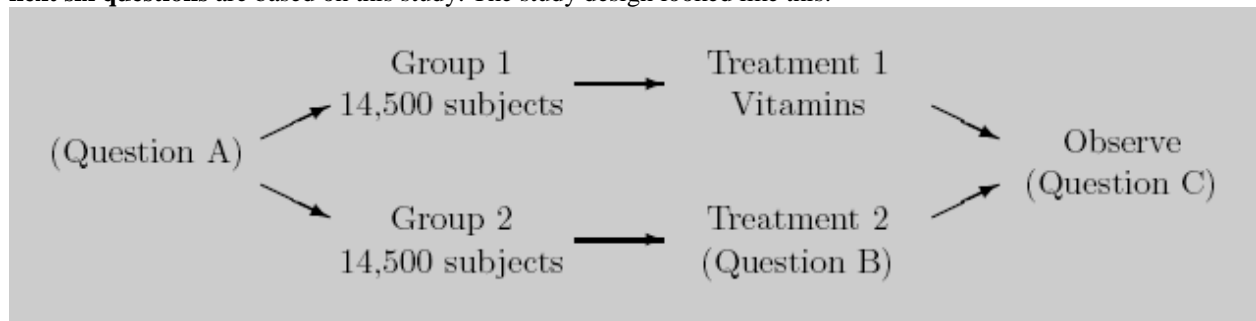
36. Ethical standards for randomized, controlled clinical trials include

- (a) not asking subjects to agree to participate without first informing them of the nature of the study and possible risks and benefits.  
(b) insuring that each subject knows which treatment he or she received.  
(c) allowing subjects to decide whether or not to be in the control group  
(d) never testing drugs which have not been proven to be completely safe.  
(e) All of the above.

37. It was difficult to establish the causal link between cigarette smoking and lung cancer because

- (a) random allocation of subjects to smoking is unethical.  
(b) observational studies generally cannot rule out confounding.  
(c) those who choose to smoke may be genetically at greater risk for lung cancer than those who don't choose to smoke.  
(d) experiments done on animals may not be valid for humans.  
(e) All of the above

Does taking large amounts of vitamins protect against cancer? To study this question, researchers enrolled 29,000 Finnish men, all smokers over the age of 50. Half of the men took vitamin supplements, and others took a dummy pill that has no active ingredient. The researchers followed all the men for eight years. At the end of the study, men in the vitamin group were no less likely to have cancer than men in the other group. This study cast doubt on the popular idea that taking lots of vitamins can reduce the risk of cancer. **The next six questions** are based on this study. The study design looked like this:



46. The statistical name for this study design is

- (a) simple random sample.  
(b) stratified random sample.  
(c) randomized comparative experiment.  
(d) multistage sample.  
(e) observational study.

47. The method used to form the groups should appear in the outline at the point marked (Question A). What is this method?

- (a) Random allocation.
- (b) Voluntary response.
- (c) First come, first served.
- (d) The double-blind method.
- (e) Stratified sampling.

48. Treatment 2 was a dummy pill. Such a dummy treatment is called a

- (a) double blind.
- (b) categorical variable.
- (c) nonsampling error.
- (d) placebo.
- (e) comparative.

49. The response variable should be named in the outline at (Question C). The response variable in this study is

- (a) whether or not a subject took vitamins.
- (b) 29,000 Finnish men.
- (c) random allocation.
- (d) a confidence statement.
- (e) whether or not a subject developed cancer.

50. In order to avoid unconscious bias, neither the subjects nor the doctors who examined them knew whether a particular subject was taking vitamins or dummy pills. This is called

- (a) the placebo effect.
- (b) the double-blind technique.
- (c) the retrospective method.
- (d) stratified sampling.
- (e) internal validity.

51. A weakness of this study is that

- (a) it isn't clear that the results apply to women.
- (b) observational studies give only weak evidence for causation.
- (c) the people who took vitamins may have had other good habits.
- (d) the response is measured in a biased way.
- (e) nonsampling errors may be large.

64. The reason that block designs are sometimes used in experimentation is to

- (a) prevent the placebo effect;
- (b) allow double blinding;
- (c) eliminate confounding with another factor;
- (d) eliminate sampling variability;

66. In an experiment to study the effect of vibrations on plant growth, the height of a chrysanthemum was measured three times. The reason for making the measurement three times instead of just once was probably to

- (a) decrease bias.
- (b) eliminate confounding.
- (c) increase reliability.
- (d) completely eliminate measurement error.

**The next four questions refer** to a hypothetical experiment whose purpose is to determine whether the nutritional benefits of Little Chocolate Doughnuts can have a beneficial effect on the exam performance of Stat 001 students.

69. Suppose all students who attend Stat 001 lectures during Fall Term 1997 are given packages of Little Chocolate Donuts at the beginning of each lecture, which they are encouraged to eat during the first five minutes of class. Students who attend Stat 001 lectures during Spring Term 1998 will not be given doughnuts. Unfortunately, any systematic difference between Fall Term students and Spring Term students on the exams might be due to the fact that the spring term teacher is more skillful than the fall term teacher, rather than the doughnuts. This is an example of

- (a) confounding. (b) the placebo effect. (c) stratification. (d) response error.

70. In the Spring Term, Stat 001 lectures will be given at 10:30 A.M. rather than at 8:30 A.M. The time of lecture (8:30 or 10:30) is

- (a) the response variable. (b) an explanatory variable. (c) a lurking variable. (d) a stratum.

71. Suppose that instead of giving Spring Term 1998 students *nothing* we give them packages of *fake* Little Chocolate Donuts, which look and taste just like the real ones but have no sugar, fat, calories, or other nutritional benefits. Suppose we find that both Fall 97 and Spring 98 students do better on their exams than Stat 001 students have ever done before, despite the fact that the lectures, tests, etc. are all nearly identical to what they have been in the past. This could be an example of

- (a) stratified sampling. (b) nonsampling error. (c) the placebo effect. (d) None of the above.

72. The response variable in this study is

- (a) the doughnut variable. (b) time of lecture (8:30 or 10:30).  
(c) the lecturer. (d) exam performance.

85. A study shows that patients who receive surgery for intestinal cancer live much longer after treatment than patients who are treated without surgery. But doctors operate only on patients in relatively good condition, so we can't conclude that surgery lengthens the patients' lives. This is an example of

- (a) double-blind technique.  
(b) internal inconsistency.  
(c) the placebo effect.  
(d) confounding.

86. The response variable in the study of the previous question is

- (a) intestinal cancer.  
(b) length of life after treatment.  
(c) the medical treatment given.  
(d) the cancer patients.

97. The essential difference between an experiment and an observational study is

- (a) observational studies may have confounded variables, but experiments never do.  
(b) in an experiment, people must give their informed consent before being allowed to participate.  
(c) observational studies are always biased.  
(d) observational studies cannot have response variables.  
(e) an experiment imposes treatments on the subjects, but an observational study does not.

105. An experiment on the effect of Vitamin A on cancer uses two randomly chosen groups of 200 men each, one given Vitamin A and the other a placebo. An estimate from a similar experiment using two groups of 1000 men each would have

- (a) less bias. (b) more bias.  
(c) more variability. (d) less variability.

106. The basic ethical requirements for any study of human subjects are

- (a) comparison, randomization, and replication.  
(b) approval by a review board, informed consent, confidentiality of data.  
(c) subjects are anonymous, subjects are randomly chosen, subjects cannot be harmed.  
(d) data production, data analysis, inference.

108. Studies with human subjects must be approved in advance by an Institutional Review Board. The Board's main purpose is to

- (a) be sure that the study is scientifically interesting.
- (b) be sure that the study uses good statistical techniques.
- (c) be sure that the study will have some benefit to society.
- (d) be sure that the subjects of the study are safe.

115. A report in a medical journal notes that the risk of developing Alzheimer's disease among subjects who (voluntarily) regularly took the anti-inflammatory drug ibuprofen (the active ingredient in Advil) was about half the risk among those who did not. Is this good evidence that ibuprofen is effective in preventing Alzheimer's disease?

- (a) Yes, because the study was a randomized, comparative experiment.
- (b) No, because the effect of ibuprofen is confounded with the placebo effect.
- (c) Yes, because the results were published in a reputable professional journal.
- (d) No, because this is an observational study. A clinical trial would be needed to confirm (or not confirm) the observed effect.
- (e) Yes, because a 50% reduction can't happen just by chance.

#### Chapter 4:

1. A company database contains the following information about each employee: age, date hired, sex (male or female), ethnic group (Asian, black, Hispanic, etc.), job category (clerical, management, technical, etc.), yearly salary. Which of the following lists of variables are *all* categorical?

- (a) age, sex, ethnic group.
- (b) sex, ethnic group, job category.
- (c) ethnic group, job category, yearly salary.
- (d) yearly salary, age.
- (e) age, date hired.

2. Were the extinctions that occurred in the last ice age more frequent among species of animals with large body sizes? A researcher gathers data on the average body mass (in kilograms) of all species known to have existed at that time. These measurements are values of

- (a) a categorical variable.
- (b) a quantitative variable.
- (c) an invalid variable.
- (d) a margin of error.

3. In the situation of the previous question, what are the explanatory and response variables?

- (a) There is no explanatory-response distinction in this situation.
- (b) Explanatory: body mass of a species. Response: whether the species went extinct.
- (c) Explanatory: the ice age. Response: whether a species went extinct.
- (d) Explanatory: whether a species went extinct. Response: the body mass of the species.
- (e) Explanatory: the ice age. Response: the body mass of a species.

The stock market did well during the 1990s. Here are the percent total returns (change in price plus dividends paid) for the Standard & Poor's 500 stock index:

Year	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Return	31.7	-3.1	30.5	7.6	10.1	1.3	37.6	23.0	33.4	28.6

**The next five questions** are related to this situation.

5. The median return during this period is

- (a) 5.5
- (b) 20.07
- (c) 23.0
- (d) 25.8
- (e) 28.6

6. The third quartile of these returns is

- (a) 7.6
- (b) 30.5
- (c) 31.1
- (d) 31.7
- (e) 33.4

7. The mean return is  
(a) 20.07            (b) 20.69            (c) 22.3    (d) 25.8            (e) 33.4

8. The standard deviation of the returns is  
(a) 13.75            (b) 13.98            (c) 14.74            (d) 20.07            (e) 25.8

9. You have similar data on returns on common stocks for all years since 1945. To show clearly how returns have changed over time, your best choice of graph is  
(a) a bar graph    (b) a line graph    (c) a pie chart    (d) a histogram            (e) a scatterplot

19. Jorge's score on Exam 1 in his statistics class was at the 64th percentile of the scores for all students. His score falls

- (a) between the minimum and the first quartile
- (b) between the first quartile and the median
- (c) between the median and the third quartile
- (d) between the third quartile and the maximum

20. Which of these statements about the standard deviation  $s$  is true?

- (a)  $s$  is always 0 or positive.
- (b)  $s$  should be used to measure spread only when the mean  $\bar{x}$  is used to measure center.
- (c)  $s$  is a number that has no units of measurement.
- (d) Both (a) and (b), but not (c).
- (e) All of (a), (b), and (c).

Here are the number of hours that each of a group of students studied for this exam:

2 4 22 6 1 4 1 5 7 4

**The next six questions** use these data.

24. What is the median number of study hours?  
(a) 2.5            (b) 4            (c) 4.5            (d) 5.6            (e) 56

25. What is the mean number of study hours?  
(a) 2.5            (b) 4            (c) 4.5            (d) 5.6            (e) 56

26. What is the third quartile of the number of study hours?  
(a) 1.5            (b) 2            (c) 5.5            (d) 6            (e) 6.5

27. What is the standard deviation of the number of study hours?  
(a) 5.8            (b) 6.1            (c) 37.2            (d) 33.4            (e) 56

28. The data contain one high outlier (22 hours). Which of your results for the previous four questions would change if this were 7 hours instead of 22 hours? (You do *not* need to calculate new values.)

- (a) All four would change.
- (b) The mean, the third quartile, and the standard deviation would change.
- (c) The mean and the standard deviation would change.
- (d) Only the mean would change.
- (e) None of the four would change.

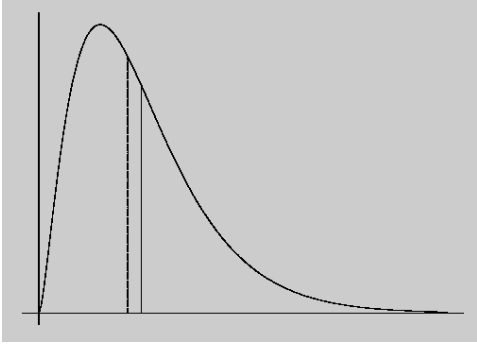
38. A stemplot is  
(a) the same as a boxplot  
(b) a part of a small tree  
(c) a picture of a distribution  
(d) the same as a histogram  
(e) useful for describing categorical variables

39. An outlier will usually have a large effect on the  
 (a) first quartile (b) mean (c) third quartile (d) median (e) sample size
40. Fifty percent of the observations will be at or above the  
 (a) maximum (b) mean (c) median (d) third quartile
42. For a distribution that is skewed to the right, usually  
 (a) the mean will be larger than the median  
 (b) the median will be larger than the mean  
 (c) the first quartile will be larger than the third quartile  
 (d) the standard deviation will be negative  
 (e) the minimum will be larger than the maximum
56. The standard deviation is a measure of  
 (a) the center of a distribution.  
 (b) the validity of a measurement.  
 (c) the strength of a straight-line relationship.  
 (d) the spread or variability of a distribution.  
 (e) the most common value in a set of data.
81. The standard deviation should *not* be used to measure spread when  
 (a) the distribution is normal  
 (b) the mean is used to measure center  
 (c) the distribution is symmetric  
 (d) the distribution is skewed
82. If 30 is added to every number on a list, the only one of the following that is *not* changed is  
 (a) the mean  
 (b) the mode  
 (c) the 75th percentile  
 (d) the median  
 (e) the standard deviation

Chapter 5:

Suppose that the BAC of male students at a particular college who drink 5 beers varies from student to student according to a normal distribution with mean 0.08 and standard deviation 0.01. **The next three questions** use this information.

1. The middle 95% of students who drink 5 beers have BAC between  
 (a) 0.07 and 0.09 (b) 0.06 and 0.10 (c) 0.05 and 0.11 (d) 0.04 and 0.12
2. What percent of students who drink 5 beers have BAC above 0.08 (the legal limit for driving in most states)?  
 (a) 2.5% (b) 5% (c) 16% (d) 32% (e) 50%
3. What percent of students who drink 5 beers have BAC above 0.10 (the legal limit for driving other states)?  
 (a) 2.5% (b) 5% (c) 16% (d) 32% (e) 50%
4. SAT scores are normally distributed with mean 500 and standard deviation 100. Julie scores 650. Her standard score is  
 (a) 150 (b) 15 (c) 1.5 (d) 0.15



9. Two measures of center are marked on the density curve above.
- The median is at the solid line and the mean is at the dashed line.
  - The median is at the dashed line and the mean is at the solid line.
  - The mode is at the dashed line and the median is at the solid line.
  - The mode is at the solid line and the median is at the dashed line.
10. Some people buy the stock of small companies. The Russell 2000 index, which tracks the price of such shares, was 648 on July 15, 1999. On October 15, the index was 415. What percent decrease is this?
- 156%
  - 64%
  - 56%
  - 36%
11. The mean of any density curve is
- the point where the curvature of the curve changes.
  - the point at which the curve reaches its highest value.
  - the point at which the curve would balance if made of solid material.
  - the point with half the area under the curve to its left and to its right.
12. Fifty percent of the observations in any distribution will be between
- the quartiles
  - the mean plus or minus one standard deviation
  - the mean plus or minus two standard deviations
  - the mean plus or minus three standard deviations
  - the mean and the standard deviation
15. If you know the mean and standard deviation of a distribution, do you know the complete shape of the distribution?
- Yes, always.
  - Yes if the distribution is normal, but not in general.
  - Yes if the distribution is symmetric, but not in general.
  - No, never.
16. For a normal distribution with mean 20 and standard deviation 5, approximately what percent of the observations will be between 5 and 35?
- 50%
  - 68%
  - 95%
  - 99.7%
  - 100%
17. For a normal distribution with mean 20 and standard deviation 5, approximately what percent of the observations will be less than 20?
- 50%
  - 68%
  - 95%
  - 99.7%
  - 100%
18. For a normal distribution with mean 20 and standard deviation 5, approximately what percent of the observations will be less than 10?
- 99.7%
  - 97.5%
  - 2.5%
  - 95%
  - 99%



19. You are told that your score on an exam is at the 85 percentile of the distribution of scores. This means that
- (a) You score was equal to or lower than approximately 85% of the people who took this exam
  - (b) You score was equal to or higher than approximately 85% of the people who took this exam
  - (c) You answered 85% of the questions correctly
  - (d) The correlation between your score and the exam is 0.85.
  - (e) You are 85% confident in your score is significant
20. The mean is 80 and the standard deviation is 10. What is the standard score for an observation of 90?
- (a) 90
  - (b) 0
  - (c) 10
  - (d) 1.0
  - (e) -1.0
21. A normal distribution always
- (a) is skewed to the right
  - (b) is skewed to the left
  - (c) is symmetric
  - (d) has a mean of 0
  - (e) has more than one peak
22. A pair of soccer shoes cost \$40.00 in 1995; a pair of the same type of shoes costs \$60.00 in 2000. Using 1995 as the base year, what is the soccer shoe index number for 2000?
- (a) \$60.00
  - (b) \$40.00
  - (c) 150
  - (d) 66.67
  - (e) 1.5
24. Tuition at Purdue University for residents of Indiana was \$1,676 per semester for the 1997- 1998 academic year. The CPI for 1997 was 160.5 and the CPI for 1990 was 130.7. What is the 1997-1998 tuition in 1990 dollars?
- (a) \$160.50
  - (b) \$1365
  - (c) \$2058
  - (d) \$130.70
  - (e) \$1676
25. The distribution of heights of adult men is approximately normal with mean 69 inches and standard deviation 2.5 inches. What percent of all men are -- to the nearest inch -- between 67 and 71 inches tall?
- (a) 27%
  - (b) 58%
  - (c) 68%
  - (d) 73%
  - (e) 95%
29. Which of the following is **least** likely to have a nearly normal distribution?
- (a) Heights of all female students taking STAT 001 at State Tech.
  - (b) IQ scores of all students taking STAT 001 at State Tech.
  - (c) The SAT Math scores of all students taking STAT 001 at State Tech.
  - (d) Family incomes of all students taking STAT 001 at State Tech.
  - (e) Time from conception to birth of all students taking STAT 001 at State Tech.
30. The average price of a pound of sliced bacon was \$2.28 in 1990 and only \$1.89 in 1994. What is the sliced bacon index number (1990=100) for 1994?
- (a) 17
  - (b) 21
  - (c) 83
  - (d) 121
  - (e) 189
34. In 2000, consumers tended to buy bigger-screen TV sets than they did in the 1982-84 base period. How does the CPI reflect this fact?
- (a) It doesn't, because it uses a fixed market basket.
  - (b) It can't possibly, because if it did, the price of TVs would have gone up instead of down.
  - (c) Every month there is a new Consumer Expenditure Survey, which records what consumers actually buy, so the market basket changes every month.
  - (d) The Bureau of Labor Statistics (BLS) adjusts the actual price to subtract out the part that pays for improved quality.
  - (e) The BLS corrects by using a different base period.

35. In addition to the national CPIs, the BLS publishes separate CPIs for 29 large metropolitan areas. These local CPIs are considerably less precise (that is, they have considerably more sampling variation). This is because

- (a) of variation in prices among these metropolitan areas.
- (b) the monthly CPI sample size within each metropolitan area is much smaller than the national sample size.
- (c) the monthly CPI sample sizes within the metropolitan areas are not proportional to their population sizes.
- (d) the metropolitan areas are not randomly selected.
- (e) of variation in weather conditions among these metropolitan areas.

43. Scores on the American College Testing (ACT) college entrance exam follow the normal distribution with mean 18 and standard deviation 6. Wayne's standard score on the ACT was -0.7. What was Wayne's actual ACT score?

- (a) 4.2
- (b) -4.2
- (c) 13.8
- (d) 22.2
- (e) 9.6

44. Wayne's buddy Garth took the SAT. His standard score on the SAT was 0.3. This means that Garth's actual score was

- (a) more than 1 standard deviation below the mean SAT score.
- (b) less than 1 standard deviation below the mean SAT score.
- (c) less than 1 standard deviation above the mean SAT score.
- (d) more than 1 standard deviation above the mean SAT score.
- (e) Can't tell without knowing the standard deviation.

47. If the Consumer Price Index (1982-84 = 100) is 152.9, this means that

- (a) prices have increased 52.9%, so that it now costs \$152.90 to buy goods and services that cost \$100 in 1984.
- (b) prices have increased 152.9%, so that it now costs \$252.90 to buy goods and services that cost \$100 in 1984.
- (c) taking 1984 = 100, the current price is  $1984/152.9 = \$12.98$ .
- (d) a mistake has been made, because 1984 is greater than 100.
- (e) a mistake has been made, because an index number can only take values between 0 and 100.

48. Athletes make more now, but prices are also higher than in the past. In 1995, the basketball player Glenn Robinson signed a contract for \$68 million. How much is this in 1975 dollars? (The CPI was 53.8 in 1975 and was 152.9 when Robinson signed.)

- (a) about \$193 million.
- (b) about \$85 million.
- (c) about \$68 million.
- (d) about \$24 million.
- (e) about \$14 million.

61. A gallon of unleaded gasoline cost \$1.19 in 1980 and \$1.06 in 1993. The gasoline price index number (1980 = 100) for 1993 is

- (a)  $\frac{1.06}{1.19} \times 100 = 89.1$
- (b)  $\frac{1.19}{1.06} \times 100 = 112.3$
- (c)  $(1.19 - 1.06) \times 100 = 13$
- (d)  $\frac{1.19 - 1.06}{1993 - 1980} = 1.108$

62. The heights of American men aged 18 to 24 are normally distributed with mean 68 inches and standard deviation 2.5 inches. So half of all young men are taller than  
(a) 68 inches      (b) 70.5 inches      (c) 73 inches      (d) 75.5 inches

71. The histogram of several hundred observations shows a normal distribution shape. The smallest observation is 11 and the largest is 89. We can estimate that the standard deviation of this distribution is approximately  
(a) 78      (b) 39      (c) 19.5      (d) 13      (e) 11

75. Suppose that adult women in China have heights which are normally distributed with mean 155 centimeters and standard deviation 8 centimeters. Adult women in Japan have heights which are normally distributed with mean 158 centimeters and standard deviation 6 centimeters. Which country has the higher percentage of women taller than 167 centimeters?  
(a) China      (b) Japan      (c) The percentages are the same.  
(d) It is not possible to tell from the information given.

80. The Consumer Price Index somewhat overstates the rise in prices over time. One reason for this is  
(a) the government uses voluntary response samples to gather price information.  
(b) many products improve in quality over time, so higher prices are partly paying for better quality.  
(c) the CPI market basket never changes, so it has out-of-date products such as typewriters  
(d) the government uses small samples, so there is a lot of sampling variability in the CPI.  
(e) prices are recorded in only a few places, and some of these are places where prices are higher than in Indiana.

81. The Consumer Price Index (1982-84 = 100) in mid-1999 was about 165.0. The CPI in 1930 (same base) was 16.7. The New York Yankees paid Babe Ruth \$80,000 in 1930, an enormous salary for an athlete in those days. The buying power of the Babe's salary in 1999 dollars is about  
(a) \$8097      (b) \$479,042      (c) \$790,419      (d) \$1,336,000      (e) \$13,200,000

85. The price of fresh oranges falls early in each year when the orange harvest in Florida is ready, then rises late in the year when oranges from that year's harvest begin to run out. This is an example of  
(a) trend in a time series.  
(b) erratic fluctuations in a time series.  
(c) seasonal variation in a time series.  
(d) confounding.  
(e) using the CPI to compare prices at different times.

93. The federal minimum wage was \$4.25 an hour before it was increased in 1996. In 1980, the minimum wage was \$3.25 an hour. The CPI (1982-84 = 100) was 82.4 in 1980 and was 153.7 in mid-1995. Which of these is true?  
(a) The 1980 minimum wage is about \$6.06 in 1995 dollars, so the minimum wage has gone down in real terms.  
(b) The 1980 minimum wage is about \$6.06 in 1995 dollars, so the minimum wage has gone up in real terms.  
(c) The 1980 minimum wage is about \$1.74 in 1995 dollars, so the minimum wage has gone down in real terms.  
(d) The 1980 minimum wage is about \$1.74 in 1995 dollars, so the minimum wage has gone up in real terms.  
(e) The 1980 minimum wage is about \$3.94 in 1995 dollars, so the minimum wage has gone up in real terms.

94. Suppose the CPI (Consumer Price Index) with respect to some unknown base period was 89 in 1985, 115 in 1990 and 127 in 1993. The CPI rose steadily during this period. The base period used  
(a) must have been between 1985 and 1990  
(b) must have been between 1985 and 1993  
(c) must have been between 1990 and 1993  
(d) is 1982-84 as usual  
(e) can't tell from the information given