PART 1

1. 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 the 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).

2. 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.

3. You might try to measure how rich a person is by looking at the car they drive. In fact, driving a fancy car has little to do with income (most luxury cars are leased). In statistical terms, measuring income by car model is
(a) not reliable. (b) not valid. (c) biased. (d) not accurate.

4. 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

5. 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.

6. 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).

7. An ad for a new heartburn treatment says that it "reduces heartburn by 300 percent." What does this mean?
(a) It means that there is 3 times as much heartburn before using the treatment as there is after using it.
(b) It means there is only seven-tenths as much heartburn after using the treatment, because 300/1000 = 0.3, or three-tenths.
(c) It's nonsense, because removing 100 percent of the heartburn already removes all of it.
(d) It's nonsense, because heartburn is a categorical variable, so percents don't make sense.
(e) It's nonsense because percents only make sense for counts, and amount of heartburn isn't a count.

8. 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.

9. An ad for a new mouth rinse says that it "reduces plaque on teeth by 300 percent." What does this mean?
(a) It means that three-tenths of the plaque is removed, because 300/1000 = 0.3, or three-tenths.
(b) It's nonsense, because plaque is a categorical variable, so percents don't make sense.
(c) It means that there is 3 times as much plaque before using the rinse as there is after using it.
(d) It's nonsense, because removing 100 percent of the plaque already removes all of it.
(e) It's nonsense because percents only make sense for counts, and amount of plaque isn't a count.

10. IQ tests are intended to measure "general problem-solving ability," which is what we mean by intelligence. Some experts think IQ tests measure not intelligence but how much education and how much exposure to middle-class culture you have. These experts say that IQ tests are
(a) biased. (b) not valid. (c) not reliable. (d) highly variable. (e) subject to nonsampling errors.

11. 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

12. "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.

13. In January of 1997, the price of Intel common stock rose from $131 per share to $162 per share. (Intel makes the processors for the computers you have been happily using.) What percent increase is this?
(a) 19.1% (b) 23.7% (c) 80.9% (d) 123.7%

14. Six years after their senior year in high school, 0.6% of the women had attained a professional or advanced degree, while 0.9% of the men had done likewise. Assuming equal numbers of male and female high school seniors, the number of men with professional or advanced degrees was what percent greater than the number of women with such degrees?
(a) 0.3% (b) 3% (c) 33% (d) 50% (e) 95%

15. Amy wants to spend a summer in France after she graduates. She is worried that this will be too expensive because the dollar buys fewer French francs now. When Amy entered college, a dollar was worth 6.5 francs. Now a dollar is worth only 5.25 francs. By about what percent has the value of the dollar in francs decreased?
(a) 10% (b) 19% (c) 24% (d) 76% (e) 81%

16. 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%

17. 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.

18. Michelle's income two years ago was $420,000. Last year her income was only $100,000. The percent change in Michelle's income was
(a) 76.2% decrease (b) 320% decrease (c) 31.3% decrease (d) 23.8% decrease (e) None of these

19. The average wage of production workers (adjusted for the effects of inflation) was $11.08 an hour in 1981 and $10.35 an hour in 1991. In the decade of the 1980s, wages went down by about
(a) 73%. (b) 7.3%. (c) 7.0%. (d) 6.6%.

20. 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.

21. 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

22. 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.

23. 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.

PART 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

7. When we say that the newspaper poll is biased, we mean that
(a) repeated polls would miss the truth about the population in the same direction
(b) repeated polls would give results that are very different from each other
(c) the question asked shows gender or racial bias
(d) faculty may have a different opinion from students

This is a "fill in the blanks" exercise. **The next three questions** ask you to fill in the blanks in this statement:

> **BLANK A** in a sampling method means that the sample results will systematically misrepresent the population in the same way when we take repeated samples. For example, if we contact only people listed in telephone directories, the sample suffers from **BLANK B**. If some people chosen for the sample refuse to participate, the sample suffers from **BLANK C**. Both **BLANK B** and **BLANK C** are common sources of **BLANK A**.

8. **BLANK A** should read
(a) bias (b) random sampling error (c) high variability (d) inaccurate measurement

9. **BLANK B** should read
(a) nonresponse (b) voluntary response (c) undercoverage (d) double-blindness

10. **BLANK C** should read
(a) nonresponse (b) voluntary response (c) undercoverage (d) double-blindness

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%

12. Gallup conducts its polls by telephone, so people without phones are always excluded from the Gallup sample. Any errors in the final result due to excluding people without phones
(a) are included in Gallup's announced margin of error
(b) are in addition to the announced margin of error
(c) can be ignored, because these people are not part of the population
(d) can be ignored, because this is a nonsampling error

13. In a table of random digits,
(a) each pair of digits 00, 01, 02, . . . , 99 appears exactly once in any row of the table
(b) any pair of entries is equally likely to be any of the 100 possible pairs 00, 01, 02, . . . , 99
(c) a specific pair such as 00 cannot be repeated until all other pairs have appeared
(d) the pair 00 can appear, but 000 is not random and can never appear in the table

The next six questions concern this situation: Do doctors in managed care plans give less charity care? Researchers chose 60 communities at random, then chose doctors at random in each community. In all, they interviewed 10,881 doctors. Overall, 77.3% of the doctors said they had given some care free or at reduced rates because of the patient's financial need in the month before the interview. Doctors who received at least 85% of their practice income from managed care plans were significantly less likely than other doctors to provide charity care.

14. This study is
(a) an experiment.
(b) an observational study, but not a survey
(c) a census.
(d) a sample survey.

15. The individuals in this study were selected using
(a) a stratified sample.
(b) voluntary response.
(c) a simple random sample.
(d) a multistage random sample.

16. The number 77.3% is
(a) a statistic, because it describes a sample.
(b) a statistic, because it describes a population.
(c) a parameter, because it describes a sample.
(d) a parameter, because it describes a population.

17. The phrase "significantly less likely" means that when we compare the charity work of doctors with more than 85% of their practice in managed care with other doctors,
(a) the difference in charity work is very large.
(b) the difference in charity work is so large that it would rarely occur just by chance in choosing a sample.
(c) the difference in charity work is large enough to affect doctors' income.
(d) the difference in charity work is less than we would expect just by chance in choosing a sample.

18. For what confidence level are margins of error usually reported?
(a) 5%
(b) 95%
(c) 90%
(d) 99%
(e) 50%

19. A survey was sent to a simple random sample of college sophomores. The sample size was 300. When asked whether or not they liked Willie Nelson's music, 35 of these students did not give any answer. This is an example of
(a) a stratified sample
(b) a census
(c) bias
(d) nonresponse
(e) the margin of error

20. 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

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 seven questions concern this situation.

21. 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.

22. 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.

23. 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.

24. 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) (b) and (c) but not (a).

25. 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.

26. 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.

27. 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. 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

29. 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

30. 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.

31. 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) all of the above.

PART 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.

The next three questions concern this situation: A researcher studied whether friendship affects the prices people set for selling things. She had 80 students all imagine selling the same six items. Half the students, assigned at random, imagined selling the items to a stranger. The other half imagined selling the items to a friend. Then the students were asked to set the price of the items. On the average, those selling to friends set lower prices than those selling to strangers.

4. 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 an SRS.

5. This study applies the principle of *replication* in
(a) assigning subjects *at random*. (b) having the students imagine selling *six* items.
(c) using *80 students* rather than just a handful. (d) *comparing* two treatments (selling to friends or strangers).

6. To randomly assign 40 of the 80 students to the "friends" group, we must first label them, then use the table of random digits. Which of these are correct ways to label?
(a) Label the 80 students 01 to 80. (b) Label the 80 students 00 to 79 .
(c) Label the 40 students in the "friends" group 01 to 40. (d) All three are correct.
(e) (a) and (b) are correct but (c) is not.

This is a "fill in the blanks" exercise. **The next three questions** ask you to fill in the blanks in this statement:

> **BLANK A** try to gather data without influencing the responses. **BLANK B**, on the other hand, impose some **BLANK C** in order to observe the response.

7. **BLANK A** should read
(a) matched pairs designs. (b) observational studies. (c) explanatory variables. (d) experiments.

8. **BLANK B** should read
(a) explanatory variables. (b) observational studies. (c) sample surveys. (d) experiments.

9. **BLANK C** should read
(a) randomization. (b) confounding. (c) response variable. (d) treatment.

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

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.

12. How many treatments did this experiment compare?
(a) two. (b) three. (c) four. (d) can't tell from the information given.

13. 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.

14. 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.

15. 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.

16. The subjects of the study included both men and women. All of the subjects were randomly assigned among all the treatments with the use of a 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.

17. 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.

18. 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.

19. 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.

20. 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.

21. 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.

PART 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.

4. An example of a categorical variable is
(a) the name of the college a student attends. (b) a student's weight in kilograms.
(c) a student's class rank, such as 25th out of 364. (d) a student's sex (male or female). (e) Both (a) and (d).

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

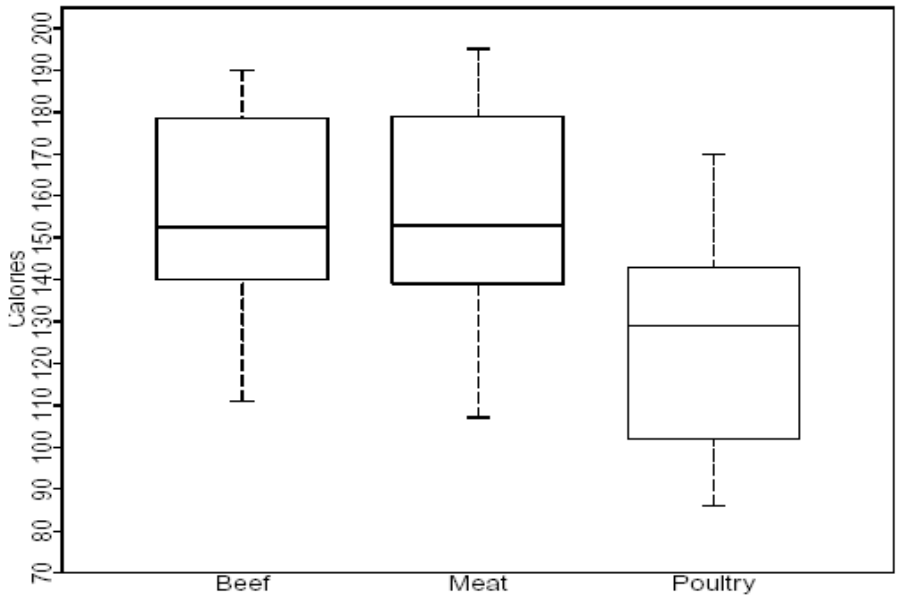
7. The mean return is
(a) 20.07 (b) 20.69 (c) 22.3 (d) 25.8 (e) 33.4

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

10. According to the student newspaper, the mean salary of male full professors in the School of Management is $117,302. The median of these salaries
(a) would be lower, because salary distributions are skewed to the left.
(b) would be lower, because salary distributions are skewed to the right.
(c) would be higher, because salary distributions are skewed to the left.
(d) would be higher, because salary distributions are skewed to the right.

Here are boxplots of the number of calories in 20 brands of beef hot dogs, 17 brands of meat hot dogs, and 17 brands of poultry hot dogs.



11. The main advantage of boxplots over stemplots and histograms is
(a) boxplots make it easy to compare several distributions, as in this example
(b) boxplots show more detail about the shape of the distribution
(c) boxplots use the five-number summary, whereas stemplots and histograms use the mean and standard deviation
(d) boxplots show skewed distributions, whereas stemplots and histograms show only symmetric distributions

12. This plot shows that
(a) all poultry hot dogs have fewer calories than the median for beef and meat hot dogs
(b) about half of poultry hot dog brands have fewer calories than the median for beef and meat hot dogs
(c) hot dog type is not helpful in predicting calories, because some hot dogs of each type are high and some of each type are low
(d) most poultry hot dog brands have fewer calories than most beef and meat hot dogs, but a few poultry hot dogs have more calories than the median beef and meat hot dog

13. We see from the plot that the median number of calories in a beef hot dog is about
(a) 190 (b) 179 (c) 153 (d) 139 (e) 129

14. The box in each boxplot marks
(a) the full range covered by the data
(b) the range covered by the middle half of the data
(c) the range covered by the middle three-quarters of the data
(d) the span one standard deviation on each side of the mean

15. The calorie counts for the 17 poultry brands are:
129 132 102 106 94 102 87 99 170 113 135 142 86 143 152 146 144
The median of these values is
(a) 129 (b) 132 (c) 130.5 (d) 121 (e) 170

PART 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

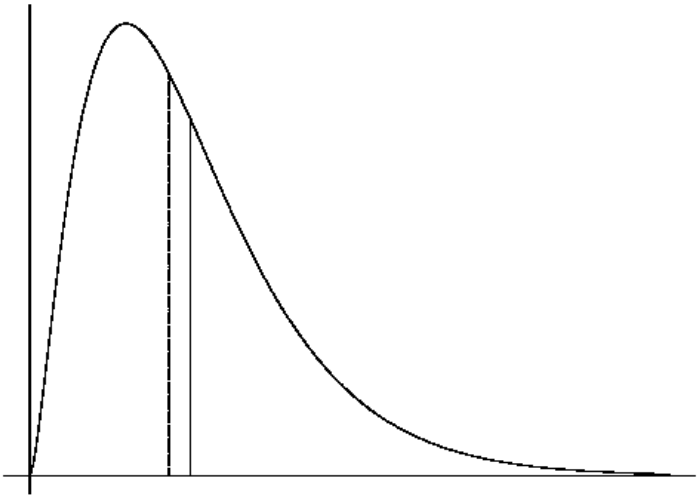
The next four questions use this information: The length of pregnancy isn't always the same. In pigs, the length of pregnancies varies according to a normal distribution with mean 114 days and standard deviation 5 days.

5. What range covers the middle 95% of pig pregnancies?
(a) 109 to 119 days (b) 104 to 124 days (c) 99 to 129 days (d) 94 to 134 days

6. What percent of pig pregnancies are longer than 114 days?
(a) 16% (b) 34% (c) 50% (d) 84%

7. What percent of pig pregnancies are longer than 109 days?
(a) 16% (b) 34% (c) 50% (d) 84%

8. The median length of a pig pregnancy is
(a) 119 days. (b) 114 days. (c) 109 days.
(d) between 109 and 119 days, but can't be more specific.
(e) greater than 114 days, but can't be more specific.

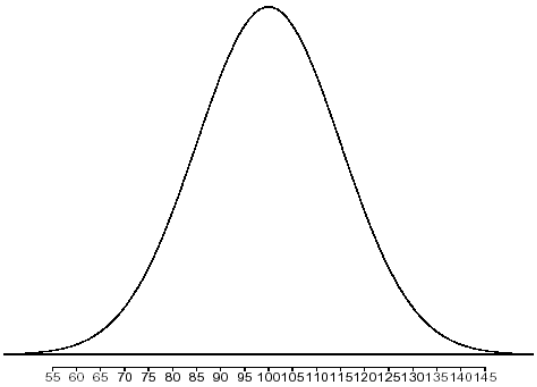


9. Two measures of center are marked on the density curve above.
(a) The median is at the solid line and the mean is at the dashed line.
(b) The median is at the dashed line and the mean is at the solid line.
(c) The mode is at the dashed line and the median is at the solid line.
(d) The mode is at the 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?
(a) 156% (b) 64% (c) 56% (d) 36%

11. The mean of any density curve is
(a) the point where the curvature of the curve changes.
(b) the point at which the curve reaches its highest value.
(c) the point at which the curve would balance if made of solid material.
(d) 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
(a) the quartiles (b) the mean plus or minus one standard deviation
(c) the mean plus or minus two standard deviations (d) the mean plus or minus three standard deviations
(e) the mean and the standard deviation



13. The mean of the normal curve to the right is
(a) 80 (b) 90 (c) 100 (d) 110 (e) 120

14. The standard deviation of the normal curve to the right is
(a) 5 (b) 10 (c) 15 (d) 20 (e) 25

15. If you know the mean and standard deviation of a distribution, do you know the complete shape of the distribution?
(a) Yes, always. (b) Yes if the distribution is normal, but not in general.
(c) Yes if the distribution is symmetric, but not in general. (d) No, never.

PART 6

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 three questions are related to this situation.

1. The correlation of U.S. stock returns with overseas stock returns during these years was $r = 0.44$. This tells you that
(a) when U.S. stocks rose, overseas stocks also tended to rise, but the connection was not very strong
(b) when U.S. stocks rose, overseas stocks rose by almost exactly the same amount
(c) when U.S. stocks rose, overseas stocks tended to fall, but the connection was not very strong
(d) there is almost no relationship between changes in U.S. stocks and changes in overseas stocks
(e) nothing, because this is not a possible value of r

2. If x is the return on U.S. stocks and y is the return on overseas stocks in the same year, the least-squares regression line for predicting y from x is $y = -2.7 + 0.47x$. You think U.S. stocks will have a return of 10% in 1999. Using this regression line, you predict that the return on overseas stocks will be
(a) 7.4% (b) -2.23% (c) 2% (d) 3.17%

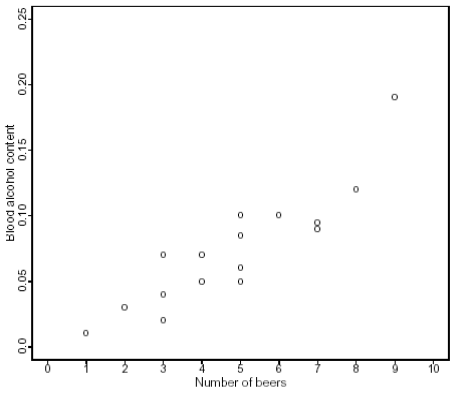
3. Stock returns are measured in percent. What are the units of the mean, the median, the quartiles, the standard deviation, and the correlation between U.S. and overseas returns?
(a) all are measured in percent.
(b) all are measured in percent except the standard deviation, which is measured in squared percent.
(c) all are measured in percent except the correlation, which is a number that has no units.
(d) all are measured in percent except the correlation, which is measured in squared percent.

4. Consider a large number of countries around the world. There is a positive correlation between the number of Nintendo games per person x and the average life expectancy y. Does this mean that we could increase the life expectancy in Rwanda by shipping Nintendo games to that country?
(a) Yes: the correlation says that as Nintendos go up, so does life expectancy.
(b) No: if the correlation were negative we could accept that conclusion, but this correlation is positive.
(c) Yes: positive correlation means that if we increase x, then y will also increase.
(d) No: the positive correlation just shows that richer countries have both more Nintendos and higher life expectancies.
(e) It makes no sense to calculate correlation between these variables.

5. Suppose that the correlation between the scores of students on Exam 1 and Exam 2 in a statistics class is $r = 0.7$. One way to interpret r is to say what percent of the variation in Exam 2 scores can be explained by the straight line relationship between Exam 2 scores and Exam 1 scores. This percent is about
(a) 84% (b) 70% (c) 49% (d) 30%

6. A study of grades at a large university finds that the mean GPA for all undergraduates is 2.77. The distribution of grades is roughly normal. To make this description useful we must also know
(a) the correlation (b) the median (c) the slope (d) the standard deviation

7. What can we say about the relationship between a correlation r and the slope b of the least-squares line for the same set of data?
(a) r is always larger than b (b) r and b always have the same sign (+ or -)
(c) b is always larger than r (d) b and r are measured in the same units



8. One student drank 9 beers. You see from the scatterplot that his BAC was about
(a) 0.19 (b) 9 (c) 19 (d) 0.05

9. The scatterplot shows
(a) a weak negative relationship (b) a moderately strong negative relationship (c) almost no relationship
(d) a weak positive relationship (e) a moderately strong positive straight-line relationship between number of beers and BAC.

10. A plausible value of the correlation between number of beers and blood alcohol content, based on the scatterplot, is
(a) $r = -0.9$ (b) $r = -0.3$ (c) r close to 0 (d) $r = 0.3$ (e) $r = 0.9$

PART 7

1. In government data, a household consists of all occupants of a dwelling unit. Choose an American household at random and count the number of people it contains. Here is the assignment of probabilities for your outcome:

Number of persons	1	2	3	4	5	6	7
Probability	0.25	0.32	???	???	0.07	0.03	0.01

The probability of finding 3 people in a household is the same as the probability of finding 4 people. These probabilities are marked ??? in the table of the distribution. The probability that a household contains 3 people must be
(a) 0.68 (b) 0.32 (c) 0.16 (d) 0.08 (e) between 0 and 1, and we can say no more.

2. Which of the following statements about a table of random digits is **true**?
(a) If each line contains 40 digits, there will be exactly 4 zeros in every line.
(b) The probability that there are exactly 4 zeros in a line of 40 digits is exactly 0.5.
(c) The number of zeros in a line of 40 digits will vary, but on the average there will be 4 zeros per line.
(d) There can never be 4 zeros in a row because that pattern isn't random.
(e) Both (c) and (d) are true.

3. A friend rolls cheap dice many times. He reports that the probabilities of the possible outcomes are about as follows:

Outcome	1	2	3	4	5	6
Probability	0.2	0.2	0.2	0.1	0.1	0.2

Is this a legitimate probability model?
(a) Yes.
(b) No -- the faces must all have the same probability.
(c) No -- the 3 and 4 faces are opposite each other, so they must have the same probability.
(d) No -- the total probability for all faces is wrong.
(e) No -- not all the values given are possible values for a probability.

Choose an American household at random and ask how many cars and trucks that household owns. Here are the probabilities as of 1997:

Number of vehicles	0	1	2	3	4	5
Probability	0.04	0.25	0.45	0.18	0.06	0.02

4. This is a legitimate assignment of probabilities because it satisfies these rules:
(a) all the probabilities are between 0 and 1. (b) all the probabilities are between -1 and 1.
(c) the sum of all the probabilities is exactly 1. (d) Both (a) and (c). (e) Both (b) and (c).

5. What is the probability that a randomly chosen household owns more than one motor vehicle?
(a) 0.96 (b) 0.71 (c) 0.26 (d) 0.25

6. Dice have six faces, showing 1 to 6 pips (spots). If a die is balanced, all six faces are equally likely. What must be the probability of each face?
(a) 1/10, or 0.10. (b) 1/6, or 0.167. (c) 2/10, or 0.20. (d) could be any number between 0 and 1.

The casino game craps is based on rolling two dice. Here is the assignment of probabilities to the sum of the numbers on the up faces when two dice are rolled:

Outcome	2	3	4	5	6	7	8	9	10	11	12
Probability	1/36	2/36	3/36	4/36	5/36	6/36	5/36	4/36	3/36	2/36	1/36

7. The most common bet in craps is the "pass line." A pass line bettor wins immediately if either a 7 or an 11 comes up on the first roll. This is called a "natural." What is the probability of a natural?
(a) 2/36 (b) 6/36 (c) 8/36 (d) 12/36 (e) 20/36

8. Gigi has rolled a natural on four straight tosses of the dice. This excites the gamblers standing around the table. They should know that
(a) Gigi has a hot hand, so she is more likely to roll another natural.
(b) The law of averages says that Gigi is now less likely to roll another natural.
(c) Rolls are independent, so the chance of rolling another natural has not changed.
(d) Four straight naturals are almost impossible, so the dice are probably loaded.

9. If I toss a fair coin five times and the outcomes are TTTTT, then the probability that tails appears on the next toss is
(a) 0.5 (b) less than 0.5 (c) greater than 0.5 (d) 0 (e) 1

10. If a coin has 0.6 probability coming up tails, the probability that it comes up heads is
(a) 0.5 (b) -0.2 (c) 0.4 (d) 0.6 (e) 1.0

PART 8

1. An exam has 40 multiple-choice questions, each with 5 choices. Only 1 of the 5 choices for each question is correct. If you used a table of random digits to randomly choose your answer on all questions, about how many answers would you expect to get correct?
(a) 40 (b) 0 (c) 20 (d) 8 (e) 50

2. A basketball player makes 47% of her shots from the field during the season. To simulate whether a shot hits or misses you would assign random digits as follows:
(a) One digit simulates one shot; 4 and 7 are a hit, other digits are a miss.
(b) One digit simulates one shot; odd digits are a hit and even digits are a miss.
(c) Two digits simulate one shot; 00 to 47 are a hit and 48 to 99 are a miss.
(d) Two digits simulate one shot; 00 to 46 are a hit and 47 to 99 are a miss.
(e) Two digits simulate one shot; 00 to 45 are a hit and 46 to 99 are a miss.

3. Use the correct choice from the previous question and these random digits to simulate 10 shots:
82734 71490 20467 47511 81676 55300 94383 14893
How many of these 10 shots are hits?
(a) 2 (b) 3 (c) 4 (d) 5 (e) 6

4. You want to estimate the probability that the player makes 5 or more of 10 shots. You simulate 10 shots 25 times and get the following numbers of hits:
5 7 5 4 1 5 3 4 3 4 5 3 4 4 6 3 4 1 7 4 5 5 6 5 7
What is your estimate of the probability?
(a) 5/25, or 0.20 (b) 11/25, or 0.44 (c) 12/25, or 0.48 (d) 16/25, or 0.64 (e) 19/25, or 0.76

5. Use the same simulation (25 trials with the results given in the previous exercise) to estimate the expected number of hits in 10 shots. Your estimate is:
(a) 4 out of 10 shots (b) 4.4 out of 10 shots (c) 4.6 out of 10 shots (d) 5 out of 10 shots

6. In government data, a family consists of two or more persons who live together and are related by blood or marriage. Choose an American family at random and count the number of people it contains. Here is the assignment of probabilities for your outcome:

Number of persons	2	3	4	5	6	7
Probability	0.42	0.23	0.21	0.09	0.03	0.02

What is the probability that the family you choose has more than 2 people?
(a) 0.35 (b) 0.42 (c) 0.58 (d) 1.00 (e) Between 0 and 1, and we can say no more.

7. Using the probabilities in the previous question, what is the expected size of the family you draw?
(a) 2 people (b) 3 people (c) 3.14 people (d) 3.5 people (e) 4.5 people

8. Computer voice recognition software is getting better. Some companies claim that their software correctly recognizes 98% of all words spoken by a trained user. To simulate recognizing a single word when the probability of being correct is 0.98, you would use random digits as follows:
(a) two digits simulate one word; 00 to 97 mean \correct." (b) two digits simulate one word; 00 to 98 mean \correct."
(c) one digit simulates one word; 0 to 9 mean \correct." (d) three digits simulate one word; 001 to 098 mean \correct."

9. The program of the previous exercise recognizes words (or not) independently. To simulate the program's performance on 10 words, use your method from the previous problem and these random digits:
60970 70024 17868 29843 61790 90656 87964 18883
The number of words correct out of the 10 is
(a) 10 (b) 9 (c) 8 (d) 2

10. A gambler who keeps placing $1 bets on roulette will, after a very large number of bets, find that his average winnings per bet are close to $0.947. (The house keeps the other $0.053 per bet.) The statistical term for the number $0.947 is
(a) the probability of winning a bet. (b) the bias of a bet. (c) a random number. (d) the expected value of a bet.

PART 9

A recent Gallup Poll asked "Do you consider the amount of federal income tax you have to pay as too high, about right, or too low?" 69% of the sample answered "Too high." Gallup says that
For results based on the sample of national adults (n = 1,055) surveyed April 6-7, 1999, the margin of sampling error is ± 3 percentage points. **The next two questions** concern this poll.

1. The poll was carried out by telephone, so people without phones are always excluded from the sample. Any errors in the final result due to excluding people without phones
(a) are included in the announced margin of error (b) are in addition to the announced margin of error
(c) can be ignored, because these people are not part of the population (d) can be ignored, because this is a nonsampling error

2. If Gallup had used an SRS of size n = 1055 and obtained the sample proportion $\hat{p} = 0.69$, you can calculate that the margin of error for 95% confidence would be
(a) ± 0.02 percentage points (b) ± 0.04 percentage points (c) ± 1.4 percentage points (d) ± 2.8 percentage points
(e) ± 3.0 percentage points

The student newspaper at a college asks an SRS of 250 undergraduates, "Do you favor eliminating the carnival from the term-end celebration?" In all 150 of the 250 are in favor.
The next five questions concern this sample survey.

3. The !@#% you want to estimate is the proportion p of all undergraduates who favor eliminating the carnival. !@#% should read
(a) bias (b) confidence level (c) mean (d) parameter (e) statistic

4. To estimate p, you will use the proportion $\hat{p}$ = 150/250 of your sample who favored eliminating the carnival. The number $\hat{p}$ is a
(a) bias (b) confidence level (c) mean (d) parameter (e) statistic

5. A 95% confidence interval for the population proportion p is
(a) 150 ± 0.03 (b) 0.6 ± 0.03 (c) 150 ± 0.06 (d) 0.6 ± 0.06 (e) 1.67 ± 0.03

6. A 90% confidence interval based on this same sample would have
(a) the same center and a larger margin of error
(b) the same center and a smaller margin of error
(c) a larger margin of error and probably a different center
(d) a smaller margin of error and probably a different center
(e) the same center, but the margin of error changes randomly

7. Suppose that (unknown to you) 55% of all undergraduates favor eliminating the carnival. If you took a very large number of SRSs of size $n = 250$ from this population, the sampling distribution of the sample proportion $\hat{p}$ would be normal with
(a) mean 0.55 and standard deviation 0.015
(b) mean 0.60 and standard deviation 0.06
(c) mean 0.55 and standard deviation 0.06
(d) mean 0.60 and standard deviation 0.03
(e) mean 0.55 and standard deviation 0.03

8. The phrase "95% confidence" in a Gallup Poll press release means that
(a) our results are true for 95% of the population of all adults.
(b) 95% of the population falls within the margin of error we announce.
(c) the probability is 0.95 that a randomly chosen adult falls in the margin of error we announce.
(d) we got these results using a method that gives correct answers in 95% of all samples.

9. A recent Gallup Poll interviewed a random sample of 1523 adults. Of these, 868 bought a lottery ticket in the past year. A 95% confidence interval for the proportion of all adults who bought a lottery ticket in the past year is (assume Gallup used an SRS)
(a) 0.57 ± 0.00016 (b) 0.57 ± 0.00032 (c) 0.57 ± 0.013 (d) 0.57 ± 0.025 (e) 0.57 ± 0.03

10. Suppose that in fact (unknown to Gallup) exactly 60% of all adults bought a lottery ticket in the past year. If Gallup took many SRSs of 1523 people, the sample proportion who bought a ticket would vary from sample to sample. The sampling distribution would be close to normal with
(a) mean 0.6 and standard deviation 0.00016
(b) mean 0.6 and standard deviation 0.0126
(c) mean 0.6 and standard deviation 0.4899
(d) mean 0.6 and standard deviation 0.0251

Prob and Stat 40 Final Review Answers

Part 1

1. b
2. d
3. b
4. e
5. d
6. a
7. c
8. b
9. d
10. b
11. d
12. c
13. b
14. c
15. b
16. a
17. a
18. a
19. d
20. d
21. d
22. b
23. b

Part 2

1. b
2. d
3. a
4. d
5. d
6. d
7. a
8. a
9. c
10. a
11. a
12. b
13. b
14. d
15. d
16. a
17. b
18. b
19. d
20. d
21. a
22. c
23. d
24. d
25. a
26. c
27. b
28. d
29. c
30. d
31. a

Part 3

1. d
2. b
3. c
4. a
5. c
6. e
7. b
8. d
9. d
10. b
11. b
12. c
13. d
14. b
15. a
16. b
17. d
18. a
19. c
20. b
21. d

Part 4

1. b
2. b
3. b
4. e
5. d
6. d
7. a
8. c
9. b
10. d
11. a
12. d
13. c
14. b
15. a

Part 5

1. b
2. e
3. a
4. c
5. b
6. c
7. d
8. b
9. b
10. d
11. c
12. a
13. c
14. c
15. b

Part 6

1. a
2. c
3. c
4. d
5. c
6. d
7. b
8. a
9. e
10. e

Part 7

1. c
2. c
3. a
4. d
5. b
6. b
7. c
8. c
9. a
10. c

Part 8

1. d
2. d
3. c
4. c
5. b
6. c
7. c
8. a
9. b
10. d

Part 9

1. b
2. d
3. d
4. e
5. d
6. b
7. e
8. d
9. d
10. b