

Statistics Proficiency Exam Fall 2016

Name _____

PART I: MULTIPLE CHOICE QUESTIONS (48 points, 1.5 points each). You may write on the exam but please MARK YOUR ANSWERS IN THE SCANTRON and turn in the scantron before proceeding to answer PART II of the exam.

There are five possible responses to each of the following multiple-choice questions. There is only one “BEST” answer. Be sure to read all possible choices before selecting your answer. You may mark on this examination. You can use a calculator but a calculator manual cannot be used.

A table for the Normal distributions will be provided. you will have **3 hours** to complete the **entire** exam. This is a closed book exam. A formula sheet will be provided.

CONFIDENCE LEVEL	90%	95%	99%
z^*	1.645	1.96	2.576

- An investigator has a computer file showing family incomes for 1,000 subjects in a certain study. These range from \$5,800 a year to \$98,600 a year. By accident, the lowest income in the file gets changed to \$580. Which of the following is correct?
 - (A) The mean, median, standard deviation, and the IQR will be affected.
 - (B) The mean, median, standard deviation, and the IQR will not be affected.
 - (C) The median and IQR will decrease but the mean and standard deviation will not be affected.
 - (D) The mean will decrease, the standard deviation will increase but the median and the IQR will not be affected.
 - (E) The mean and standard deviation will both decrease.
- You look at real estate ads for houses in Sarasota, Florida. There are many houses ranging from \$200,000 to \$400,000 in price. The few houses on the water, however; have prices up to \$15 million. The distribution of house prices will be
 - (A) skewed to the right.
 - (B) skewed to the left.
 - (C) roughly symmetric.
 - (D) roughly normal.
 - (E) correlated to the location of the house.

Use the following for the next 3 questions. Environmental Protection Agency fuel economy estimates for automobile models tested predicted a mean of 24.8 miles per gallon (mpg) and a standard deviation of 6.2 mpg for highway driving. Assume that mpg can be approximated by the Normal distribution.

- About what percent of autos should get less than 31 mpg?
 - (A) 16%
 - (B) 32%
 - (C) 50%
 - (D) 68%
 - (E) 84%
- About what percent of autos should get between 6.2 and 43.4 mpg?
 - (A) 32%
 - (B) 50%
 - (C) 68%
 - (D) 95%
 - (E) 99.7%
- The gas mileage of the best 2.5% of all cars
 - (A) is above 37.2 mpg.
 - (B) is less than 18.6 mpg.
 - (C) is less than 12.4 mpg.
 - (D) is less than 6.2 mpg.
 - (E) is between 12.4 and 37.2 mpg.
- To illustrate a talk you are giving, you want to make a graph to compare the percent of adults in several countries who have completed an undergraduate degree. For example, this percent is 9% in France and 24% in the United States. You should make a
 - (A) histogram.
 - (B) boxplot.
 - (C) pie chart.
 - (D) bar graph.
 - (E) stemplot.

Use the following for the next 2 questions. The population of the United States is aging, though less rapidly than in other developed countries. Here are the percents (sorted) of residents aged 65 and older in the 50 states, according to the 2000 census.

5.7 8.5 9.6 9.7 9.9 10.6 11.0 11.2 11.2 11.3 11.3 11.6 11.7 11.7 12.0 12.0 12.1 12.1 12.1 12.1
 12.3 12.4 12.4 12.5 12.7 12.8 12.9 13.0 13.0 13.0 13.1 13.2 13.2 13.3 13.3 13.3 13.4 13.5 13.5 13.6
 13.8 14.0 14.3 14.4 14.5 14.7 14.9 15.3 15.6 17.6

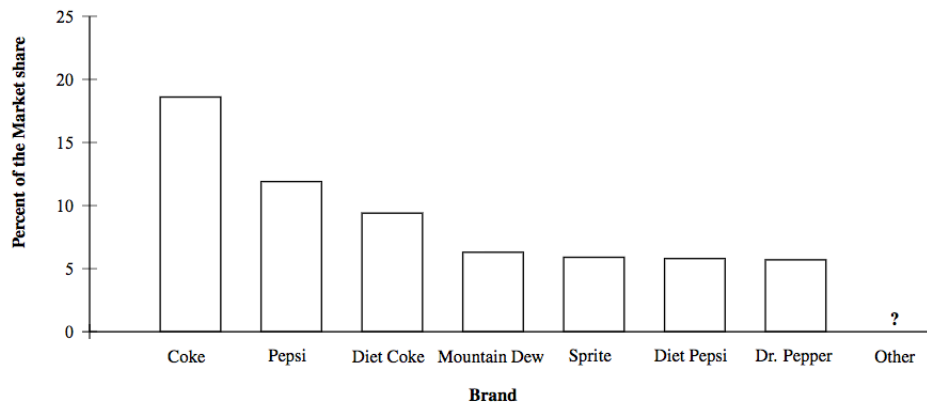
7. Which of the following best describes the distribution of the percents of residents aged 65 and older in the 50 states?
- (A) The distribution is multimodal with no outliers. There are many centers and the variability in the percents among the states is quite small.
 - (B) The distribution is evenly spaced between 5.7 and 17.6 with outliers. The middle value is about $(5.7 + 17.6)/2 = 11.65\%$ and the spread is approximately 12%.
 - (C) The distribution is single-peaked, skewed right and has possible outliers.
 - (D) The distribution is normally distributed ranging from 5.7 to 17.6. We are 95% confident that the true mean percent of residents aged 65 and over lies between ± 2 standard deviations of the mean.
 - (E) The distribution is fairly symmetric with center around 12.75%. The percents range from 5.7% to 17.6%, which shows variability in the percents of residents aged 65 and older among the states. There are also possible outliers.
8. The center of the distribution is close to
- (A) 13.5%. (B) 12.7%. (C) 13.8%. (D) 11.0% (E) 5.7% to 17.6%

Use the following for the next 2 questions. Here are the IQ test scores of 10 randomly chosen fifth-grade students:

145 139 126 122 125 130 96 110 118 118

9. The five-number summary of the 10 IQ scores is
- (A) 96, 114, 125, 134.5, 145. (C) 96, 118, 122, 130, 145.
 - (B) 96, 118, 123.5, 130, 145. (D) 145, 126, 127.5, 110, 118.
 - (E) 96, 188, 122.9, 130, 145.
10. The mean of these 10 IQ scores is
- (A) 123.5 (B) 122.9 (C) 136.6 (D) 127.5 (E) 13.95.
11. A radio talk show host in Chicago is interested in the proportion p of adults in his listening area who think the drinking age should be lowered to eighteen. To find this out, he poses the following questions to his listeners, "Do you think that the drinking age should be reduced to eighteen in light of the fact that eighteen-year-olds are eligible for military service?" He asks listeners to phone in and vote "yes" if they agree the drinking age should be lowered and "no" if not. Of the 1000 people who phoned in, 700 answered "yes." Which of the following assumptions for inference about a proportion using a confidence interval are violated?
- (A) The data are an SRS from the population of interest.
 - (B) The population is at least ten times as large as the sample.
 - (C) n is so large that both the count of successes $n\hat{p}$ and the count of failures $n(1 - \hat{p})$ are fifteen or more.
 - (D) Each observation falls into one of just two categories.
 - (E) There appear to be no violations.

Use the following for the next 2 questions. The following bar graph shows the percent of market share of the best-selling brands of carbonated soft drinks in 2003/



12. About what percent of the soft drink market is held by all **other** brands?
 (A) 36% (B) 12.5% (C) 64% (D) 0% (E) 100%
13. Comment on this graph.
 (A) The distribution is skewed right. (C) The center of this graph is Mountain Dew.
 (B) Ignoring all **other** brands, Coke has the largest market share. (D) The distribution is U-shaped.
 (E) The distribution is nearly symmetric.

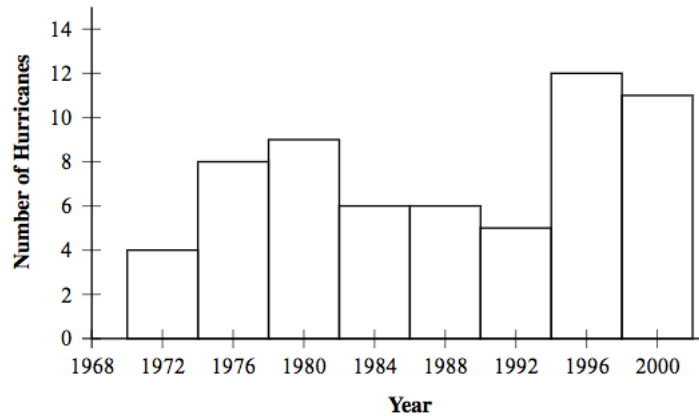
Use the following for the next 2 questions. The Physicians Health Study followed 22,000 male physicians for a period of several years. About 11,000 took an aspirin every second day while the rest took a placebo. The subjects had been randomly placed in one of the two groups. At the completion of the study, it was noted whether a subject had experienced a heart attack during the period of the study. It was found that the aspirin group had significantly fewer heart attacks than the placebo group.

14. The factor in the experiment is
 (A) the severity of the heart attack. (C) use of a placebo.
 (B) the length of the study. (D) the 22,000 subjects.
 (E) medication used (aspirin or placebo).
15. The response variable in this experiment is
 (A) whether a heart attack occurred. (C) the length of the study.
 (B) the placebo effect. (D) whether the symptoms lessened.
 (E) aspirin or placebo.
16. The national mean IQ test scores for seventh grade girls is 100. An educator wonders if seventh grade girls who attend charter schools have a mean IQ different from the national mean IQ score. She selects a simple random sample of 50 seventh grade girls from charter schools and finds the mean IQ of those 50 girls in charter schools and finds it to be (98.305, 105.695). Which of these statements IS TRUE?
 (A) The study definitely concludes that charter school seventh grade girls have a mean IQ score higher than the national mean of 100 at the 0.05 level.
 (B) We are 95% confident that all charter schoolgirls have their IQ scores between 98.305 and 105.695.
 (C) The sample mean is equal to the population mean and this can be stated with 95% confidence.
 (D) 95% of girls in charter schools have their IQ scores between 98.305 and 105.695.
 (E) The study does not provide enough evidence to claim that charter school seventh grade girls have a mean IQ different from the national mean of 100 at the 0.05 level.

17. A student was given an assignment to make a histogram from data showing the number of hurricanes recorded annually from 1970-2000. Here is the data:

year	'70	'71	'72	'73	'74	'75	'76	'77	'78	'79	'80	'81
number of hurricanes	2	1	0	1	2	3	2	1	2	2	2	3
year	'82	'83	'84	'85	'86	'87	'88	'89	'90	'91	'92	'93
number of hurricanes	1	1	1	3	0	1	3	2	1	2	1	1
year	'94	'95	'96	'97	'98	'99	'00					
number of hurricanes	0	5	6	1	3	5	3					

The student produced the following display.



Comment on this graph.

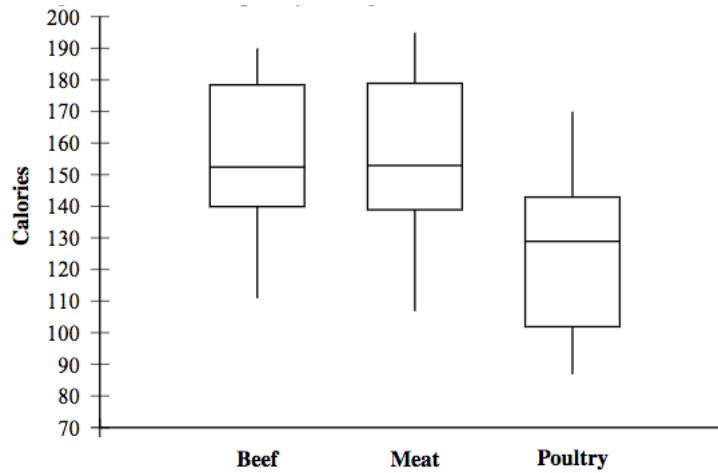
- (A) The distribution of hurricanes looks bimodal with a center of 1986 and a spread of 30 years.
 - (B) The distribution is skewed left.
 - (C) The distribution is skewed right with a center around 1986.
 - (D) The distribution is nearly symmetric around 1986.
 - (E) The is not correct. The horizontal axis should be split the number of hurricanes recorded into classes. The vertical axis should show the number of years in each class.
18. Here is a stemplot of the percent of adult males who are illiterate in 142 countries, according to the United Nations. For example, the highest illiteracy rate was 79%, in the African country Niger.

0	000000000000001111111111122223344444444
0	555556666777788889999
1	0000111123344
1	5677788899
2	0000111234
2	556677899
3	00011344
3	6777888
4	024
4	56668
5	0111234
5	557
6	002
6	
7	1
7	9

The overall shape of this distribution is

- (A) somewhat symmetric.
- (B) strongly skewed left.
- (C) no clear shape.
- (D) strongly skewed right.
- (E) bimodal.

Use the following for the next 3 questions. Here are the 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.



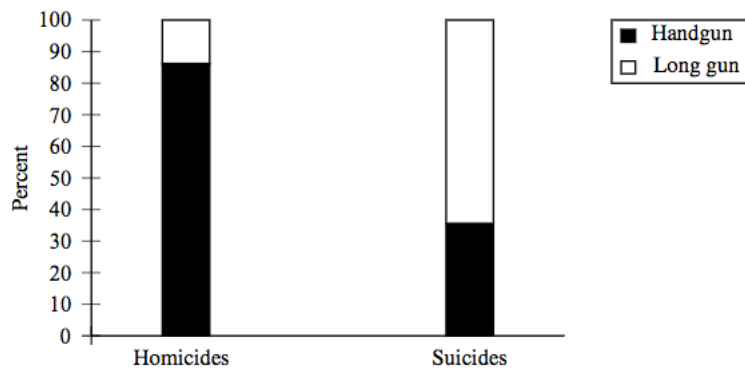
19. The main advantage of boxplots over stemplots and histograms is
 - (A) boxplots show more detail about the shape of the distribution.
 - (B) boxplots use the five-number summary, whereas stemplots and histograms use the mean and standard deviation.
 - (C) boxplots show skewed distributions, whereas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

20. This plot shows that
 - (A) all poultry hot dogs have fewer calories than the median for beef and meat hot dogs.
 - (B) 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.
 - (C) about half of poultry hot dog brands have fewer calories than the median for beef and meat hog dogs.
 - (D) hot dog type is not helpful in predicting calories, because some hot dogs of each type are high and some of each type is low.
 - (E) the mean number of calories for poultry hot dogs is 130.

21. We see from the plot that the median number of calories in a beef hot dog is about
 - (A) 190. (B) 179. (C) 139. (D) 153. (E) 129.

22. There is a positive correlation between the size of a hospital (measured by number beds) and the median number of days that patients remain in the hospital. Does this mean that you can shorten a hospital stay by choosing to go to a small hospital?
 - (A) Yes, the data show that stays are shorter in smaller hospitals.
 - (B) Yes, the correlation can't be just by accident.
 - (C) No, a negative correlation would allow that conclusion, but this correlation is positive.
 - (D) No, this is reverse cause-and-effect.
 - (E) No, the positive correlation is probably explained by the fact that seriously ill people go to large hospitals.

23. Firearms are second to motor vehicles as a cause of non-disease deaths in the United States. Here are the bar charts from a study of all firearm-related deaths in Wisconsin between 2000 and 2002 for children and youth under the age of 25 where the type of firearm used was known. We want to compare the types of firearms used in homicides and suicides.



What can this study conclude?

- (A) The bar charts show that a considerably higher percentage of long-gun deaths were homicides.
 - (B) The graph is clearly bimodal with the same number of homicides as suicides
 - (C) There aren't any differences between the number of homicides and suicides since the bars are of equal height.
 - (D) There is evidence to suggest that long guns are used more often for suicides than for homicides. We also observe that handguns accounted for 86% of homicides but only about 36% of suicides.
 - (E) Firearms and deaths are negatively correlated. In other words, as guns get longer the firearm-related deaths go from homicide to suicide.
24. On October 23, 2008 AOL conducted an online poll of their subscribers to see whom voters preferred in the presidential race. Approximately 281,000 responses were recorded. Of these, 56% picked McCain and 42% picked Obama. Identify the type of sampling used in this example.
- (A) simple random sampling (C) census
 - (B) systematic sampling (D) voluntary response sampling
 - (E) stratified random sampling
25. In a study of the relationship for senior citizens between physical activity and frequency of colds, participants were asked to monitor their weekly time spent in exercise over a five-year period and frequency of colds. The study demonstrated that a negative statistical relation exists between time spent in exercise and frequency of colds. The investigator concluded that increasing the time spent in exercise is an effective strategy for reducing the frequency of colds for senior citizens. This is an example of
- (A) an experiment. (C) an experiment using a block design.
 - (B) a matched pairs experiment. (D) an observational study, not an experiment.
 - (E) a stratified experiment.
26. The Pepsi Company designed a study to demonstrate that Coke drinkers prefer Pepsi when they taste both colas blind. The subjects, all people who said that they were Coke drinkers, tasted both colas using cups without brand identification and said which they liked better. Because responses depend on which cola is tasted first, the order of tasting was chosen at random for each subject. This experiment uses
- (A) a matched pair design. (C) double blinding.
 - (B) a factorial design. (D) random placebos.
 - (E) double replication.

27. A light bulb manufacturer sells a light bulb that has a mean life of 1450 hours with a standard deviation of 33.7 hours. A new manufacturing process is being tested and there is interest in knowing the mean life μ of the new bulbs. How large a sample is required in order to get a margin of error no larger than ± 5 hours with 95% confidence? You may assume that the standard deviation is 33.7 hours.
- (A) 14 (B) 12 (C) 123 (D) 175 (E) 4
28. Joe is writing a report on the backgrounds of American presidents. He looks up the ages of all 43 presidents when they entered office. He finds the mean age of the presidents is 54.8 years with a standard deviation of 6.19 years. Because Joe took a statistics course, he calculates a 95% confidence interval for the mean age of all men who have been president to be 54.8 ± 1.89 . Comment on the result.
- (A) The confidence interval makes no sense since Joe has the entire population of ages.
 (B) Joe can be 95% confident that the mean age of all presidents is 54.8 years.
 (C) 95% of all the ages of the presidents lie between 54.8 ± 1.89 .
 (D) Joe is 95% confident that the mean age of all presidents lies between 52.91 and 56.69 years.
 (E) Joe should have taken a larger sample to reduce the margin of error.
29. Studies have shown that walnuts can reduce blood cholesterol. Rich in polyunsaturated fatty acids, walnuts also help keep blood vessels healthy and elastic. Almonds appear to have a similar effect, resulting in a marked improvement within just four weeks. A statistical test is more likely to find a significant decrease in blood cholesterol if
- (A) it is based on a very small random sample. (C) the p-value is large.
 (B) it is based on a very larger random sample. (D) the test of hypotheses is not rejected.
 (E) the size of the sample doesn't have any effect on the significance of the test.
30. An anthropologist suspects that color blindness is less common in societies that live by hunting and gathering than in settled agricultural societies. He tests a number of adults in two populations in Africa, one of each type. The proportion of color-blind people is significantly lower ($P - value \leq 0.05$) in the hunter-gatherer population. What additional information would you want to help decide whether you accept the claim about color blindness?
- (A) What was the proportion of color-blind people in the hunter-gatherer population?
 (B) Were these random samples? How big were the samples?
 (C) Was this a double-blind study?
 (D) What is the **Who, What, Where**?
 (E) What does the side-by-side boxplots look like? Were the samples normally distributed?
31. A Tennessee state senator wants to know what the voters of Tennessee think of proposed legislation regarding an increase in state sales tax. He mails a questionnaire to a simple random sample of 3000 voters in Tennessee. His staff reports that 789 questionnaires have been returned, of which 678 are against the legislation. This is an example of
- (A) a survey with little bias because a large SRS was used.
 (B) a survey containing nonresponse.
 (C) a survey with little bias because it was the voters that elected the senator.
 (D) a survey that is representative of the voters thinking.
 (E) All of the above.
32. The results of an experiment are said to be statistically significant if
- (A) the observed effect is too large to attribute plausibly to chance.
 (B) the results are important to the researchers, regardless of their importance to the researchers.
 (C) both researchers and statisticians agree that the results are meaningful and important.
 (D) they support the findings of previous, similar studies.
 (E) a null hypothesis has to be accepted.