

Statistics Competency Exam Fall 2019

Name _____

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.

Stat Comp

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

1. Which of these questions from a class survey produced variables that are categorical?

- i. What is the fastest you have ever driven a car? (in mph)
- ii. How old is your car? (in years)
- iii. What is your religious identification? (Christian Religion, Non-Christian Religion, None)
- iv. How many speeding tickets have you got since you started driving?
- v. Have you, yourself, ever smoked cigarettes in the past week? (Yes, No)

(A) i, ii, iv (B) iii, iv, v (C) i, v (D) iii, v (E) i, ii

Use the following for the next two questions. Suppose the table below represents the probability distribution for ETSU graduate students owning a certain number of dogs.

Number of Dogs Owned	0	1	2	3	4	5
Probability	0.34	0.20	0.16	?	0.05	0.01

2. What is the probability that a randomly selected ETSU graduate student owns 3 dogs?

(A) 0.14 (B) 0.24 (C) 0.18 (D) 0.20 (E) 0.19

3. What is the mean number of dogs owned by ETSU graduate students?

(A) 0 (B) 1 (C) 2.5 (D) 2.16 (E) 1.49

4. According to healthline.com, as of 2016, the average height for American women aged 20 years and older is 63.7 inches. Assume that heights for American women are normally distributed with a mean of 63.7 inches and a standard deviation of 3.5 inches. Approximately what percent of American women, aged 20 years and older, are taller than 70.7 inches?

(A) 68% (B) 97.5% (C) 34% (D) 16% (E) 2.5%

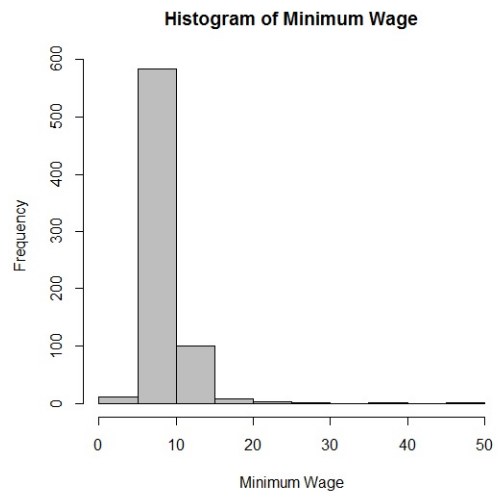
5. The number of students a professor has had in a class is as follows:

25 20 15 5 30 8 10 12

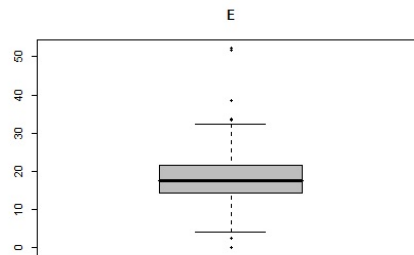
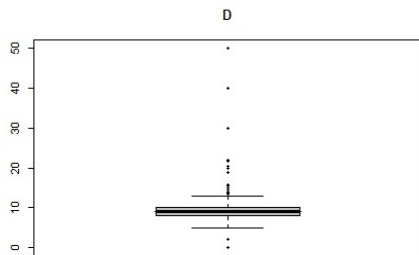
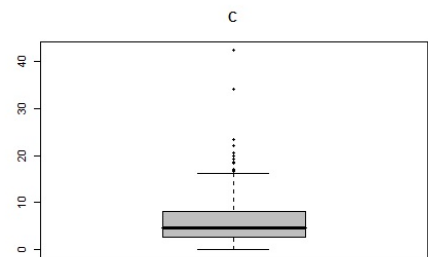
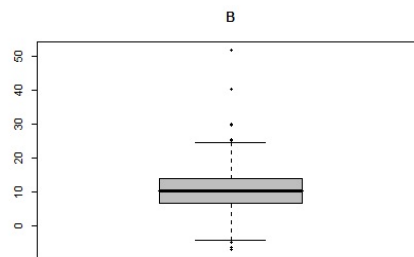
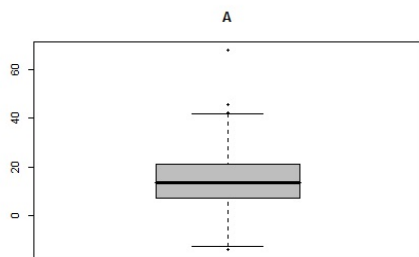
The five-number summary (calculated by hand) would be

- (A) 5, 9, 13.5, 22.5, 30
- (B) 25, 20, 17.5, 8, 12
- (C) 5, 9.5, 15.62, 21.25, 30
- (D) Median = 13.5, Mean = 15.62, Range=25, Min = 5, Max = 30
- (E) N=8, IQR = 11.75, Mean = 15.62, Range = 25, Median = 13.5

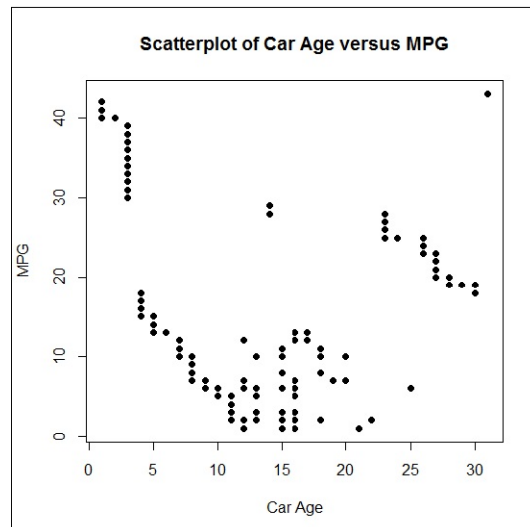
Use the following for the next 2 questions. A class survey asked “How much do you believe minimum wage should be? (in US dollars)” The figure below represents the responses of 708 students.



6. Which of the following best describes this distribution? This distribution is
- (A) right-skewed, with the center around \$9 and spread from \$0 to \$50, with possible outliers.
 - (B) left-skewed with possible outliers.
 - (C) symmetric around \$9, with very little variation.
 - (D) multi-peaked with the bulk of data from \$5 to \$10.
 - (E) evenly-spaced from \$0 to \$50.
7. Which of the following boxplots corresponds to the above histogram?



Use the following for the next two questions. A class survey asked the following questions: “How old is your car? (in years)” and “How many miles per gallon (mpg) does your car get? (in mpg)”. A scatterplot of the data from these questions is given:



8. A plausible value for the correlation between car age and mpg is:
 (A) -1.0 (B) 0.85 (C) 0.3 (D) 1.0 (E) 2.0
9. A linear model was fit to predict mpg using a car's age; the fitted model is $\hat{MPG} = 11.997 + 0.530AGE$. Choose the correct interpretation of the slope.
 (A) On average, for every 1 year increase in a car's age, the mpg increases by 11.997.
 (B) For every 1 year increase in a car's age, the mpg increases by 0.530.
 (C) For every 0.530 year increase in a car's age, the mpg increases by 11.997, on average.
 (D) When a car is brand new, the mpg is 11.997, on average.
 (E) On average, for every 1 year increase in a car's age, the mpg increases by 0.530.
10. A student working in ETSU's Treehouse wanted to see how often people bought something to eat or drink. She decided she would ask every 15th person who checked out at her kiosk, “How many times have you bought something here this week?” She picked a random starting place (starting with the third person who checked out at her kiosk), and then selected every 15th person thereafter. This is an example of
 (A) an experiment.
 (B) a systematic sample.
 (C) a matched-pairs design.
 (D) a simple random sample.
 (E) a volunteer sample.
11. The standard normal distribution is a normal distribution whose
 (A) mean is $\mu = 1$ and standard deviation $\sigma = 0$.
 (B) mean μ can be determined by using a z-score.
 (C) mean is $\mu = 0$ and standard deviation $\sigma = 1$.
 (D) mean μ can have any real value, and standard deviation $\sigma = 1$.
 (E) mean $\mu = 1$ and standard deviation $\sigma = 1$.

Use the following for the next three questions. A question from a class survey asked students, “How many books (not including textbooks or other books for class) did you read in 2015?” According to Pew Research, Americans read an average of 12 books per year. On average, is the number of books read by ETSU students the same as reported by the research? The output from running the appropriate analysis is given:

One Sample t-test

```
data: spr_dat$Books
t = -7.0502, df = 707, p-value = 4.258e-12

99 percent confidence interval:
 5.947940 9.193303
sample estimates:
mean of x
 7.570621
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12. Which of the following are the correct null and alternative hypotheses for the test?
- (A) $H_0 : \bar{x} = 12$ vs $H_a : \bar{x} \neq 12$
 - (B) $H_0 : \mu = 12$ vs $H_a : \mu < 12$
 - (C) $H_0 : \mu = 12$ vs $H_a : \mu \neq 12$
 - (D) $H_0 : \bar{x} = 7.57$ vs $H_a : \bar{x} \neq 7.57$
 - (E) $H_0 : \bar{x} = 12$ vs $H_a : \bar{x} < 12$
13. Which of the following is the appropriate decision and conclusion for the test?
- (A) Reject H_0 . With 1% significance level, there is sufficient evidence that the true mean number of books read by all ETSU students is less than 12.
 - (B) Do not reject H_0 . With 1% significance level, there is not sufficient evidence that the true mean number of books read by all ETSU students is less than 12.
 - (C) Reject H_0 . With 1% significance level, there is sufficient evidence that the true mean number of books read by this sample of ETSU students is not 12.
 - (D) Reject H_0 . With 1% significance level, there is sufficient evidence that the true mean number of books read by all ETSU students is not 12.
 - (E) Do not reject H_0 . With 1% significance level, there is sufficient evidence that the true mean number of books read by this sample of ETSU students is not 7.57.
14. Which of the following is the correct interpretation of the confidence interval?
- (A) With 99% confidence, the true mean number of books read by all ETSU students is between 5.95 and 9.19 books.
 - (B) With 95% confidence, the true mean number of books read by all ETSU students is between 5.95 and 9.19 books.
 - (C) With 99% confidence, the mean number of books read by this sample of ETSU students is between 5.95 and 9.19 books.
 - (D) With 95% confidence, the mean number of books read by this sample of ETSU students is between 5.95 and 9.19 books.
 - (E) With 99% confidence, the true mean number of books read by all ETSU students is 7.57 books.

15. Which of the following is an example of a matched pairs design?

- (A) A nutritionist compares the pre-diet and post-diet weights of her clients.
- (B) A nutritionist compares the post-diet weight loss of clients who followed a keto diet with the post-diet weight loss of other clients who followed a Mediterranean diet.
- (C) A nutritionist compares the post-diet weight loss of her clients with a national average weight loss.
- (D) A nutritionist compares her client's average weight loss over 3 months with a national average weight loss over 3 months.
- (E) None of the above.

Use the following for the next two questions. According to the Pew Research organization (in 2005), of all U.S. teenagers between 12 and 17 years old, 63% said they call friends on the phone to talk with them most often, 32% said they most often write messages to their friends, and 4% say they do both equally.

16. For a randomly selected U.S. teenager between 12 and 17 years old, what is the probability that the teen uses either calling or writing, but not both?

- (A) 0.96 (B) 0.91 (C) 0.87 (D) 0.09 (E) 0.13

17. For a randomly selected U.S. teenager between 12 and 17 years old, what is the probability that the teen doesn't call, nor write messages to their friends?

- (A) 0.01 (B) 0.05 (C) 0.04 (D) 0.09 (E) 0.13

Use the following for the next three questions. Snee (1974) reports the following table corresponding to hair and eye color for 592 students:

Eye Color	Hair Color				Total
	Black	Brown	Red	Blond	
Brown	68	119	26	7	220
Blue	20	84	17	94	215
Hazel	15	54	14	10	93
Green	5	29	14	16	64
Total	108	286	71	127	592

18. Find the probability that a person will have blue eyes given that they have brown hair.

- (A) $\frac{84}{592}$ (B) $\frac{215}{286}$ (C) $\frac{84}{215}$ (D) $\frac{215}{592}$ (E) $\frac{84}{286}$

19. Are the events having blue eyes and having brown hair independent?

- (A) Yes because $P(\text{Blue eyes}|\text{Brown hair}) = P(\text{Blue eyes})$.
- (B) No because $P(\text{Blue eyes}|\text{Brown hair}) = P(\text{Blue eyes})$.
- (C) Yes because $P(\text{Blue eyes}|\text{Brown hair}) \neq P(\text{Blue eyes})$.
- (D) No because $P(\text{Blue eyes}|\text{Brown hair}) \neq P(\text{Blue eyes})$.
- (E) Not enough information given to answer.

20. We are interested in testing whether eye color differs among the different hair colors. Which of the following statistical methods can be used to address this?

- (A) Regression analysis (B) Chi-square test (C) Two-sample t procedure (D) Z-test (E) Paired-t test

Use the following for the next two questions. A class survey asked “What is your favorite way of spending an evening? (Staying at home, Watching TV, Resting/Relaxing, Reading, Visiting with friends, Other)” A total of 708 students responded to this survey question. 36.7% of the sample responded “Visiting with friends”.

21. Calculate a 95% confidence interval for the proportion of all ETSU students whose favorite way of spending an evening is visiting with friends.
- (A) 0.367 ± 0.0355
 - (B) 0.367 ± 0.9447
 - (C) 0.367 ± 0.0446
 - (D) 0.367 ± 0.0006
 - (E) 0.367 ± 0.0181
22. How could we achieve a more narrow confidence interval than the one calculated above?
- (A) Decrease the sample size and increase the confidence level.
 - (B) Increase the sample size and increase the confidence level.
 - (C) Increase the sample size and decrease the confidence level.
 - (D) Decrease the sample size and decrease the confidence level.
 - (E) Not enough information given to answer.

Use the following for the next two questions. According to one source, newborn baby weights have a mean of 7.5 pounds with a standard deviation of 1.1 pounds.

23. How much would a newborn baby need to weigh to be at the 90th percentile?
- (A) 8.919 lbs (B) 8.49 lbs (C) 8.6 lbs (D) 8.398 lbs (E) 9.656 lbs
24. An OBGYN has delivered 49 babies this year. What’s the probability that the mean weight for these 49 babies is greater than 7.75 pounds?
- (A) 0.0559 (B) 0.5910 (C) 0.4090 (D) 0.5160 (E) 0.9441
25. A scatterplot of ice cream sales (in dollars) shows a strong positive correlation with number of homicides. Does that mean that we shouldn’t buy ice cream, as that causes homicides?
- (A) No, a negative correlation would allow that conclusion, but this correlation is positive.
 - (B) No, this is reverse cause-and-effect.
 - (C) No, the positive correlation is probably explained by the fact that more ice cream is bought and more people are out-and-about when the weather is sunny.
 - (D) Yes, the correlation can’t be just by an accident.
 - (E) Yes, the data show that as people buy and eat more ice cream, they gain weight, which makes it harder for them to run away from a dangerous situation.
26. According to CollegeAtlas.org, thirty percent of college freshmen drop out after their first year of college. A random sample of 12 college freshmen is obtained. The probability that exactly four of the 12 freshmen will not return for their sophomore year is
- (A) 0.3333 (B) 0.0078 (C) 0.1000 (D) 0.2311 (E) 0.3000
27. Suppose a researcher performs a test of $H_0 : p = 0.5$ vs. $H_a : p < 0.5$. Which of the following statements is correct?
- (A) An extremely small p-value indicates that the actual data differs significantly from that which would be expected if the null hypothesis were true.
 - (B) The p-value measures the probability that the hypothesis is true.
 - (C) The larger the p-value, the stronger the evidence against the null hypothesis.
 - (D) A large p-value indicates that the data is consistent with the alternative hypothesis.
 - (E) None of the above.

28. An automobile dealer believes that certain colors of cars are more popular than other colors. He randomly selects 50 sales records from the previous year, and records the color of each car sold. A hypothesis test is performed in order to determine if the data supports the claim of the automobile dealer. The alternate hypothesis would be
- (A) H_a : The color "red" has a higher preference than the other colors.
 - (B) H_a : At least one color is preferred differently than the other colors.
 - (C) H_a : The color "yellow" has a lower preference than the other colors.
 - (D) H_a : All colors are equally preferred.
 - (E) None of the above.
29. The GPAs of 34 randomly selected fraternity members (F) and 37 randomly selected non-fraternity students (S) were obtained from the student body. To determine if there is a difference between the average GPA of fraternity members and the average GPA of non-fraternity students, which set of hypotheses would be appropriate?
- (A) $H_0 : p_F = p_S$ vs $H_a : p_F \neq p_S$
 - (B) $H_0 : \mu_F = \mu_S$ vs $H_a : \mu_F < \mu_S$
 - (C) $H_0 : \mu_d = 0$ vs $H_a : \mu_d \neq 0$
 - (D) $H_0 : \mu_F - \mu_S = 0$ vs $H_a : \mu_F - \mu_S > 0$
 - (E) $H_0 : \mu_F = \mu_S$ vs $H_a : \mu_F \neq \mu_S$
30. A researcher performed a hypothesis test to determine if the average age of U.S. freshman college students is different than 18 years old. He conducted his test using a 10% significance level and decided not to reject the null hypothesis. Suppose the researcher constructs a 90% confidence interval on μ . For the 90% confidence interval,
- (A) the value of 18 would be contained in it.
 - (B) cannot be constructed after the researcher has performed a hypothesis test.
 - (C) as there is insufficient information, cannot say anything about it.
 - (D) the value of 18 would not be contained in it.
 - (E) a 95% confidence interval is more narrow.