STA 2023 Practice Questions Final Exam

1. Which of the following is not a property of the t distribution?
a) has fatter tails than a Z distribution
b) it is symmetric and mound shaped
c) it is centered at zero
d) as the degrees of freedom increase it becomes less like a Z distribution.

Questions 2 – 5 An education researcher has developed a new technique to teach Spanish to high school students. To prove this new method is better, she will teach two groups of students for an entire semester, one with the new method and one with the standard method used today in high schools. She wishes to obtain 12 sets of identical twins, 24 people total, and split the twins up so that one of each twin is in Class 1, which will receive the new technique, and one is in Class 2, which will receive the old technique. At the end of the semester both classes will take a standardized exam and the results will be compared.

2. What method should be used to analyze this data?
a) one mean
b) two independent means
c) matched pairs
d) two independent proportions

3. What should our hypotheses be to test if your new method is better than the old method?
a) $H_0: \mu_1 - \mu_2 = 0$ vs. $H_A: \mu_1 - \mu_2 < 0$
b) $H_0: \mu_D = 0$ vs. $H_A: \mu_D < 0$
c) $H_0: \mu_1 - \mu_2 = 0$ vs. $H_A: \mu_1 - \mu_2 > 0$
d) $H_0: \mu_D = 0$ vs. $H_A: \mu_D > 0$

4. What distribution would you use to look up the p-value for this test of hypothesis?
a) t(11)
b) t(12)
c) t(23)
d) Z

5. Suppose we collect the data from this experiment and we find a p-value of 0.009. Which of the following is our conclusion at any reasonable alpha level?
a) There is no difference between the two educational methods.

b) The old method is better than the new method.
c) The new method is better than the old method.
d) We cannot determine without more information.

Questions 6-8 use the following modifications to the above scenario.
Unable to obtain the 12 sets of twins to conduct the experiment, the researcher has to use two existing Spanish classes at a local high school, one with 12 students and the other one with 11 students.

6. What method should be used to analyze this data?
a) one mean
b) two independent means
c) matched pairs
d) two independent proportions

7. What should our hypotheses be to test if your new method is better than the old method?
a) $H_0: \mu_1 - \mu_2 = 0$ vs. $H_A: \mu_1 - \mu_2 < 0$
b) $H_0: \mu_D = 0$ vs. $H_A: \mu_D < 0$
c) $H_0: \mu_1 - \mu_2 = 0$ vs. $H_A: \mu_1 - \mu_2 > 0$
d) $H_0: \mu_D = 0$ vs. $H_A: \mu_D > 0$

8. What distribution would you use to look up the p-value for this test of hypothesis?
a) t(11)
b) t(10)
c) t(23)
d) Z

9. What distribution would Minitab use to find the p-value for this test of hypothesis?
a) t with more degrees of freedom than we use
b) t with less degrees of freedom than we use
c) t with same degrees of freedom we use
d) Z

Questions 10 – 13 We suspect that men are convicted of DUI (driving under the influence of alcohol or drugs) more often than women. Let p_1 be the proportion of males convicted of a DUI offense and p_2, the proportion of females convicted of a DUI offense.

10. If the 95% CI for $p_1 - p_2$ is (-.163 , -.02). Which of the following can we conclude?
a) Males have a higher proportion of convictions for DUI than females.
b) Females have a higher proportion of convictions for DUI than males.
c) There is no difference in the proportion of convictions for DUI for males and females.

11. Suppose we test $H_0: p_1 - p_2 = 0$ vs. $H_A: p_1 - p_2 \neq 0$. What can we say about the p-value?
a) it is greater than .05
b) it is less than .05

c) it is equal to .025 d) cannot say anything about the p-value

12. Suppose we test $H_0: p_1 - p_2 = 0$ vs. $H_A: p_1 - p_2 > 0$. What can we say about the p-value?
a) it is greater than .05 b) it is less than .05
c) it is less than .025 d) cannot say anything about the p-value

13. According to the story above, are there any problems with the assumptions necessary for these conclusions to be valid?
a) The data may not have been randomly selected, and thus, not representative of the population.
b) The sample sizes may not have been large enough for the formulas to be appropriate.
c) There may be problems with both randomness and sample sizes.
d) There are no problems with this data.

Questions 14 – 16 Many university courses require students to type their written assignments. Do students get better at typing because of this? Researchers want to see if incoming freshmen have a slower average typing rate (in words per minute) than graduating seniors. A random sample of 50 freshmen and 50 seniors was taken, and each was given a typing test to determine their typing rate. This data was entered into Minitab, and the results are shown below:

```
            N      Mean     StDev   SE Mean
Freshmen   50      27.9      13.4       1.9
Seniors    50      34.0      12.5       1.8

95% CI for mu Freshmen - mu Seniors: ( -11.2,  -0.9)
T-Test mu Freshmen= mu Seniors (vs <): T= -2.32  P=0.011  DF= 97
```

14. Which of the following can we conclude from this output (at the 95% confidence level)?

a) Freshmen have a lower average typing rate than seniors.

b) Freshmen have a higher average typing rate than seniors.

c) Freshmen and seniors type at exactly the same rate, on average.

d) We cannot show a difference between the mean typing rates of freshmen and seniors.

15. Which of the following statements are true?

I. We are 98.9% confident that the mean typing rate for freshmen is smaller than the mean typing rate for seniors.

II. There is a 0.95 probability that the true mean difference for freshmen-seniors lies between -0.9 and -11.2.

III. The probability that the mean typing rate of freshmen equals the mean typing rate of seniors is .011.

a) Only I is true.
b) Only III is true.
c) Only I & II are true.
d) All three statements are true.

16. Which of these are necessary assumptions when making inferences based on this data?

I. Each sample is randomly drawn from the population

II. The two samples are independent.

III. Each population size is at least10 times larger than the sample size from that population.

a) Only I is assumed.
b) Only III is assumed.
c) Only I & II are assumed.
d) All three are assumed.

Questions 17 – 22 Global warming has gotten a lot of media attention over the past few years, but researchers in Antarctica are keeping track of temperatures at the South Pole to try to see if temperatures really are rising. They know that from 1900- 1999 the average temperature at the South Pole was -6 degrees Celsius. They have randomly sampled 25 days from the past 2 years and collected the following data:

-6.0 -1.3 -2.4 -0.4 -3.4 2.1 -6.1 6.4 1.1 -4.2 -38.0 -0.1
0.5 -5.8 -3.5 2.8 -6.5 4.3 -1.5 -1.8 1.9 2.8 3.5 0.8 2.1

17. What are the appropriate H_0 and H_a to use here?

a) H_0: ? = -2.1 H_a: ? > -2.1
b) H_0: ? = -6 H_a: ? > -6
c) H_0: ? = -6 H_a: ? ? -6
d) H_0: ? 1- ? 2 = 0 H_a: ? 1- ? 2 ? 0
e) H_0: ? 1- ? 2 = 0 H_a: ? 1- ? 2 > 0

18. What is the standard error?
a) 8.26 b) 8.09 c) 1.618 d) 1.652

19. What is the Test Statistic for this test?
a) - 4.9 b) 3.89 c) - 1.28 d) 2.35

20. Suppose the Test Statistic was 2.4. Then the p- value is between:
a) .01 and .02 b) .02 and .025
c) .005 and .01 d) .10 and .15

21. The 98% Confidence Interval obtained from this sample is (- 5.99, 1.79). Based on this interval, which of the following statements are true? We are 98% confident that:
a) the true mean temperature of this century is between 5.99 degrees lower and 1.79 degrees
higher than the true mean temperature of last century at the South Pole.
b) the true mean temperature of this century is between 5.99 degrees higher and 1.79 degrees
lower than the true mean temperature of last century at the South Pole.
c) the true mean temperature of this century is different than the true mean temperature of last
century at the South Pole.
d) the true mean century of this century is the same as the true mean temperature of last century
at the South Pole.
e) None of the above statements are true.

22. Which of the following problems cast doubts on our conclusions?
a) The data was not randomly selected.
b) The data is not representative of the whole century.
c) The data does not seem to come from a Normal distribution.
d) all of the above
e) only a and b
f) only b and c
g) only a and c
h) no problems

23. The executives at Sandbachian, Inc., having recently solved their widget crisis, have another problem with one of their products. Many cities are sending complaints that their manhole covers are defective and people are falling into the sewers. The workers took a random sample of 800 manhole covers and found that 40 of them were defective. What is the 95% CI for p, the true proportion of defective manhole covers, based on this sample?
a) (37.26, 42.74)
b) (.037, .068)
c) (.047, .053)

d) (.015, .085)

24. What is a Wilson estimate?
a) A pooled proportion of all successes seen in both samples, which is our best guess at the
proportion of successes in the population if there really is no difference between the two.
b) An adjusted sample proportion, computed by adding 4 phantom trials (half of which are
successes), which gives better confidence intervals than the regular sample proportion.
c) A value we assume is the true population proportion, as specified in the null hypothesis,
which is also used to compute the standard error when making significance tests.
d) An estimate of the population proportion that is always further from 0.5 than the regular
sample proportion, resulting in a smaller standard error and requiring smaller samples.

Questions 25 and 26 Researchers are designing a study to determine if the age of the victim is a factor in reported scams. The researchers are testing to determine if more than
half of all reported scams victimize the elderly. They randomly sample 350 reported
scams over the past 10 years from the Better Business Bureau archives, and note that,
for 287of them, the victim is over 65 years old.

25. Match the following symbols with the correct number on the right:

_____ p	a) 0.50
_____ p-hat	b) 65
_____ p_0	c) 287
_____ x	d) 350
_____ n	e) 0.820
_____ p-tilde	f) 0.816
	g) unknown

26. Minitab reports the p-value for this test to be 0.00. Which of the following is the best interpretation of the results?
a) Minitab made a mistake, since we can never be 100% confident of our results.

b) We are very confident that most scams involve elderly victims.
c) We are very confident that most reported scams involve elderly victims.
d) We are very confident that most scams do not involve elderly victims.

Questions 27 – 29 Is left-handedness associated with gender in some way? Researchers were trying to determine if a connection could be made between the dominant hand and gender in high school students. They randomly sampled 1417 high school students across the country and obtained the following data:

	Male Students	Female Students
Left Handed Students	68	97
Right Handed Students	545	707

27. What is the population of interest here?
a) all left-handed high school students in the country
b) all right-handed high school students in the country
c) all male high school students in the country
d) all female high school students in the country
e) all high school students in the country

28. The 95% CI was (-0.0430, 0.0242) What can we conclude about the proportions of left handed students among male and female high school students at the 95% confidence level?
a) The true proportion of male students that are left handed is higher than the true proportion of
female students that are left handed.
b) The true proportion of male students that are left handed is lower than the true proportion of
female students that are left handed.
c) The true proportion of male students that are left handed is equal to the true proportion of
female students that are left handed.
d) We cannot conclude that the true proportion of male students that are left handed is different
from the true proportion of female students that are left handed.

29. Which of the following assumptions, necessary for the validity of this test, could have been violated in this case?

a) data may not have been randomly selected
b) males and females are not independent
c) population was not ten times larger than the sample
d) samples were too small
e) none seems to be violated

Questions 30 – 33 Below is data collected from a random sample of 3,647 American professionals from 10 urban cities. We would like to know if male professionals are more likely to have children than female professionals of the same age (33- 38).

	WOMEN		MEN		TOTALS	
	Without children	With children	Without children	With children	Without children	With children
18-25	265	62	132	164	397	226
26-32	408	216	178	397	583	613
33-38	276	412	86	563	362	978
39-45	89	294	23	275	112	569
46+	23	145	64	455	87	600

30. This would be best analyzed as a:

a) Matched pairs
b) One proportion
c) Two independent means
d) Two independent proportions

31. Which data from the table above would we be analyzing in this case?

a) all women vs. all men
b) women aged 33- 38 vs. men aged 33- 38
c) women aged 33- 38 vs. totals for all people 33- 38
d) women aged 33- 38 with children vs. women aged 33- 38 without children

32. Are there any problems with this data that would violate the assumptions?

a) Yes, there is an outlier.
b) Yes, all the counts are too large.
c) Yes, the data does not come from a Normal distribution.
d) No problems.

33. Minitab gave the following CI for the difference in the proportion of professional men and women in urban cities, aged 33- 3, who have children: (0.206951, 0.297170). What conclusion can we make?
a) There is not enough evidence to conclude that professional men are more likely than
professional women in this age group to have children.
b) The proportion of professional men who have children is different than the proportion of
professional women in this age group.
c) Professional men are significantly more likely to have children than professional women in
this age group.
d) Professional women are significantly more likely to have children than professional men in
this age group.

Questions 34 – 43 Which case is it? You can use each answer more than once.

a) one mean
b) one proportion
c) matched pairs
d) two independent means
e) two independent proportions

34. According to a survey of 403 pet owners conducted by the Pet Supplies plus chain in September 2003, 208 of all owners planned to dress up their four-footed friends in costumes this Halloween. Do significantly more than half of pets dress up for Halloween?

35. Public health officials are concerned that there has been an increase in the frequency of fetal alcohol syndrome, which has been steady at 2.3 cases per 100,000 live births for nearly a decade. This year, there were 4.1 cases per 100,000 live births.

36. A sociologist suspects that members of pairs of heterosexual siblings of the same gender (brother- brother or sister- sister) get married at earlier ages on average than siblings who come from mixed- gender (brother- sister) pairs.

37. Does pesticide X affect the yield (in lbs) of any of 10 different varieties of tomatoes ? Two fields (one treated and one untreated) are planted with 2 rows each of 10 varieties of tomatoes, and their yields are compared.

38. A gourmet pet food shop owner wants to estimate how many of his customers would continue to shop with him if he moved across town. He asks a random 50 shoppers if they'd drive across town to shop with him, and he makes a confidence interval to help make the decision to move or not.

39. The migration of African buffalo herds might be affected by the weight of the transponder used to track them. Last year, the scientists tried their standard transponder on eight herds of buffalo and recorded how far each group traveled. This year they will swap out the heavy transponders with more expensive, lighter ones and see if the same buffalo herds travel farther than last year.

40. A political action group wonders if college graduates are more likely to support increased penalties for repeat offenders than are those without college degrees.

41. Is the ice- cream cup filling machine accurate or not? A random sample of 20 quarts of ice cream is taken to see if the average contents is 247 mL of product.

42. Does eating breakfast improve productivity? In a Guess jeans factory, the workers of one sewing crew of 20 are fed a hearty breakfast for a month, while

another sewing crew of 20 is asked to go without eating until lunch time. The teams' productivity is compared for each of 30 days.

43. Equal rights activists claim that, if admissions into a college's architecture program are fair, half of all students admitted should be female. To test this hypothesis, they look at admissions data from 1982 (before aggressive recruiting of women) and 2001, asking "Has the proportion of women admitted changed significantly in the last decade?"

General Questions

44. When are p-values negative?

a) when the test statistic is negative.
b) when the sample statistic is smaller than the hypothesized value of the parameter
c) when the confidence interval includes only negative values
d) when we fail to reject the null hypothesis
e) never

45. When can we decide to reject the null hypothesis by looking at a confidence interval?

a) when the interval includes only negative values
b) when the interval includes only positive values
c) when the interval includes both positive and negative values
d) when the interval does not include the hypothesized value of the parameter
e) never

Questions 46 – 50 Two UF students are investigating how long it takes shoppers to find parking spaces at the Publix in Butler Plaza on different days of the week. To collect data, they position themselves at the parking lot entrance closest to Publix and, using a stopwatch, they record how long (in minutes) it takes every fifth car to come to a complete stop in a parking space. "Parkwkda" regards data collected on a weekday; "Parksat" on Saturday, and "Parkgame" on a Saturday which was also a UF football game day.

NOTE: Minitab output appears on the following page. Some are relevant to this question, and some are not. Read them carefully.

46. How long, on average, does it take to find a parking space on a weekday?

a) 0.935 minutes
b) 0.395 minutes
c) 0.740 minutes
d) cannot be determined from the information given

47. Does it take longer to find a parking space on Saturday than on a weekday? This should be analyzed as:

a) two independent means b) two independent proportions c) matched pairs

48. What can we conclude about the time it takes to find a parking space on Saturday compared to a weekday?

a) The p-value for this significance test is .23, which means there is not enough evidence to prove a significant difference between these two times.
b) The p-value for this significance test is .33, which means there is not enough evidence to prove a significant difference between these two times.
c) The p-value for this significance test is .0005, which means that it takes longer on a Saturday to find a parking space.
d) The p-value for this significance test is .002, which means the time to find a space on Saturday is different than on a weekday.

49. Does it take longer to find a parking space on a Saturday than on a game day? This should be analyzed as:

a) two independent means b) two independent proportions c) matched pairs

50. What can we conclude about the time it takes to find a parking space on a Saturday compared to a game day?

a) The p-value for this significance test is .23, which means there is not enough evidence to prove a significant difference between these two times.
b) The p-value for this significance test is .33, which means there is not enough evidence to prove a significant difference between these two times.
c) The p-value for this significance test is .0005, which means that it takes longer on a game day than on a Saturday to find a parking space.
d) The p-value for this significance test is .002, which means the time to find a space on a game day is different than on a Saturday.

Two Sample T-Test and Confidence Interval

```
Two sample T for parkwkday vs parksat
```

```
           N      Mean     StDev   SE Mean
parkwkda  20     0.395     0.307     0.069
parksat   20     0.935     0.583      0.13

95% CI for mu parkwkda - mu parksat: ( -0.842,  -0.24)
T-Test mu parkwkda = mu parksat (vs <): T = -3.66  P = 0.0005  DF = 28
```

Paired T-Test and Confidence Interval

```
Paired T for parkwkday - parksat

                  N      Mean     StDev   SE Mean
parkwkda         20     0.395     0.307     0.069
parksat          20     0.935     0.583     0.130
Difference       20    -0.540     0.678     0.152

95% CI for mean difference: (-0.857, -0.223)
T-Test of mean difference = 0 (vs not = 0): T-Value = -3.56  P-Value =
0.002
```

Two Sample T-Test and Confidence Interval

```
Two sample T for parksat vs parkgameday

           N      Mean     StDev   SE Mean
parksat   20     0.935     0.583      0.13
parkgame  20     0.740     0.421     0.094

95% CI for mu parksat - mu parkgame: ( -0.13,  0.522)
T-Test mu parksat = mu parkgame (vs not =): T = 1.21  P = 0.23  DF =
34
```

Paired T-Test and Confidence Interval

```
Paired T for parksat - parkgameday

                  N      Mean     StDev   SE Mean
parksat          20     0.935     0.583     0.130
parkgame         20     0.740     0.421     0.094
Difference       20     0.195     0.879     0.197

95% CI for mean difference: (-0.217, 0.607)
T-Test of mean difference = 0 (vs not = 0): T-Value = 0.99  P-Value =
0.33
```

ANSWERS

1. **d**
2. **c**

3. d
4. a
5. c
6. b
7. c
8. b
9. a
10. b
11. b
12. a
13. c
14. a
15. a
16. c
17. b
18. d
19. d
20. a
21. c
22. f
23. b
24. b
25. g e a c d f
26. c
27. e
28. d
29. e
30. d
31. b
32. d
33. c
34. b
35. a
36. d
37. c
38. b
39. c
40. e
41. a
42. c
43. e
44. e
45. d
46. b
47. a
48. c
49. a
50. a