

Name: _____

AP Stats Assignment: Ch12.1 Confidence Interval for the Difference in Population Mean or Proportion:

1. What is the difference between creating a confidence interval for one population vs two populations? Explain:
 2. When creating a confidence interval to compare two population means, the two population must be independent, why? Explain:
 3. When creating a confidence interval to compare two population means, do both sample sizes need to be the same? Explain:
 4. When creating a confidence interval to compare two population means, how is standard error calculated differently from creating a confidence interval for one population? Explain:
 5. What conditions must be met to create a confidence interval for the difference of two population means or proportions? Explain:
 6. How do you calculate the standard error when creating a Z-confidence interval, or T-interval for the difference in population means or proportion. Explain:
 7. What is a Paired T-test? Do the two populations compared need to be independent?
 8. How do you determine the degrees of Freedom when creating a T-interval for the difference in population means? Explain:

9. Quality control when manufacturing wafers used in semi conductor technology undergo a very stringent process. One aspect of the TTV [Total Thickness Variation], where typically is around $2\mu\text{m}$ [micrometers]. The smaller the value, the flatter the wafer, the higher quality it is. A random of 1500 wafers from TSMC had an average TTV of $2.01\mu\text{m}$ with a standard deviation of $0.075\mu\text{m}$. Another random sample of 1200 wafers from Global Foundries [NY] had an average TTV of $2.82\mu\text{m}$ with a standard deviation of $0.164\mu\text{m}$.
- a) Indicate the parameters and statistics involved
 - b) What conditions must be met to create a confidence interval? Are these conditions met?
 - c) Create a 95% confidence interval for the difference mean TTV between TSMC and Global Foundries. Show all your work and steps.
 - d) Interpret the confidence interval. Interpret your results in context. Do your results suggest that there is a difference in TTV between the two foundries?
10. The rise in unemployment rate is usually a indication of a economic downturn. The federal government would often introduce new policies to help reverse this effect. Examples of these policies or interventions include lowering interest rates, subsidizing childcare, or reducing regulatory barriers on labor laws. A random sample of 2500 citizens were surveyed and 315 were unemployed. Six months after, when their policies were introduced another sample was taken. 3000 citizens, and 320 were unemployed.
- a) State the parameters and statistics involved
 - b) Are we creating a confidence interval for difference in mean or proportion? Explain:
 - c) What are the conditions required to create a confidence interval? Are they met?
 - d) Create a confidence interval for the difference in unemployment rate before and after government policies were introduced. Interpret this confidence interval

- e) According to your confidence interval, does it suggest that policies introduced were effective in reducing unemployment rates? Explain:

11. A hemoglobin A1C test is often used to test for diabetes. It measures the percentage of hemoglobin that is coated with sugar and provides an average blood sugar level over the past 2 to 3 months. An A1C level between 5.7% to 6.4% is prediabetic and 6.5% or higher is considered diabetic. People with diabetes are often suggested a KETO diet that is high in protein and absent in sugar. 60 patients with an average A1C level of 6.3% [$s=1.2\%$] were given administered a KETO diet for 6months. Afterwards, the A1C levels were at 5.7% [$s=1.5\%$].

- a) State the parameters and statistics involved

- b) Are we creating a Z-interval or T-interval for difference in mean or proportion? Explain:

- c) What are the conditions required to create a confidence interval? Are these conditions met?

- d) Create a confidence interval for the difference in A1C levels for patients before and after being administered a keto diet. Interpret the confidence interval in context.

- e) According to your confidence interval, does it suggest that having KETO diet for 6 months was effective in reducing A1C levels?

2. A bank wonders whether omitting the annual credit card fee for customers who spend atleast \$2400 annually would increase their spending using their cc. The bank makes this offer to an SRS of 200 of it's credit card customers. It then compares how much these customers spend with their cc compared to last year. The mean increase is \$332, and the SD is \$108.

- a) Is there significant evidence at the 1% level that the mean amount spend on their cc increases under the no-fee offer? Give appropriate statistical evidence to support your conclusion

- b) Construct and interpret a 99% confidence interval for the mean amount of the increase
- c) The distribution amount charged is skewed to the right, but outliers are prevented by the credit limit that the bank enforces on each card. Use of the t-procedures is justified in this case even though the population distribution is not normal. Explain why
- d) A critic points out that the customers would probably have charged more on their cc this year than last year even without the free offer because the economy is more prosperous and interest rates are lower. Briefly describe the design of an experiment to study the effect of the no-fee offer that would avoid this criticism

Question #3) The design of controls and instruments affects how easily people can use them. A student project investigated this effect by asking 25 right-handed students to turn a knob (with their right hands) that moved an indicator. There were two identical instruments, one with a right-hand thread (the knob turns clockwise) and the other with a left-hand thread (the knob must be turned counterclockwise). Each of the 25 students used both instruments in a random order. The following table gives the times in seconds each subject took to move the indicator a fixed distance

Subject	Right thread	Left thread
1	113	137
2	105	105
3	130	133
4	101	108
5	138	115
6	118	170
7	87	103
8	116	145
9	75	78
10	96	107
11	122	84
12	103	148
13	116	147
14	107	87
15	118	166
16	103	146
17	111	123
18	104	135
19	111	112

a)

Subject	Right thread	Left thread
20	89	93
21	78	76
22	100	116
23	89	78
24	85	101
25	88	123

- b) How likely is the significance test in part (b) to detect a mean difference of 5 seconds between the left vs right hand? Is this sufficient power?
- c) Construct and interpret a 90% confidence interval for the mean time advantage of right-hand over left hand threads