WORKSHEET 22
MATH 2510
Mini Exam 2

Use the given data to find the minimum sample size required to estimate the population proportion.

1) Margin of error: 0.012; confidence level: 93%; $\hat{p}$ and $\hat{q}$ unknown
A) 7687 B) 4685 C) 5537 D) 5688

2) Margin of error: 0.04; confidence level: 99%; from a prior study, $\hat{p}$ is estimated by 0.12.
A) 254 B) 438 C) 526 D) 18

Use the given degree of confidence and sample data to construct a confidence interval for the population proportion p.

3) Of 260 employees selected randomly from one company, 18.46% of them commute by carpooling. Construct a 90% confidence interval for the true percentage of all employees of the company who carpool.
A) $12.3\% < p < 24.7\%$ B) $12.9\% < p < 24.1\%$ C) $14.5\% < p < 22.4\%$ D) $13.7\% < p < 23.2\%$

Use the given degree of confidence and sample data to construct a confidence interval for the population mean μ. Assume that the population has a normal distribution.

4) A sociologist develops a test to measure attitudes towards public transportation, and 27 randomly selected subjects are given the test. Their mean score is 76.2 and their standard deviation is 21.4. Construct the 95% confidence interval for the mean score of all such subjects.
A) $69.2 < \mu < 83.2$ B) $64.2 < \mu < 88.2$ C) $67.7 < \mu < 84.7$ D) $74.6 < \mu < 77.8$

Use the given information to find the minimum sample size required to estimate an unknown population mean μ.

5) How many business students must be randomly selected to estimate the mean monthly earnings of business students at one college? We want 95% confidence that the sample mean is within $135 of the population mean, and the population standard deviation is known to be $538.
A) 43 B) 62 C) 86 D) 54

Provide an appropriate response.

6) Construct a 98% confidence interval for the population mean, μ. Assume the population has a normal distribution. A study of 14 car owners showed that their average repair bill was $192 with a standard deviation of $8. Round to the nearest cent.
A) ($186.33, $197.67) B) ($328.33, $386.99) C) ($222.33, $256.10) D) ($115.40, $158.80)

Use the confidence level and sample data to find a confidence interval for estimating the population μ. Round your answer to the same number of decimal places as the sample mean.

7) A group of 59 randomly selected students have a mean score of 29.5 with a standard deviation of 5.2 on a placement test. What is the 90% confidence interval for the mean score, μ, of all students taking the test?
A) $27.9 < \mu < 31.1$ B) $27.8 < \mu < 31.2$ C) $28.2 < \mu < 30.8$ D) $28.4 < \mu < 30.6$

Find the P-value for the indicated hypothesis test.

8) An article in a journal reports that 34% of American fathers take no responsibility for child care. A researcher claims that the figure is higher for fathers in the town of Littleton. A random sample of 225 fathers from Littleton, yielded 97 who did not help with child care. Find the P-value for a test of the researcher's claim.
A) 0.0038 B) 0.0015 C) 0.0019 D) 0.0529

Use the traditional method to test the given hypothesis. Assume that the samples are independent and that they have been randomly selected

9) A researcher finds that of 1000 people who said that they attend a religious service at least once a week, 31 stopped to help a person with car trouble. Of 1200 people interviewed who had not attended a religious service at least once a month, 22 stopped to help a person with car trouble. At the 0.05 significance level, test the claim that the two proportions are equal.

Assume that a simple random sample has been selected from a normally distributed population and test the given claim. Use either the traditional method or P-value method as indicated. Identify the null and alternative hypotheses, test statistic, critical value(s) or P-value (or range of P-values) as appropriate, and state the final conclusion that addresses the original claim.

10) A large software company gives job applicants a test of programming ability and the mean for that test has been 160 in the past. Twenty-five job applicants are randomly selected from one large university and they produce a mean score and standard deviation of 183 and 12, respectively. Use a 0.05 level of significance to test the claim that this sample comes from a population with a mean score greater than 160. Use the P-value method of testing hypotheses.

Solve the problem.

11) A researcher wishes to compare how students at two different schools perform on a math test. He randomly selects 40 students from each school and obtains their test scores. He pairs the first score from school A with the first school from school B, the second score from school A with the second school from school B and so on. He then performs a hypothesis test for matched pairs. Is this approach valid? Why or why not? If it is not valid, how should the researcher have proceeded?

Assume that a simple random sample has been selected from a normally distributed population. Find the test statistic, P-value, critical value(s), and state the final conclusion.

12) Test the claim that the mean age of the prison population in one city is less than 26 years. Sample data are summarized as $n = 25$, $\bar{x} = 24.4$ years, and $s = 9.2$ years. Use a significance level of $\alpha = 0.05$.

Use the traditional method of hypothesis testing to test the given claim about the means of two populations. Assume that two dependent samples have been randomly selected from normally distributed populations.

13) A test of abstract reasoning is given to a random sample of students before and after they completed a formal logic course. The results are given below. At the 0.05 significance level, test the claim that the mean score is not affected by the course.

Before	74	83	75	88	84	63	93	84	91	77
After	73	77	70	77	74	67	95	83	84	75

Test the indicated claim about the means of two populations. Assume that the two samples are independent simple random samples selected from normally distributed populations. Do not assume that the population standard deviations are equal. Use the traditional method or P-value method as indicated.

14) A researcher was interested in comparing the resting pulse rates of people who exercise regularly and of those who do not exercise regularly. Independent simple random samples of 16 people who do not exercise regularly and 12 people who exercise regularly were selected, and the resting pulse rates (in beats per minute) were recorded. The summary statistics are as follows.

Do not exercise regularly	Exercise regularly
$\bar{x}_1$ = 73.0 beats/min	$\bar{x}_2$ = 68.4 beats/min
s_1 = 10.9 beats/min	s_2 = 8.2 beats/min
n_1 = 16	n_2 = 12

Use a 0.025 significance level to test the claim that the mean resting pulse rate of people who do not exercise regularly is larger than the mean resting pulse rate of people who exercise regularly. Use the traditional method of hypothesis testing.

Solve the problem.

15) An educator wanted to look at the study habits of university students. As part of the research, data was collected for three variables - the amount of time (in hours per week) spent studying, the amount of time (in hours per week) spent playing video games and the GPA - for a sample of 20 male university students. As part of the research, a 95% confidence interval for the average GPA of all male university students was calculated to be: (2.95, 3.10). What assumption is necessary for the confidence interval analysis to work properly?

A) The population that we are sampling from needs to be a t-distribution with n-1 degrees of freedom.
B) The sampling distribution of the sample mean needs to be approximately normally distributed.
C) The Central Limit theorem guarantees that no assumptions about the population are necessary.
D) The population that we are sampling from needs to be approximately normally distributed.

Construct the indicated confidence interval for the difference between the two population means. Assume that the two samples are independent simple random samples selected from normally distributed populations. Do not assume that the population standard deviations are equal.

16) A researcher was interested in comparing the amount of time spent watching television by women and by men. Independent simple random samples of 14 women and 17 men were selected, and each person was asked how many hours he or she had watched television during the previous week. The summary statistics are as follows.

Women	Men
$\bar{x}_1$ = 12.6 hrs	$\bar{x}_2$ = 14.0 hrs
s_1 = 3.9 hrs	s_2 = 5.2 hrs
n_1 = 14	n_2 = 17

Construct a 99% confidence interval for $\mu_1 - \mu_2$, the difference between the mean amount of time spent watching television for women and the mean amount of time spent watching television for men.

A) $-5.92 \text{ hrs} < \mu_1 - \mu_2 < 3.12 \text{ hrs}$
B) $-5.91 \text{ hrs} < \mu_1 - \mu_2 < 3.11 \text{ hrs}$
C) $-6.05 \text{ hrs} < \mu_1 - \mu_2 < 3.25 \text{ hrs}$
D) $-6.04 \text{ hrs} < \mu_1 - \mu_2 < 3.24 \text{ hrs}$

Solve the problem.

17) A researcher wished to perform a hypothesis test to test the claim that the rate of defectives among the computers of two different manufacturers are the same. She selects two independent random samples and obtains the following sample data.

Manufacturer A: $n_1 = 400$, rate of defectives: 1.5%

Manufacturer B: $n_2 = 200$, rate of defectives: 3.5%

Can the methods of this book be used to perform a hypothesis test to test for the equality of the two population proportions? Go through the steps of checking whether the conditions for the hypothesis test for two population proportions are satisfied. Show your calculations and state your conclusion.

18) A small private college is interested in determining the percentage of its students who live off campus and drive to class. Specifically, it was desired to determine if less than 20% of their current students live off campus and drive to class. The college decided to take a random sample of 108 of their current students to use in the analysis. Is the sample size of n = 108 large enough to use this inferential procedure?

A) Yes, since both np and nq are greater than 5
B) Yes, since the central limit theorem works whenever proportions are used
C) Yes, since $n \geq 30$
D) No

Provide an appropriate response.

19) A researcher wishes to determine whether people with high blood pressure can lower their blood pressure by performing yoga exercises. A treatment group and a control group are selected. The sample statistics are given below. Construct a 90% confidence interval for the difference between the two population means, $\mu_1 - \mu_2$. Would you recommend using yoga exercises? Explain your reasoning.

Treatment Group	Control Group
$n_1 = 100$	$n_2 = 100$
$\bar{x}_1 = 178$	$\bar{x}_2 = 193$
$s_1 = 35$	$s_2 = 37$

20) Construct a 98% confidence interval for $p_1 - p_2$. The sample statistics listed below are from independent samples.

Sample statistics: $n_1 = 1000$, $x_1 = 250$, and $n_2 = 1200$, $x_2 = 195$

A) (-0.621, 0.781)
B) (0.581, 1.819)
C) (1.516, 3.021)
D) (0.047, 0.128)

1) D
2) B
3) C
4) C
5) B
6) A
7) D
8) C
9) H_0: $p_1 = p_2$. H_1: $p_1 \neq p_2$.
Test statistic: $z = 1.93$. Critical values: $z = \pm 1.96$.
Fail to reject the null hypothesis. There is not sufficient evidence to warrant rejection of the claim that the two proportions are equal.
10) H_0: $\mu = 160$. H_1: $\mu > 160$. Test statistic: $t = 9.583$. P-value < 0.005. Reject H_0. There is sufficient evidence to support the claim that the mean is greater than 160.
11) There is no natural pairing here; hence, it is not appropriate to perform a test for matched pairs. The two samples are independent and a hypothesis test for large, independent samples should have been performed.
12) $\alpha = 0.05$
Test statistic: $t = -0.87$
P-value: $p = 0.1966$
Critical value: $t = -1.711$
Because the test statistic, $t > -1.711$, we do not reject the null hypothesis. There is not sufficient evidence to support the claim that the mean age is less than 26 years.
13) H_0: $\mu_d = 0$. H_1: $\mu_d \neq 0$.
Test statistic $t = 2.366$. Critical values: $t = \pm 2.262$.
Reject H_0. There is sufficient evidence to warrant rejection of the claim that the mean is not affected by the course.
14) H_0: $\mu_1 = \mu_2$
H_1: $\mu_1 > \mu_2$
Test statistic: $t = 1.274$
Critical value: $t = 2.060$
Do not reject H_0. At the 2.5% significance level, there is not sufficient evidence to support the claim that the mean resting pulse rate of people who do not exercise regularly is larger than the mean resting pulse rate of people who exercise regularly.
15) D
16) B
17) $x_1 = 400(0.015) = 6$
$x_2 = 200(0.035) = 7$
$\overline{p} = \dfrac{6+7}{400+200} = 0.0217$
$n_1\overline{p} = 400(0.0217) = 8.7$
$n_2\overline{p} = 200(0.0217) = 4.3$
Because $n_2\overline{p} < 5$, the conditions for the hypothesis test are not satisfied.
18) A
19) confidence interval: $-23.38 < \mu_1 - \mu_2 < -6.623$; Since the interval does not contain zero, we can reject the claim of $\mu_1 = \mu_2$. Since the interval is negative, it appears that the yoga exercises lower blood pressure.
20) D