1.(1 pt) In order to compare the means of two populations, independent random samples of 433 observations are selected from each population, with the following results:

Sample 1	Sample 2
$\bar{x}_1 = 5401$	$\bar{x}_2 = 5183$
$s_1 = 160$	$s_2 = 200$

(a) Use a 95 % confidence interval to estimate the difference between the population means $(\mu_1 - \mu_2)$.
_______ $\leq (\mu_1 - \mu_2) \leq$ _______

(b) Test the null hypothesis: $H_0 : (\mu_1 - \mu_2) = 0$ versus the alternative hypothesis: $H_a : (\mu_1 - \mu_2) \neq 0$. Using $\alpha = 0.05$, give the following:
(i) the test statistic $z =$ _______
(ii) the positive critical z score _______
(iii) the negative critical z score _______
The final conclusion is

- A. We can reject the null hypothesis that $(\mu_1 - \mu_2) = 0$ and accept that $(\mu_1 - \mu_2) \neq 0$.
- B. There is not sufficient evidence to reject the null hypothesis that $(\mu_1 - \mu_2) = 0$.

(c) Test the null hypothesis: $H_0 : (\mu_1 - \mu_2) = 25$ versus the alternative hypothesis: $H_a : (\mu_1 - \mu_2) \neq 25$. Using $\alpha = 0.05$, give the following:
(i) the test statistic $z =$ _______
(ii) the positive critical z score _______
(iii) the negative critical z score _______
The final conclusion is

- A. We can reject the null hypothesis that $(\mu_1 - \mu_2) = 25$ and accept that $(\mu_1 - \mu_2) \neq 25$.
- B. There is not sufficient evidence to reject the null hypothesis that $(\mu_1 - \mu_2) = 25$.

2.(1 pt) Test the claim that the two samples described below come from populations with the same mean. Assume that the samples are independent simple random samples. Use a significance level of 0.05.
Sample 1: $n_1 = 84$, $\bar{x}_1 = 16$, $s_1 = 5$.
Sample 2: $n_2 = 75$, $\bar{x}_2 = 19$, $s_2 = 2$.
The test statistic is _______
The P-Value is _______
The conclusion is

- A. There is sufficient evidence to warrant rejection of the claim that the two populations have the same mean.
- B. There is not sufficient evidence to warrant rejection of the claim that the two populations have the same mean.

3.(1 pt) The purpose of this question is to compare the variability of $\bar{x}_1$ and $\bar{x}_2$ with the variability of $(\bar{x}_1 - \bar{x}_2)$.

(a) Suppose the first sample of 100 observations is selected from a population with mean $\mu_1 = 160$ and variance $\sigma_1^2 = 810$. Construct an interval extending 2 standard deviations of $\bar{x}_1$ on each side of μ_1.
_______ $\leq \mu_1 \leq$ _______

(b) Suppose the second sample of 100 observations is selected from a population with mean $\mu_2 = 160$ and variance $\sigma_2^2 = 1550$. Construct an interval extending 2 standard deviations of $\bar{x}_2$ on each side of μ_2.
_______ $\leq \mu_2 \leq$ _______

(c) Consider the difference between the two sample means $(\bar{x}_1 - \bar{x}_2)$. Compute the mean and the standard deviation of the sampling distribution of $(\bar{x}_1 - \bar{x}_2)$.
mean = _______
standard deviation = _______

(d) Based on 100 observations, construct an interval extending 2 standard deviations of $(\bar{x}_1 - \bar{x}_2)$ on each side of $(\mu_1 - \mu_2)$
_______ $\leq (\mu_1 - \mu_2) \leq$ _______

4.(1 pt) Randomly selected 130 student cars have ages with a mean of 7.6 years and a standard deviation of 3.8 years, while randomly selected 75 faculty cars have ages with a mean of 6 years and a standard deviation of 3.7 years.

1. Use a 0.01 significance level to test the claim that student cars are older than faculty cars.
The test statistic is _______
The critical value is _______
Is there sufficient evidence to support the claim that student cars are older than faculty cars?

- A. No
- B. Yes

2. Construct a 99% confidence interval estimate of the difference $\mu_1 - \mu_2$, where μ_1 is the mean age of student cars and μ_2 is the mean age of faculty cars.
_______ $< (\mu_1 - \mu_2) <$ _______

5.(1 pt) Two independent samples have been selected, 64 observations from population 1 and 91 observations from population 2. The sample means have been calculated to be $\bar{x}_1 = 11.8$ and $\bar{x}_2 = 8.7$. From previous experience with these populations, it is known that the variances are $\sigma_1^2 = 35$ and $\sigma_2^2 = 25$.

(a) Find $\sigma_{(\bar{x}_1 - \bar{x}_2)}$.
answer: _______

(b) Determine the rejection region for the test of $H_0 : (\mu_1 - \mu_2) = 3.14$ and $H_a : (\mu_1 - \mu_2) > 3.14$ Use $\alpha = 0.02$.
$z >$ _______

(c) Compute the test statistic.
$z =$ _______
The final conclusion is

- A. There is not sufficient evidence to reject the null hypothesis that $(\mu_1 - \mu_2) = 3.14$.

- B. We can reject the null hypothesis that $(\mu_1 - \mu_2) = 3.14$ and accept that $(\mu_1 - \mu_2) > 3.14$.

(d) Construct a 98 % confidence interval for $(\mu_1 - \mu_2)$.

______ $\leq (\mu_1 - \mu_2) \leq$ ______

6.(1 pt) Test the claim that the two samples described below come from populations with the same mean. Assume that the samples are independent simple random samples. Use a significance level of $\alpha = 0.01$

Sample 1: $n_1 = 18$, $\bar{x}_1 = 23.9$, $s_1 = 5.94$

Sample 2: $n_2 = 4$, $\bar{x}_2 = 28.9$, $s_2 = 7.22$

(a) The degree of freedom is ______

(b) The test statistic is ______

(c) Determine the rejection region for the test of $H_0 : (\mu_1 - \mu_2) = 0$ and $H_a : (\mu_1 - \mu_2) \neq 0$

$|t| >$ ______

The final conclusion is

- A. There is not sufficient evidence to reject the null hypothesis that $(\mu_1 - \mu_2) = 0$.
- B. We can reject the null hypothesis that $(\mu_1 - \mu_2) = 0$ and accept that $(\mu_1 - \mu_2) \neq 0$.

7.(1 pt) Test the given claim using the $\alpha = 0.05$ significance level and assuming that the populations are normally distributed.

Claim: The treatment population and the placebo population have the same mean.

Treatment group: $n = 9, \bar{x} = 119, s = 5.4$.

Placebo group: $n = 11, \bar{x} = 114, s = 5.2$.

The test statistic is ______

The positive critical value is ______

The negative critical value is ______

Is there sufficient evidence to warrant the rejection of the claim that the treatment and placebo populations have the same mean?

- A. Yes
- B. No

8.(1 pt) Randomly selected students were given five seconds to estimate the value of a product of numbers with the results shown below.

Estimates from students given $1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8$:

2040, 6000, 4000, 50, 600, 800, 1110, 40320, 200, 150

Estimates from students given $8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$:

3600, 100000, 400, 25000, 2050, 40320, 400, 3000, 40000, 1876

Use a 0.05 significance level to test the following claims:

1. Claim: the two populations have equal variances.

The test statistic is ______

The larger critical value is ______

The conclusion is

- A. There is sufficient evidence to warrant the rejection of the claim that the two populations have equal variances
- B. There is not sufficient evidence to warrant the rejection of the claim that the two populations have equal variances

2. Claim: the two populations have the same mean.

The test statistic is ______

The positive critical value is ______

The negative critical value is ______

The conclusion is

- A. There is not sufficient evidence to warrant the rejection of the claim that the two populations have the same mean
- B. There is sufficient evidence to warrant the rejection of the claim that the two populations have the same mean

9.(1 pt) Suppose you want to test the claim the the paired sample data given below come from a population for which the mean difference is $\mu_d = 0$.

x	72	88	61	51	51	50	62
y	86	74	84	92	79	65	68

Use a 0.01 significance level to find the following:

(a) The mean value of the differnces d for the paired sample data

$\bar{d} =$ ______

(b) The standard deviation of the differences d for the paired sample data

$s_d =$ ______

(c) The t test statistic

$t =$ ______

(d) The positive critical value

$t =$ ______

(e) The negative critical value

$t =$ ______

(f) Does the test statistic fall in the critical region?

- A. No
- B. Yes

(g) Construct a 99% conficence interval for the population mean of all differences $x - y$.

______ $< \mu_d <$ ______

10.(1 pt) Ten randomly selected people took an IQ test A, and next day they took a very similar IQ test B. Their scores are shown in the table below.

Person	A	B	C	D	E	F	G	H	I	J
Test A	112	104	90	85	79	118	126	101	93	97
Test B	117	105	90	87	79	119	129	101	94	99

1. Use a 0.05 significance level to test the claim that people do better on the second test than they do on the first.

The test statistic is ______

The critical vaue is ______

Is there sufficient evidence to support the claim that people do better on the second test?

- A. No
- B. Yes

2. Construct a 95% confidence interval for the mean of the differences.

__________ $< \mu <$ __________

11.(1 pt) A paired difference experiment yielded n_D pairs of observations. In each case described below, what is the rejection region for testing $H_0 : \mu = 3$ against $H_a : \mu > 3$? Use $s_D = 6.3$.

(a) $n_D = 44$, $\alpha = 0.03$

$z >$ __________

(b) $n_D = 20$, $\alpha = 0.02$

$t >$ __________

(c) $n_D = 15$, $\alpha = 0.09$

$t >$ __________

12.(1 pt) A paired difference experiment produced the following results:

$$n_D = 47,\ \bar{x}_1 = 185,\ \bar{x}_2 = 180,\ \bar{x}_D = 5,\ s_D = 56,$$

(a) Determine the rejection region for the hypothesis $H_0 : \mu_D = 0$ if $H_a : \mu_D > 0$. Use $\alpha = 0.1$.

$z >$ __________

(b) Conduct a paired difference test described above.

The test statistic is __________

The final conclusion is

- A. There is not sufficient evidence to reject the null hypothesis that $\mu_D = 0$.
- B. We can reject the null hypothesis that $\mu_D = 0$ and accept that $\mu_D > 0$.

13.(1 pt) In a study of red/green color blindness, 800 men and 2550 women are randomly selected and tested. Among the men, 73 have red/green color blindness. Among the women, 5 have red/green color blindness. Test the claim that men have a higher rate of red/green color blindness.

The test statistic is __________

Is there sufficient evidence to support the claim that men have a higher rate of red/green color blindness than women?

- A. No
- B. Yes

Construct the 99% confidence interval for the difference between the color blindness rates of men and women.

__________ $< (p_1 - p_2) <$ __________

14.(1 pt) Independent random samples, each containing 800 observations, were selected from two binomial populations. The samples from populations 1 and 2 produced 707 and 733 successes, respectively.

(a) Test $H_0 : (p_1 - p_2) = 0$ against $H_a : (p_1 - p_2) \neq 0$. Use $\alpha = 0.09$

test statistic = __________

rejection region $|z| >$ __________

The final conclustion is

- A. We can reject the null hypothesis that $(p_1 - p_2) = 0$ and accept that $(p_1 - p_2) \neq 0$.
- B. There is not sufficient evidence to reject the null hypothesis that $(p_1 - p_2) = 0$.

(b) Test $H_0 : (p_1 - p_2) = 0$ against $H_a : (p_1 - p_2) > 0$. Use $\alpha = 0.03$

test statistic = __________

rejection region $z >$ __________

The final conclustion is

- A. We can reject the null hypothesis that $(p_1 - p_2) = 0$ and accept that $(p_1 - p_2) > 0$.
- B. There is not sufficient evidence to reject the null hypothesis that $(p_1 - p_2) = 0$.

15.(1 pt) Suppose a group of 1000 smokers (who all wanted to give up smoking) were randomly assigned to recieve an antidepressant drug or a placebo for six weeks. Of the 193 patients who recieved the antidepressant drug, 12 were not smoking one year later. Of the 807 patients who recieved the placebo, 242 were not smoking one year later. Given the null hypothesis $H_0 : (p_1 - p_2) = 0$ and the alternative hypothesis $H_a : (p_1 - p_2) \neq 0$, conduct a test to see if taking an antidepressant drug can help smokers stop smoking. Use $\alpha = 0.03$

(a) The rejection region is $|z| >$ __________

(b) The test statistic is $z =$ __________

The final conclusion is

- A. There is not sufficient evidence to reject the null hypothesis that $(p_1 - p_2) = 0$.
- B. We can reject the null hypothesis that $(p_1 - p_2) = 0$ and accept that $(p_1 - p_2) \neq 0$.

16.(1 pt) Test the given claim using the $\alpha = 0.05$ significance level and assuming that the populations are normally distributed.

Claim: The treatment population and the placebo population have different variances.

Treatment group: $n = 11, \bar{x} = 77.3, s = 15.7$.

Placebo group: $n = 8, \bar{x} = 89.1, s = 11.3$.

The test statistic is __________

The larger critical value is __________

What is your conclusion?

- A. There is not sufficient evidence to support the claim that the treatment and placebo populations have different variances.
- B. There is sufficient evidence to support the claim that the treatment and placebo populations have different variances.

17.(1 pt) Suppose you wanted to estimate the difference between two population means correct to within 3.7 with probability 0.97. If prior information suggests that the popluation variances are approximately equal to $\sigma_1^2 = \sigma_2^2 = 12$ and you want to select independent random samples of equal size from the poulations, how large should the sample sizes, n_1 and n_2 be?

answer: $n_1 = n_2 =$ __________

18.(1 pt) Find the size of each sample needed to estimate the difference between the proportions of boys and girls under 10 years old who are afraid of spiders. Assume that we want 99% confidence that the error is smaller than 0.06.

$n =$ ____________________

19.(1 pt)

The sample size needed to estimate the difference between two population proportions to within a margin of error E with a significance level of α can be found as follows. In the expression

$$E = z_{\alpha/2}\sqrt{\frac{p_1 q_1}{n_1} + \frac{p_2 q_2}{n_2}}$$

we replace both n_1 and n_2 by n (assuming that both samples have the same size) and replace each of p_1, p_2, q_1, and q_2 by 0.5 (because their values are not known). Then we solve for n, and get

$$n = \frac{(z_{\alpha/2})^2}{2E^2}.$$

Finally, increase the value of n to the next larger integer number.

Use the above formula to find the size of each sample needed to estimate the difference between the proportions of boys and girls under 10 years old who are afraid of spiders. Assume that we want 98% confidence that the error is smaller than 0.02.

$n =$ ____________________