

MAT1080 Final Part A
Due before Monday, 5/13, 5:00PM.

NAME: _____

Other files provided with this exam:

1. Equations.pdf
2. Tables.pdf

Questions in the final may refer to these other files.

When complete, scan to a PDF and submit on D2L.

Be sure to read the instructions carefully before answering a question. Every small detail asked for in the question must be provided. If a problem asks you to solve a problem in a certain way, it must be solved in that way.

If stuck on a question, look through the equation sheet for ideas (although most of the problems can be solved with technology). Also look through old worksheets for similar problems.

1. Total plasma volume is important in determining the required plasma component in blood replacement therapy for a person undergoing surgery. Plasma volume is influenced by the overall health and physical activity of an individual. Suppose that a random sample of 50 male firefighters are tested and that they have a plasma volume sample mean of $\bar{x} = 37.5$ ml/kg. Assume that $\sigma = 7.70$ ml/kg for the distribution of blood plasma.

a. Find a 99% confidence interval for the population mean blood plasma volume in male firefighters. What is the margin of error? What is the confidence interval?

(SHOW WORK FOR A MANUAL CALCULATION, INCLUDING THE EQUATION USED AND ALL VALUES PLUGGED INTO THE EQUATION)

(SHOW WORK)

[final answer] Margin of Error: $E =$ _____ (value with units)

[final answer] Confidence Interval : _____ $<$ _____ $<$ _____
(value with units) (correct symbol) (value with units)

b. State in words what the margin of error means for this problem, e.g. something like (for a proportion problem, which this is not) “with 90% confidence, we can state that between 1.4% and 3.8% of the parts manufactured are defective”.

c. Find the sample size necessary for a 99% confidence level with a maximal margin of error of $E=2.50$. Round UP to the nearest whole person.

(SHOW WORK)

(SHOW WORK) [final answer]: $n =$ _____

2. At wind speeds above 1000 cm/sec, significant sand-moving events begin to occur. Wind speeds below 1000 cm/sec deposit sand and wind speeds above 1000 cm/sec move sand to new locations. The cyclic nature of wind and moving sand determines the shape and location of large dunes. At a test site, the prevailing direction of the wind did not change noticeably. However, the velocity did change. Sixty-five wind speed readings gave an average velocity of $\bar{x} = 1075$ cm/sec. Based on long-term experience, σ can be assumed to be 270 cm/sec.

a. Find a 99% confidence interval for the population mean wind speed at this site. (Round your answers to the nearest whole number)

(SHOW WORK FOR A MANUAL CALCULATION, INCLUDING THE EQUATION USED AND ALL VALUES PLUGGED INTO THE EQUATION)

(SHOW WORK)

[final answer] Margin of Error: $E =$ _____ (value with units)

[final answer] Confidence Interval : _____ $<$ _____ $<$ _____
(value with units) (correct symbol) (value with units)

b. Does the confidence interval indicate that the population mean wind speed is such that the sand is always moving at this site? Explain.

The following table is provided for problem #3

Area in One Tail				
0.005	0.01	0.025	0.05	0.10
Area in Two Tails				
0.01	0.02	0.05	0.10	0.20
Critical Z-Value (or negative this value if left-tailed, + and – if two-tailed)				
2.576	2.326	1.960	1.645	1.282

3. State the null and alternative hypotheses, show which is the original claim, state whether left/right/two-tailed, find the P-Value, find the critical value, should we reject H_0 , or should we fail to reject H_0 at 5% level of significance? Show both the criteria using the P-method and the critical value method.

Example: The test statistic of $z = -1.5$ is obtained when testing the claim that $\mu < 2.3$.

$H_0: \mu = 2.3$

$H_1: \mu < 2.3$ (claim)

Left-tailed

$P = .0668$ (must be a value from the z-Scores table that came in a separate file with this exam)

$z_c = -1.645$ (from the above table)

Critical Value method: $z > z_c$ P-Value method: $P > .05$ Fail to reject the null hypothesis

Careful: This example is for a mean problem, not for a proportion problem like the other problems in #3

a. The test statistic of $z = 1.23$ is obtained when testing the claim that $p > 0.3$

b. The test statistic of $z = -2.57$ is obtained when testing the claim that $p < 0.75$

c. The test statistic of $z = -1.98$ is obtained when testing the claim that $p = 0.475$

4. State the null and alternative hypotheses, show which is the original claim, state whether left/right/two-tailed, find the P-Value, should we reject H_0 , or should we fail to reject H_0 at 1% level of significance? Use the P-Value method only, not the critical value method.

Example: The test statistic of $z = -1.5$ is obtained when testing the claim that $\mu < 2.3$.

$H_0: \mu = 2.3$

$H_1: \mu < 2.3$ (claim)

Left-tailed

$P = .0668$ (use technology)

$P > .01$ Fail to reject the null hypothesis

a. The claim is that for Verizon data speeds at airports, the mean is $\mu = 14.00$ mbps. The size is $n = 14$ and the test statistic is $t = -2.645$.

b. The claim is that for 12 AM body temperatures, the mean is $\mu < 98^\circ$ F. The size is $n = 5$ and the test statistic is $t = -1.603$.

5. IQ and Lead Exposure: A study looked at the relationship between blood lead-levels and IQ. The IQ scores were measured for a group with low blood lead levels, and the IQ scores were measured for a group with high blood lead levels. The result are as follows, where $\bar{x}$ is the average IQ score for each group:

Low Blood Lead Level: $n = 78$, $\bar{x} = 92.88462$, $s = 15.34451$

High Blood Lead Level: $n = 21$, $\bar{x} = 86.90476$, $s = 8.988352$

The population standard deviations are unknown and not assumed to be the same.

Use a 0.05 significance level to test the claim that the mean IQ score of people with low blood levels is higher than the mean IQ score of people with high blood lead levels.

$H_0: \mu_1 = \mu_2$ $H_1: \mu_1 > \mu_2$ (claim)

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}}, \text{ d.f. is the smaller of } n_1 - 1 \text{ or } n_2 - 1$$

a. State the value of α and whether this is a left-tailed, right-tailed, or two-tailed test.

$\alpha =$ left-tailed, right-tailed, or two-tailed?

b. State the value of all the variables in the test statistic equation above and the degrees of freedom (d.f.).

[Hint: remember that for the purpose of this calculation, you can set $\mu_1 - \mu_2 = 0$

$n_1 =$ $\bar{x}_1 =$ $s_1 =$

$n_2 =$ $\bar{x}_2 =$ $s_2 =$

$\mu_1 - \mu_2 =$ d.f. =

c. Using technology, find the value of the test statistic t and well as the value of P .

[final answer]: $t =$

[final answer]: $P =$

d. Compare the values of α and P to determine if you reject or fail to reject the null hypothesis.

e. What is your conclusion about the original claim?

6. Listed below are heights (in.) of fathers and their first sons. Use a 0.05 significance level to test the claim that there is a difference in height between fathers and their first sons.

Height of Father	72.0	66.0	69.0	70.0	70.0	70.0	70.0	75.0	68.2	65.0
Height of Son	73.0	68.0	68.0	71.0	70.0	70.0	71.0	71.0	70.0	63.0

$$d = x_1 - x_2 \quad H_0: \mu_d = 0 \quad H_1: \mu_d \neq 0 \text{ (claim)}$$

$$t = \frac{\bar{d} - \mu_d}{s_d / \sqrt{n}}, \text{ d.f.} = n - 1 \quad \alpha = .05$$

$\mu_d = 0$ when calculating t (testing for any difference, not difference by a certain amount)

a. Using technology, find the value of the test statistic t and well as the value of P.

[final answer]: t =

[final answer]: P =

b. Compare the values of α and P to determine if you reject or fail to reject the null hypothesis.

c. What is your conclusion about the original claim?

7. Do heavier cars really use more gasoline? Suppose a car is chosen at random. Let x be the weight of the car (in hundreds of pounds), and let y be the miles per gallon (mpg). At the 5% level of significance, test the claim is that heavier cars use more gasoline. Remember that a claim of correlation would be that $\rho \neq 0$.

X	29	46	29	47	23	40	34	52
Y	30	21	22	14	29	27	22	34

a. State H_0 and H_1 , and note which is equal to the original claim.

H_0 :

H_1 :

b. Use technology to calculate the value of the sample correlation coefficient r . (Round your value for r to be three decimal places). You may also want to note the value for P for (c) and the values of m and b for (e).

[final answer] $r =$

c. By using the P -value method, do we reject or fail to reject the null hypothesis?

[final answer]: $P =$

[final answer] Comparison that supports your conclusion:

[final answer] Conclusion about the null hypothesis:

d. What is the conclusion about the original claim?

[final answer] Conclusion about the original claim:

e. Find the equation of the least-squares line $\hat{y} = mx + b$ (Round your value for m and b to three decimal places)

[final answer] Equation of line:

8. Researchers investigated the issue of race and equality of access to clinical trials. The table given in (a) shows the population distribution and the numbers of participants in clinical trials involving lung cancer. At a significance level of 0.01, using a P-value test, test the claim that the distribution of clinical trial participants fits well with the population distribution. Is there a race/ethnic group that appears to be very underrepresented? Use the following steps:

(a) Complete the expected column in the table below, use two decimal places for E.

Race/ethnicity	Expected Percentage (p)	Observed Frequency (O)	Expected Frequency (E)=np
White(non-Hispanic)	75.6%	3855	
Hispanic	9.1%	60	
Black	10.8%	316	
Asian/Pacific Islander	3.8%	54	
American Indian/Alaskan Native	0.7%	12	
		----- n=4297	

HINT: As a double-check, add up the expected frequency column, it should also total n (within a small rounding error)

(b) What is the name of the test we will be using and what is alpha?

Test: $\alpha =$

(c) Write the equation that would be used to find the test statistic χ^2 and calculate the degrees of freedom.

(d) Using technology, find χ^2 and P.

[final answer] $\chi^2 =$

[final answer] P =

(e) What are the null and alternate hypotheses? Indicate which one is the claim.

H_0 :

H_1 :

(f) Do you “reject” or “fail to reject” the null hypothesis? Why? (show P-value test)

(g) What is your conclusion about the original claim?

(h) From comparing E and O, which two groups in particular seem particularly underrepresented?

9. A study was conducted to investigate a relationship between the colors of helmets worn by motorcycle drivers and whether they are injured or killed in a crash. Results are given in the table below. Test the claim that injuries are independent of helmet color. Should motorcycle drivers choose helmets with a particular color? If so, which color appears best? Use a P-value test at the 0.05 significance level. Remember that $\chi^2 = 0$ is total independence of the variables.

	Color of Helmet				
	Black	White	Yellow/Orange	Red	Blue
Controls (not injured)	491	377	31	170	55
Cases (injured or killed)	213	112	8	70	26

(a) What is the name of the test we will be using and what is alpha?

Test: $\alpha =$

(b) Write the equation that would be used to find the test statistic χ^2 and calculate the degrees of freedom.

(c) Complete the table below, including finding the expected frequencies, using two decimal places for each expected frequency. The expected frequencies can be put in parentheses after the observed frequencies.

	Color of Helmet					
	black	white	yellow	red	blue	TOTAL
Controls (not injured)	491	377	31	170	55	
Cases (injured or killed)	213	112	8	70	26	
TOTAL						

Technology can be used to complete the table. If so, be sure to note the values of χ^2 and P for part (d).

(d) Using technology, find χ^2 and P.

[final answer]: $\chi^2 =$

[final answer]: P =

(e) What are the null and alternate hypotheses? Indicate which one is the claim.

H_0 :

H_1 :

(f) Do you “reject” or “fail to reject” the null hypothesis? Why? (show P-value test)

(g) What is your conclusion about the claim?

10. At the same time each day, a researcher records the temperature in each of three greenhouses. The table shows the temperatures in degrees Fahrenheit recorded for one week.

Greenhouse#1	Greenhouse#2	Greenhouse#3
73	71	77
72	69	68
73	72	62
66	72	71
68	65	64
71	73	69
72	71	72
69	65	63

Use a 0.05 significance level to test the claim that the average temperature is the same in each greenhouse. State the null and alternative hypotheses. Use the P-value method for your test.

A one-way analysis of variance (ANOVA) is provided.

Analysis of Variance results:

Data stored in separate columns.

Column statistics

Column	n	Mean	Std. Dev.	Std. Error
var1	8	70.5	2.5634798	0.90632697
var2	8	69.75	3.1509636	1.1140339
var3	8	68.25	5.1199888	1.8101894

ANOVA table

Source	DF	SS	MS	F-Stat	P-value
Columns	2	21	10.5	0.73745819	0.4903
Error	21	299	14.238095		
Total	23	320			

(a) What is the name of the test we will be using and what is alpha?

Test: $\alpha =$

(b) From the Anova Table, what is P?

[final answer]: P =

(c) What are the null and alternate hypotheses? Indicate which one is the claim.

H_0 :

H_1 :

(d) Do you “reject” or “fail to reject” the null hypothesis? Why? (show P-value test)

(e) What is your conclusion about the claim?