

92.283 Final Exam ~~5/4/15 Section 206/207~~

Name: _____ Section: _____

Show all analytic work for all problems.

- 1) (10 pts) A company produces packets of soap powder labeled "Giant Size 32 Ounces." The actual weight of soap powder in such a box has a Normal distribution with a mean, μ , of 33 oz and a standard deviation, σ , of 0.7 oz. To avoid having dissatisfied customers, the company says a box of soap is considered underweight if it weighs less than 32 oz. To avoid losing money, it labels boxes weighing greater than 34.15 oz as overweight. What is the proportion of the boxes that are greater than underweight but less than overweight boxes (between 32 oz and 34.15 oz).

Note: Round Z values to 2 decimal places and after all other calculations round the final answer 3 decimal places e.g. .2215 becomes .222 and .2212 becomes .221.

2) (10 pts) The following table is the US aggravated assault rate for 30 years in order from least to most.

Make a box plot of the US aggravated assault rate. Be sure to show how you determined/calculated all the required values.

Ordered value	Aggravated assault	Ordered value	Aggravated assault	Ordered value	Aggravated assault
1	262.8	11	295.5	21	370.2
2	276.7	12	298.5	22	382.3
3	279.2	13	302.9	23	383.4
4	283.8	14	309.5	24	391.0
5	287.5	15	318.6	25	418.3
6	288.6	16	324.0	26	424.1
7	289.1	17	334.3	27	427.6
8	289.7	18	347.4	28	433.3
9	290.2	19	352.9	29	440.3
10	290.8	20	360.5	30	441.8

3) How well materials conduct heat matters when designing houses, for example. Conductivity is measured in terms of watts of heat power transmitted per square meter of surface per degree Celsius of temperature difference on the two sides of the material. In these units, glass has conductivity about 1. The National Institute of Standards and Technology (NIST) provides data on properties of materials. Here are 9 NIST measurements of the heat conductivity of a particular type of glass:

-----Data-----									Mean \bar{x}	standard Deviation s
1.11	1.07	1.11	1.07	1.12	1.08	1.18	1.18	1.12	1.116	0.042

Stem Plot

1.0	7	7
1.0	8	
1.1	1	1
1.1	2	2
1.1		
1.1		
1.1	8	8
2.0		

(a) (2 pts) We can consider this an SRS of all specimens of glass of this type. Looking at the stem plot Is there any sign of major deviation from Normality?

(b) Is there significant evidence at a level of significance of $\alpha = 0.01$ that the mean conductivity of this type of glass is greater than 1?

i) (2 pts) State the null and alternative hypothesis

ii) (4 pts) Calculate the needed t statistic,

iii) (3 pts) determine the degrees of freedom and the associated p value of the test.

iv) (2 pts) State your conclusion

(c) (8 pts) Give a 95% confidence interval for the mean conductivity.

4) Our bodies have a natural electrical field that helps wounds heal. Does changing the field strength slow healing? A series of experiments with newts investigated this question. The data below are the healing rates of cuts (micrometers per hour) in a matched pairs experiment. The pairs are the two hind limbs of the same newt, with the body's natural field in one limb (control) and half the natural value in the other limb (experimental). Is there good evidence that changing the electrical field from its natural level slows healing at a level of significance of $\alpha = 0.05$?

Newt	Experimental	Control	Difference (Control - Experimental)
1	24	25	1
2	23	13	-10
3	47	44	-3
4	42	45	3
5	26	45	19
6	46	42	-4
7	38	50	12
8	33	36	3
9	28	35	7
10	28	38	10
11	21	36	15
12	27	31	4
13	25	26	1
14	45	48	3

Mean of Differences, \bar{x}	4.36
Standard Deviation of Differences, s	7.76

- (2pts) State the null and alternative hypothesis:
- (5 pts) Calculate the needed 1 sample t statistic (round to 3 places)
- (4 pts) Determine the number of degrees of freedom you will use for this test and find the p value
- (2 pts) State your conclusion

5) Based on a student survey of an SRS of students in an introduction to statistics course the GPAs of these students is in the table given. We wish to test at a level of significance of $\alpha = 0.05$ "is there a difference between the GPAs of Female and Male students".

	Females	Males
	2.30	3.70
	2.70	2.90
	3.60	2.75
	3.00	2.70
	3.60	3.35
		2.50
		2.70
		2.40
		2.59
		2.90
		2.90
		2.40
		2.46
		2.89
		3.26
		2.50
		3.00
		3.00
		2.40
		3.10
		3.00
		2.80
Mean, \bar{x}		2.83
Standard Deviation, s	0.568	0.338

a) (5 pts) Calculate any needed missing values for the table at the left.

b) (2 pts) State the null and alternative hypothesis

c) (7 pts) Calculate the needed 2 sample t statistic (round to 3 places)

d) (5 pts) Determine the number of degrees of freedom you will use for this test and find the p value.

e) (2 pts) State your conclusion

6) "Durable press" cotton fabrics are treated to improve their recovery from wrinkles after washing. Unfortunately, the treatment also reduces the strength of the fabric. A study compared the breaking strength of three commercial durable press processes. Five specimens of the same fabric were assigned at random to each group. Here are the data, in pounds of pull needed to tear the fabric:

P55	P48	HY
29.9	24.8	28.8
30.7	24.6	23.9
30	27.3	27
29.5	28.1	22.1
27.6	30.3	24.2

a) (2 pts) We would like to determine if there is a difference in breaking strength of the fabric using the 3 different treatments. State the null and alternative hypothesis.

The result of the ANOVA using excel is shown below.

SUMMARY

<i>Groups</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>	<i>Standard Deviation</i>
P55	5	147.7	29.54	1.363	1.167
P48	5	135.1	27.02	5.697	2.387
Hy	5	126	25.2	7.125	2.669

ANOVA

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	47.49733	2	23.74867	5.02263	0.0260133	3.885294
Within Groups	56.74	12	4.728333			
Total	104.2373	14				

b) (4pts) Recall ANOVA requires that the standard deviations of the groups be the same. The author gave us a rule of thumb to determine this, what is this rule and if is that rule satisfied? If not what does it mean?

d) (4 pts) At a level of significance of $\alpha = 0.05$ what is your conclusion?

d) (2 pts) What is the pooled standard deviation?

7) (10 pts) A manufacturing process has historically yielded 95% of the parts within specification limits. Over the last 2 weeks 100 parts have been produced of which 90 of them are within specification limits. Is there evidence at a level of significance of $\alpha = 0.05$ that the process yield in the last 2 weeks is less than the historic level? Conduct the required test and state your conclusion. (You will need to state the null and alternative hypothesis, calculate the test statistic – round to 2 decimal places, determine the p value – 4 decimal places and report your conclusion.)

8) (10 pts) You are to conduct a poll on the percentage of votes the Democratic nominee for President will receive in 2016. You want to be 95% confidence with a margin of error of 3%. Assume your best estimate is this nominee will receive 50% of the vote. How large will your sample need to be?