Math 247: Test 4 **Name:_____**

1. (2 pts) What is a P-value?

2. (2 pts) Can a P-value ever be zero? YES NO

   If Minitab reports a P-value as 0.000, what does this mean about the P-value?

3. (2 pts) Why do we use the t-distribution instead of the z-distribution (the Normal distribution) for making inferences about population means?

4. (2 pts) The two types of statistical inference that you've learned about are

   a. _____ b. _____

Multiple Choice: Circle the best answer to each question.
(Each question is worth 3 points)

For problems 5, 6, and 7, use this information: Suppose we have a population, take a sample of size n = 10, and find the sample mean. We then repeat this process 1000 times.

5. If we were to graph the result of all those sample means in a histogram or dotplot we will have created which of the following:

(a) the population distribution (b) the sampling distribution of the mean (c) the distribution of the sample

6. The shape of this distribution would be which of the following:

(a) Normal (b) skewed left (c) skewed right (d) can't tell from this information

7. If we increased the sample size to n = 50 then the shape of this distribution would be which of the following:

(a) Normal (b) skewed left (c) skewed right (d) can't tell from this information

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8. For a Before-and-After study, you would use which test:

   a. One sample t-test b. Paired t-test c. Two sample t-test d. ANOVA

9. In a Before-and-After study, the samples are

    a. Independent b. Dependent c. Can't tell

10. If a study finds a statistically significant result, that automatically means that result is clinically significant.

    True False

11. In an ANOVA test, you will reject the null hypothesis if which of the following are true:
    a. All the means are equal
    b. There is a large amount of variation between the sample means and a small amount of variation within the samples.
    c. There is a small amount of variation between the sample means and a large amount of variation within the samples.
    d. You know all of the population standard deviations.

12. In an ANOVA test, the Test Statistic is
    a. A z-value
    b. A t-value
    c. A Confidence Interval
    d. An F-value

Short answer:

13. (6 pts) In finding a confidence interval for a random sample of 30 Cuesta students' GPA's, one interval was
    (2.60, 3.20) and the other was (2.65, 3.15). One of these intervals is a 95% CI and the other is a 99% CI.

    (a) Which interval is the 95% CI? _____

    (b) Interpret the interval from part (a) (whichever one you chose) in the context of the problem.

14. (6 pts) A company has developed a new type of lightbulb, and wants to estimate its mean lifetime. A simple random sample of 26 bulbs had a mean lifetime of 560 hours with a standard deviation of 30 hours.

Construct a 90% confidence interval for the population mean lifetime of all bulbs manufactured by this new process. Do this by hand, using the formula. The t-chart is at the end of the test. <u>Assume the conditions for the CLT are satisfied.</u>

CI: _____ (you do not have to interpret the interval)

15. (8 pts) A researcher is investigating whether non-vegetarian women weigh a different amount on average than vegetarian women. A sample of 30 non-vegetarian women had a mean of 142 pounds and a sample of 40 vegetarian women had a mean of 135 pounds.

    (a) What would the hypotheses be for the test? Write them in symbols and in words.

    (b) The 95% confidence interval for the difference between the mean weight of non-vegetarian and vegetarian women is (-1.2, 14.2).

        Does this interval show that there is a significant difference between weights of vegetarians and non-vegetarians? Explain your answer.

        Based on this interval, would you reject or not reject the null hypothesis (assume the significance level for the test was .05)? (Circle your answer.)

        Reject the null Do not reject the null

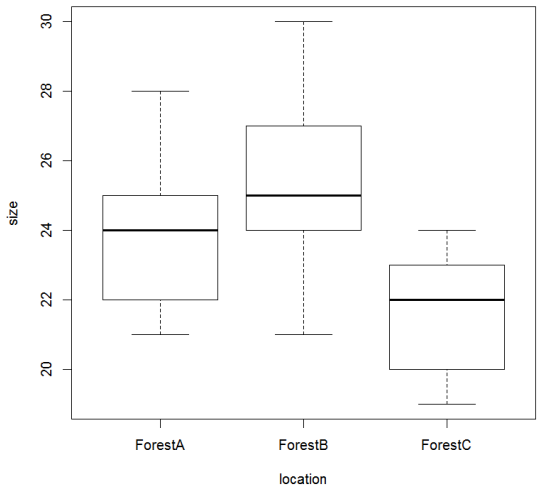
16. (4 pts) To study the ages of pennies, a random sample of 10 pennies is drawn with the ages (in years) shown below.

    0, 0, 1, 1, 1, 2, 4, 10, 25, 36

    (a) Make a dotplot of this data

    (b) Why would it NOT be appropriate to construct a confidence interval for the mean age of pennies using this data? Include your observations about the dotplot in your answer.

17. (6 pts) A biologist did a study on the diameter of trees in 3 different forests. She gathered random, independent samples of 15 trees in each of the 3 forests. Given the boxplots of the data shown, and considering just the conditions of sample size and equal variance, would it be appropriate for her to use ANOVA to see whether there is a significant difference in mean tree size in the different forests?



It IS or IS NOT appropriate to use ANOVA (circle one)

Explain.

18. (8 pts) A random sample of students was studied to see whether seating position in the class is associated with GPA. The seating position of the students was observed (front, middle, back) and their GPA's were noted.

    What is the factor (treatment) in this study? _____

    What is the response? _____

What are the hypotheses for the test?

An ANOVA test was performed with the following Minitab result:

Analysis of Variance

Source	DF	Adj SS	Adj MS	F-Value	P-Value
Factor	2	2.350	1.1752	7.50	0.003
Error	27	4.229	0.1566		
Total	29	6.580			

Which number measures the total variance BETWEEN the groups?_____

Which number measures the total variance WITHIN the groups? _____

Show how the F-value is determined from these values:

What is the conclusion of the test? (Assume all of the conditions were met).

t Table

cum. prob	$t_{.50}$	$t_{.75}$	$t_{.80}$	$t_{.85}$	$t_{.90}$	$t_{.95}$	$t_{.975}$	$t_{.99}$	$t_{.995}$	$t_{.999}$	$t_{.9995}$
one-tail	0.50	0.25	0.20	0.15	0.10	0.05	0.025	0.01	0.005	0.001	0.0005
two-tails	1.00	0.50	0.40	0.30	0.20	0.10	0.05	0.02	0.01	0.002	0.001
df											
1	0.000	1.000	1.376	1.963	3.078	6.314	12.71	31.82	63.66	318.31	636.62
2	0.000	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	0.000	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	0.000	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	0.000	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	0.000	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	0.000	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	0.000	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	0.000	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	0.000	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	0.000	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	0.000	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	0.000	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	0.000	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	0.000	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	0.000	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	0.000	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	0.000	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	0.000	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	0.000	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	0.000	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	0.000	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	0.000	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.485	3.768
24	0.000	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	0.000	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	0.000	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	0.000	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	0.000	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	0.000	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	0.000	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	0.000	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	0.000	0.679	0.848	1.045	1.296	1.671	2.000	2.390	2.660	3.232	3.460
80	0.000	0.678	0.846	1.043	1.292	1.664	1.990	2.374	2.639	3.195	3.416
100	0.000	0.677	0.845	1.042	1.290	1.660	1.984	2.364	2.626	3.174	3.390
1000	0.000	0.675	0.842	1.037	1.282	1.646	1.962	2.330	2.581	3.098	3.300
z	0.000	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.090	3.291
	0%	50%	60%	70%	80%	90%	95%	98%	99%	99.8%	99.9%
	Confidence Level										

Take home (due Wednesday 5/3/17) Name:_____

(10 pts) In trying to determine whether air pollution causes reduction in children's lung health a researcher proposes to see if the lung volume of 10-year-old boys who live in high ozone pollution is significantly less than the lung volume of all 10-year-old boys. The mean volume for all 10-year-old boys is 2.05 liters A random sample of 100
10-year-old boys who live in a community with high levels of ozone pollution is found to have a mean volume of 1.98 liters, with a standard deviation of 0.3 liters.

Perform all steps of the hypothesis test. For full credit, include a sketch of the sampling distribution with two axes. Shade in the area that represents the P-value. Find the P-value using Minitab (but do all other parts of the test by hand). Include a printout of your Minitab work.