**Final Exam Review**

**Formulas**

*The binomial distribution formula, the confidence interval formula and the test statistic formula will be provided on the final exam.*

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| **Binomial Distribution:**  Parameters  **n** ~ numbers of trials  **p** ~ probability of success  **x** ~ probability desired  Probability Calculations | **Normal Distribution:**  Parameters  ~ mean  ~ standard deviation  Probability Calculations |
| **Central Limit Theorem:**  Suppose you make **n** observations from a  population **X** that is distributed as follows,  **X** ~ population mean :  standard deviation :  Then the distribution of the sample mean is  normally distributed around with a  standard deviation equal to the standard error  , i.e.  ~ *Normal* () | **Confidence Intervals**  **with known**  *CONFIDENCE + SIGNIFICANCE = 100%*  Information Needed:  ~ sample mean  ~ number of samples  ~ significance level  Calculate:  ~ Standard Error  ~ Z-score |
| **Confidence Intervals**  **with unknown**  *CONFIDENCE + SIGNIFICANCE = 100%*  Information Needed:  ~ sample mean  s ~ sample standard deviation  ~ number of samples  ~ significance level  Calculate:  ~ Standard Error  ~ t-score | **Hypothesis Testing**  Set level = 1%, 5% or 10% (*by convention*)  Null Hypothesis:  (*Null always contains equality!*)  Alternate Hypothesis:  (1) (*Two-Tailed*)  (2) (*Right-Tailed*)  (3) (*Left-Tailed*)  Test Statistic:  Decision Rule  (*Two Tailed.* Replace with for one-tailed tests.)  1. Critical Value Version:  Calculate: Critical Value of t at  significance.  If reject  If do not reject  2. P-Value Version  Calculate: Probability of observing a test  statistic greater or less than the calculated  value (< or > depends on the type of test:  one tailed or two tailed.)  If reject  If do not reject |

**Excel Functions**

*You will be allowed to use Excel, but no other information will be provided on the Exam about Excel functions. You will need to know how to use these functions for the exam.*

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| **Binomial Distribution**  binom.dist(x, n, p, *TRUE/FALSE*) | **Arguments:**  x – desired probability  n – number of trials  p – probability of success  *TRUE/FALSE* -  *TRUE →*  *FALSE →* |
| **Standard Normal Distribution:**  norm.s.dist(z, *TRUE/FALSE*) | **Arguments:**  z – desired probability  *TRUE/FALSE* - ALWAYS TRUE! |
| **Inverse Standard Normal:**  norm.s.inv(prob) | **Arguments:**  prob – area to the left of the z-score |
| **Normal Distribution:**  norm.dist(x, mu, sigma, *TRUE/FALSE*) | **Arguments:**  x – desired probability  mu – mean of the distribution  sigma – standard deviation of the distribution  *TRUE/FALSE* - ALWAYS TRUE! |
| **Inverse Normal:**  norm.inv(prob, mu, sigma) | **Arguments:**  prob – area of the left of the x-score  mu – mean of the distribution  sigma – standard deviation of the distribution |
| **T Distribution:**  t.dist(t, deg, *TRUE/FALSE*) | **Arguments:**  t – desired probability  deg – degrees of freedom (always *n -1*!)  *TRUE/FALSE –* ALWAYS TRUE! |
| **Inverse T:**  t.inv(prob, deg) | **Arguments:**  prob – area of the left of the t-score  deg – degrees of freedom (always *n -1*!) |

*Other Useful Functions to Know*

*SUM()* → Add together the values in a range.

*COUNTA()* → Counts up the number of values in a range.

*AVG()* → Averages the values in a range.

*STDEV.S()* → Calculates the sample standard deviation of a range.

*VAR.S()* → Calculates the sample variance of a range.

*SQRT()* → Calculates the square root of a number

*Histograms*: Make sure you remember how to make histograms!

**Sample Problems**

1. **Binomial Distribution.**

According to a statistic I made up, 22% of people have met a U.S. President. Suppose you randomly sample 50 people. Answer the following questions regarding this sample:

a. What is the expected number of people who have met a U.S. President in this sample?

b. What is the probability that out of the sample of 50 people, exactly 12 have met a U.S. President?

c. What is the probability more than 10 people in this sample have met a U.S. President?

d. What is the probability between 9 and 18 people in this sample have met a U.S. President?

2. **Standard Normal Distribution.**

Using either a standard normal table (*one will be provided on the exam*) or the appropriate Excel Function (*Norm.S.Dist()* or *Norm.S.Inv()*), calculate the following probabilities and percentiles from the standard normal distribution:

a.

b.

c.

d.

e.

3. **Normal Distribution**

Suppose the height of a citizen of Longmont is normally distributed with a mean of and a standard deviation of . Using either a standard normal table and then the transformation or the appropriate Excel function (*Norm.Dist() or Norm.Inv()*), calculate the following probabilities and percentiles from this normal distribution:

a.

b.

c.

d.

e.

4. **Sampling Distributions**

Suppose you make 34 samples from a population that is normally distributed with a mean of and a standard deviation of . Answer the following questions regarding this sample.

a. What is the probability of observing a member of this population greater than 3?

b. What is the probability of calculating a sample mean greater than 3?

c. Describe the distribution of the sample mean in relation to the distribution of the population. What is the same? What is different?

5. **Confidence Intervals With Standard Deviation Known**

You have made a random sample of data regarding the amount of time users spend on a website before clicking away to another site. The sample is summarized below:

Based on historical data, you have reason to believe the standard deviation of the time spent by website users on a single page is given by . Construct a 95% confidence interval for the true mean of time spent by users on this web page.

**Note:** On the exam, you will be provided a spreadsheet of data and asked to calculate the sample mean and the number of samples, rather than being given the information up front.

6. **Confidence Intervals With Standard Deviation Unknown**

You have been keeping track of the closing price of the S&R stock index for the past 30 trading days. Your sample is summarized below:

Construct a 90% confidence interval for the true mean of the stock price over this time interval.

**Note:** On the exam, you will be provided a spreadsheet of data and asked to calculate the sample mean, sample standard deviation and the number of samples, rather than being given the information up front.

7. **Hypothesis Testing**

You are given a random sample of data that represents the IQ of members of a certain population. You want to test the claim that the mean IQ of the population is greater than 104. You calculate the following sample statistics:

a. Identify the claim being tested. Set up the null and alternate hypothesis. Is this a two- tailed, right tailed or left tailed test?

b. Calculate the test statistic for this hypothesis.

Part 1

1c. Find the critical value of the t-distribution at a significance of .

1d. Apply the decision rule and state the conclusion of the hypothesis test.

Part 2

2c. Find the p-value of the test statistic.

2d. Apply the decision rule at a significance of and state the conclusion of the hypothesis test.