MTH 265 - EXAM II REVIEW

For this exam you may bring the largest notecard you can find sold labelled "Notecard". You can write on both sides but all notes must be hand written. Exam 2 will cover the following sections:

4.1 The Binomial Distribution

- Know what requirements must be fulfilled for a random variable to be Binomial. See p. 120.
- Be able to find the distribution for a Binomial random variable (recognize it is Binomial and find the mean, variance, and standard deviation). See example 4.1.
- Be able to calculate probabilities for a Binomial random variable. See example 4.2 through 4.5.
- Typical and reasonable test questions would be like problems 1, 3, 5, 7, and 9.

4.2 The Poisson Distribution

- Be able to recognize when you have a Poisson random variable. Clue into the wording that there is a number of occurrences of an event in a specified unit (volume, time, area…). This is a DISCRETE random variable.
- Be able to determine the parameter, λ, needed to specify the Poisson probability distribution and be able to explain what that parameter means.
- Be able to calculate probabilities for a Poisson random variable using the probability distribution or using your poissonpdf or poissoncdf features of your calculator. See examples 4.6, 4.7, 4.9, 4.10, and 4.11.
- Typical and reasonable test questions would be like problems 4, 5, and 11.

4.3 The Normal Distribution

- Be able to calculate the area under the normal curve (probabilities) for given values of the standard normal variable *Z*. See examples 4.15, 4.16, and 4.17.
- Be able to calculate percentiles for a standard normal random variable. See example 4.18.
- Be able to convert a normal random variable to a standard normal random variable. See example 4.13. Note that this involves the z-score.
- Be able to calculate probabilities and percentiles for any normal random variable given its mean and standard deviation. You may convert first to the z-score or use your normalcdf feature on your calculators to get the probability for that specific normal distribution directly. See examples 4.19 and 4.20, and 4.21.
- Be able to give the distribution information for the sample mean. See page 141.

Typical and reasonable test questions would be like 5, 6, 9, 10, and 11.

4.5 The Exponential Distribution

- Know that this is a continuous distribution that is related to a Poisson process. The parameter λ is the same one you would use for a Poisson distribution. Read the bottom of page 148.
- We derived the cumulative exponential distribution formula, so you can use it to calculate probabilities associated with this distribution. See example 4.25.
- Remember that the Exponential distribution has a lack of memory…so it does not matter how long it has been since the last occurrence. Read pages 149 and 150.
- Typical and reasonable test questions would be like exercises 2, 3, 4, and 6.

4.8 The Central Limit Theorem

- Be able to use the Central Limit Theorem to determine the mean, variance, and standard deviation for the sample mean of a simple random sample and be able to calculate probabilities using them. See example 4.31. Be sure you clue in to the wording that the probability is being asked about the average or mean of the sample. The sample mean has its own distribution.

- Be able to explain what the Central Limit Theorem tells us.
- We skipped the information on the normal approximation to the Poisson and Binomial.
- Typical and reasonable test questions would be like exercises1, 2, 3, 4, 5, 6, 7, and 8.

5.2 Large-Sample Confidence Intervals for a Population Mean

- Be able to find two-sided confidence intervals (we skipped the one-sided intervals on pages 185 and 186) for the mean of a population using a sample from a population with known mean and standard deviation. See examples 5.3, 5.4, and 5.5.
- Know how to interpret a confidence interval. Read pages 182 and 183 carefully!!
- If you are given a completed confidence interval for the mean of a population, then find the confidence level. See example 5.6.
- Be able to find the size of the sample needed to obtain a given level of confidence for the mean of a population. See page 184
- Know the vocabulary: point estimate, confidence level, margin of error, standard error, critical value.
- Typical and reasonable test questions would be like exercises 4, 5, 6, 7, 8 and 9.

5.3 Confidence Intervals for Proportions

- Be able to find two-sided confidence intervals for a proportion, P, using the modern method on page 190. (We did not cover one sided confidence intervals, so do not use the boxed formula on page 191.)
- Be able to find the size of the sample needed to obtain an interval with a given level of confidence for a specified margin of error. See the top of page 192. When would you use each formula?
- Typical and reasonable test questions would be like exercises 1, 2, 3, 4, 5, and 12.

5.4 Small-Sample Confidence Intervals for a Population Mean

- Be able to probabilities involving the ***t*** distribution. See examples 5.14, 5.15, and 5.16.
- Be able to determine when the ***t*** distribution applies. Read page 198. I will not tell you which distribution to use. You will have to know whether to use the normal or the ***t*** distribution when you build a confidence interval.
- If you don't know whether the population is normal, look at a box plot. Read the bottom of page 198 and the top of page 199.
- Typical and reasonable test questions would be like exercises 4, 5, 6, 7, 8, 9, and 10.

6.1 Hypothesis Tests for a Single Sample for the Mean

- We developed a pattern for writing up the hypothesis test. Be able to create the null hypothesis, alternate hypothesis, test statistic, p-value, and conclusion. The homework problems in this section set up hypothesis statements for you. Be sure you look carefully at those because you will be expected to set them up yourself. The hypothesis statements involve the unknown population mean. Look at the two examples we walked through during lecture. Those are good test questions.
- Understand when you are conducting a two-tailed versus a one-tailed test. The p-value calculation differs depending on the test. The information is all summarized in the box on page 219.
- Think about the hypothesis test procedure. During the test we **temporarily** ASSUME the null hypothesis is true so we have a distribution to work with. We use the test-statistic to judge how likely the sample information was to be selected. Then we decide if our assumption was reasonable or should be rejected.
- Typical and reasonable test questions would be like exercises1, 2, 3, 4, 5, 6, 7, 8, and 9.

6.2 Conclusions from Hypothesis Tests

- This section gave you guidance on interpreting the P-value. Read it carefully!!!
- What is statistical significance?
- This section gave guidance on setting up the null hypothesis and alternate hypothesis. Since we can NEVER prove or say the null hypothesis test is true, the power in conducting a hypothesis test is in the ability to reject the null hypothesis. Read page 224 which shows you the thought process involved in rejecting or not rejecting the null hypothesis and how important it is to construct those hypothesis statements carefully.
- Typical and reasonable test questions would be like exercises1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 16

6.3 Tests for a Population Proportion

- This section covered Hypothesis testing in the context of proportions.
- We justified using a normal distribution with the Central Limit Theorem, provided that n was large enough. How large is large enough? The CLT kicks in provided that:

$$\boldsymbol{n * p_0 > 10 \text{ and } n * (1 - p_0) > 10}$$

6.4 Small-Sample Tests for a Population Mean

- Hrmm… your sample is small AND σ is unknown? Use the t-distribution!
- Note that we still require the population to be approximately normal.