Exam 3 Review

Note: This is not a complete list of topics – you should study your lecture notes and homework in addition to reviewing the items listed here.

1. The Normal Distribution
   a. properties
   b. area = probability
   c. standard normal: $\mu = 0, \sigma = 1$
   d. reading the table
   e. z_α - area to the right is α

2. Finding normal probabilities:
   a. Draw a picture, showing the mean, std. dev., and the values/area being considered.
   b. Calculate $Z = \dfrac{X - \mu}{\sigma}$
   c. Use the normal table to find the corresponding area/probability.

   } Another option is using the calculator's normalcdf(capabilities.

3. Finding values of a normally distributed random variable
   a. Draw a picture, illustrating the approximate location of the value.
   b. Use the normal table to find the *Z* value corresponding to the desired area.
   c. Find the corresponding *X* using $X = \mu + \sigma Z$.

4. Normal Probability Plots
   If sample data are from a normally distributed population, the normal probability plot should be approximately linear.

5. Normal Approximation to the Binomial
   a. If $np(1-p) \geq 10$, then the binomial random variable *X* is approximately normally distributed with $\mu = np$ and $\sigma = \sqrt{np(1-p)}$.
   b. Don't forget the <u>continuity correction</u>! (see pg. 404 for details)

6. Distribution of the Sample Mean
   a. The sampling distribution of $\bar{x}$ will have mean $\mu_{\bar{x}} = \mu$ and std. dev. $\sigma_{\bar{x}} = \dfrac{\sigma}{\sqrt{n}}$.

      (Note: This will still be true if *X* is not normally distributed but $n \geq 30$.)

   b. **Central Limit Theorem**: Regardless of the shape of the distribution, the sampling distribution of $\bar{x}$ becomes approximately normal as the sample size *n* increases.

7. Distribution of the Sample Proportion $\hat{p} = x/n$
   a. If $n \leq 0.05N$ and $np(1-p) \geq 10$, $\hat{p}$ will be normally distributed.
   b. $\mu_{\hat{p}} = p$ and $\sigma_{\hat{p}} = \sqrt{\dfrac{p(1-p)}{n}}$

8. Confidence intervals

statistic	conditions	$(1-\alpha)\cdot 100\%$ CI
μ σ known	normally distributed population or $n \ge 30$ with no outliers	$\bar{x} \pm z_{\alpha/2} \cdot \frac{\sigma}{\sqrt{n}}$
μ σ unknown	normally distributed population or $n \ge 30$ with no outliers	$\bar{x} \pm t_{\alpha/2} \cdot \frac{s}{\sqrt{n}}$
p	$n \le 0.05N$ and $n\hat{p}(1-\hat{p}) \ge 10$	$\hat{p} \pm z_{\alpha/2} \cdot \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$
σ^2	X is normally distributed	$\frac{(n-1)s^2}{\chi^2_{\alpha/2}} < \sigma^2 < \frac{(n-1)s^2}{\chi^2_{1-\alpha/2}}$

9. Sample size necessary

a. Sample size necessary for a $(1-\alpha)\cdot 100\%$ CI about μ: $n = \left(\frac{z_{\alpha/2} \cdot \sigma}{E}\right)^2$.

b. Sample size necessary for a $(1-\alpha)\cdot 100\%$ CI about p:

i. $n = \hat{p}(1-\hat{p})\left(\frac{z_{\alpha/2}}{E}\right)^2$ if $\hat{p}$ is a prior estimate.

ii. $n = 0.25\left(\frac{z_{\alpha/2}}{E}\right)^2$ if no prior estimate is available.