Sampling Distributions: Chapter 7

What to Study: To be successful on this section of the final, the student will

- Know that no sample fully and exactly describes a population; sample proportions and means will vary from sample to sample. That's sampling error (or, better, sampling variability).
- Know how the Central Limit Theorem describes the behavior of a sample proportions and means, as long as certain assumptions and conditions are met.
- Understand that the variability of a statistic (as measured b the standard deviation of its sampling distribution) depends on the size of the sample. Statistics based on larger samples are less variable.
- Be able to use a sampling distribution model to make simple statements about the distribution of a proportion or mean under repeated sampling.
- Be able to interpret a sampling distribution model as describing the values taken by a statistic in all possible realizations of a sample or randomized experiment und the same conditions.

Vocabulary:

- Sampling distribution model
- Sampling variability (sampling error)
- Central Limit Theorem
- Sampling distribution model for a proportion
- Sampling distribution model for a mean

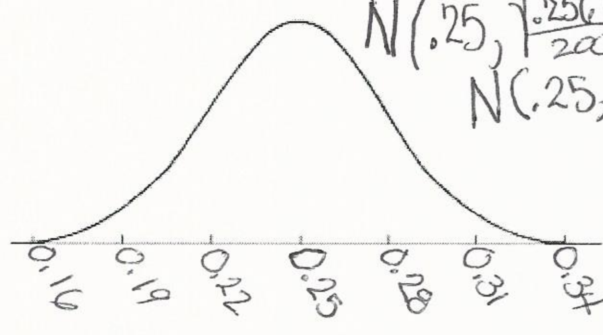
Problems to Review:

21. Assume that 25% of students at a university wear contact lenses. We randomly pick 200 students.

    a. What is the mean and standard deviation of the proportion of students in this group who may wear contact lenses? Draw the appropriate graph.

$N\left(.25, \sqrt{\frac{.25(.75)}{200}}\right)$

$N(.25, .031$



    b. What is the probability that the proportion for this group of 200 students that wears contact lenses is between 27% and 32%?

Ncdf(Low=.27, high=.32, mean=.25, std=.031) = **.247**

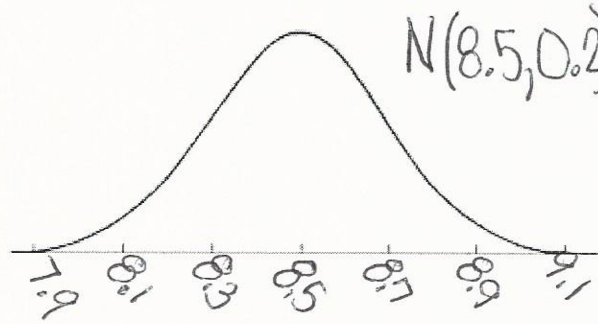
    c. What is the probability that under 20% of the 200 students wears contact lenses?

Ncdf(low=-99⁹, high=.20, mean=.25, std=.031) = **.053**

22. The lengths of adult yellow-bellied sapsuckers are normally distributed, with mean of 8.5 inches and standard deviation of 0.2 inches.

   a. Construct a model for this information.

$N(8.5, 0.2)$



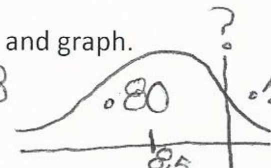
   b. For a randomly selected adult sapsucker, what is the probability that it is between 8.3 and 9.0 inches long? Ncdf(low=8.3, high=9.0, mean=8.5, std=0.2)

   =

   c. How long is an adult sapsucker in the 80th percentile? Include Z score and graph.

   INV N (0.8 (area), mean=8.5, std=0.2) = 8.668

   Z-score = INV N (.8, 0, 1) (area, mean, sd) = .842



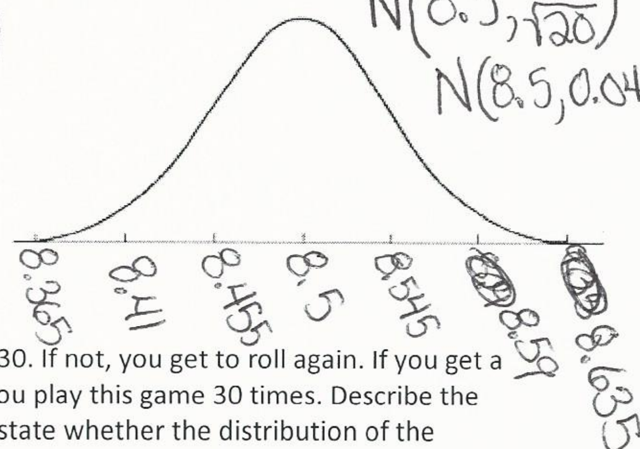
   d. A random sample of 20 adult sapsuckers is measured. Find the probability that their mean length is greater than 8.6 inches. Include graph.

   Ncdf (low=8.6 high=99 mean=8.5, std=0.045)

   = 0.0131

$N\left(8.5, \frac{0.2}{\sqrt{20}}\right)$

$N(8.5, 0.045)$



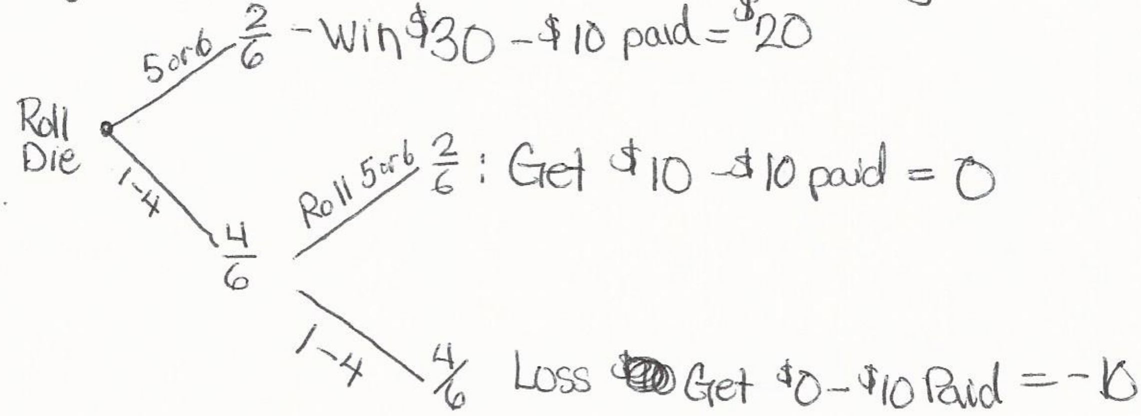
23. You pay \$10 and roll a die. If you get a five or six, you win \$30. If not, you get to roll again. If you get a 5 or 6 on the second roll, you get your \$10 back. Suppose you play this game 30 times. Describe the sampling distribution of your mean winnings. In particular, state whether the distribution of the sample mean is normal or approximately normal, and give its mean and standard deviation.

   See next paper

24. Researchers believe that 7% of children have a gene that may be linked to a certain childhood disease. In an effort to track 50 of these children, researchers test 950 newborns for the presence of this gene. What is the probability that they find enough subjects for their study?

23 Let X = amount of winnings

Pay \$10



X	20	0	-10
P(X=x)	.333	.222	.444

Play game 30 times
~~Not~~ Normal Dist

E(X) = X in L_1, P(X=x) = L_2, Run 1 Var Stats, List = L_1, Freq = L_2

E(X) = \$2.22

SD(X) = \$13.147

N(2.22, 13.147)

(24) Let p = proportion of children that have the gene = 7%

n = 950 newborns tested

E(np) = .07(950) = 66.5

SD(n) = $\sqrt{npq} = \sqrt{.07(.93)(950)} = \sqrt{61.845} = 7.864$

~~ND~~

Binomialcdf (X=950 p=.07, n=50) = .01787

Probability of getting 50+

= 1 − .01787 = **.98213**

Ncdf (low=50, high=999, mean=66.5, sd=7.864)

= .982