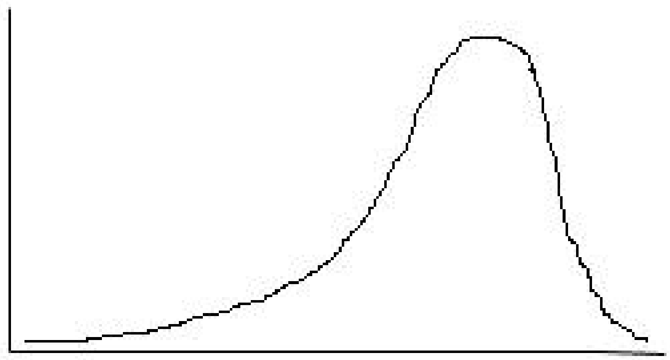
Exam 1 PS217, Spring 1995

1. You are dealing with a negatively skewed distribution. [10 pts]

a. First, sketch what a negatively skewed distribution look like:



b. Which score is smaller (lower), the mean or the mode? **mean**

c. Which score is smaller (lower), the median or the mode? **median**

You next convert all the scores in this negatively skewed distribution to z-scores.

d. What is the mean of this distribution of z-scores? **0**

e. What is the standard deviation of this distribution of z-scores? **1**

f. What would be the shape of the distribution of z-scores? **negatively skewed**

g. What percentage of the scores would be above a z-score of 0?
You can't know for sure, because you can't use the Unit Normal Table (where 50% of the scores would be above a z=0). However, you do know that the percentage above z=0 would be > 50%.

2. Below is a sample of scores. Estimate the parameters of the population from which the sample was drawn. [10 pts]

X	X^2
1	1
2	4
3	9
4	16
5	25
15	55

$$\hat{\mu} = \bar{X} = \frac{\sum X}{n} = \frac{15}{5} = 3$$

$$SS = \sum X^2 - \frac{(\sum X)^2}{n} = 55 - \frac{15^2}{5} = 55 - 45 = 10$$

$$\hat{\sigma}^2 = s^2 = \frac{SS}{n-1} = \frac{10}{4} = 2.5$$

$$\hat{\sigma} = s = \sqrt{s^2} = 1.58$$

3. As you know, gestation periods are normally distributed with $\mu = 268$ and $\sigma = 16$. If you were pregna nt (males should use their imaginations, a la Arnold's movie)…

a. What would be the probability that you would carry your child between 276 and 300 days (i.e., what percentage of women carry their children between 276 and 300 days)? [5 pts]

$$z = \frac{276 - 268}{16} = 0.5$$

$$z = \frac{300 - 268}{16} = 2.0$$

About 31% (.3085) of women carry their babies for 276 days or longer. About 2% (.0228) carry their babies for 300 days or longer. Thus, about 29% (.2857) would carry their babies between 276 and 300 days.

b. Suppose that you figure that you're pretty normal, so that your gestation period would also be fairly nor mal. You presume that you will be like 90% of the women in the world, so you'd like to know the range o f gestation periods you would likely encounter. What gestation periods bound the upper and lower 90% of

the population? (In other words, what gestation periods cut off the upper and lower 5% of the distribution?) [5 pts]

A z-score of ±1.645 would cut off the upper and lower 5% of the distribution. Thus, 90% of women would carry their babies between 241.7 and 294.3 days.

4. SAT scores are normally distributed with μ = 500 and σ = 100. You are interested in knowing if Skidmore students have typical SAT scores (i.e., they are sampled from the normal distribution of SAT scores). To test this assertion, you collect a random sample of n = 25 Skidmore students. Your sample mean is 530.

a. State the null and alternative hypotheses you would be using to test the assertion. [1 pt]

H_0: μ = 500
H_1: μ ≠ 500

b. Test the null hypothesis, then tell me what you would conclude (be explicit!!). [9 pts]

Decision Rule: Reject H_0 if $|z_{Obt}| \geq 1.96$.

$$\sigma_{\bar{X}} = \sigma / \sqrt{n} = 100/5 = 20$$

$$z = \frac{\bar{X} - \mu_{\bar{X}}}{\sigma_{\bar{X}}} = \frac{530 - 500}{20} = 1.5$$

Thus, we would fail to reject H_0 and conclude that it is possible that SAT scores of Skidmore students are sampled randomly from a population with μ = 500.

c. Tell me, in words, what kind of error you might be making in your conclusion. [5 pts]

You could be making a Type II error, retaining the null hypothesis when it is false. Or, in terms of this problem, concluding that Skidmore students were sampled from a population with μ = 500, when they are sampled from a population with μ ≠ 500.

d. On the curves seen below, label the areas that represent Type I Errors, Type II Errors, Power, and Correct "Acceptance?" [5 pts]