Exam 1 PS 217, Spring 2003

1. Given that SAT math scores are normally distributed with μ = 500 and σ = 100, answer the following questions: [10 pts]

a. If all the SAT math scores were transformed to z-scores, the distribution of z-scores would have parameters as follows (fill in the box below each parameter):

μ	σ
0	**1**

b. If a person achieved an SAT math score of 535, what proportion (or percentage) of people would have higher SAT math scores?

$z = \frac{535-500}{100} = .35$, **so .3632 (or 36%) would have SAT scores of 535 or higher**

c. What SAT math scores would determine the middle 50% of the distribution? (In other words, 25% above and 25% below the mean.)

$z = \pm .67 = \frac{x-500}{100}$**, so SAT scores between 433 and 567 would determine the middle 50% of the scores**

d. What proportion (or percentage) of people would have SAT math scores between 550 and 650?

$z = \frac{550-500}{100} = 0.5$ **and** $z = \frac{650-500}{100} = 1.5$**, so .3085 - .0668 = .2417 or 24.17%**

2. Suppose that you take a sample of n = 16 students and determine the GPA for each of them, as seen below:

	GPA	GPA^2
	3.5	12.25
	3.0	9.0
	3.8	14.44
	2.9	8.41
	2.5	6.25
	3.5	12.25
	3.1	9.61
	3.0	9.0
	2.9	8.41
	3.4	11.56
	3.5	12.25
	2.1	4.41
	3.4	11.56
	3.8	14.44
	3.2	10.24
	2.7	7.29
Sum	50.3	161.37

a. Estimate the parameters of the population from which the sample was drawn. [5 pts]

$$M \text{ or } \overline{X} = \hat{\mu} = \frac{50.3}{16} = 3.14$$

$$s^2 = \hat{\sigma}^2 = \frac{SS}{df} = \frac{3.24}{15} = .22$$

$$SS = 161.37 - \frac{50.3^2}{16} = 3.24$$

$$s = \hat{\sigma} = \sqrt{.22} = .47$$

b. Test the hypothesis that the sample was drawn from a population with μ = 3.0. [10 pts]

H_0: μ = 3.0
H_1: μ ≠ 3.0
$t_{Crit}(15) = 2.131$

$$s_{\overline{X}} \text{ or } s_M = \sqrt{\frac{.22}{16}} = .12 \text{ so } t_{Obt} = \frac{3.14 - 3}{.12} = 1.17$$

Decision: Retain H_0, because $|t_{Obt}| < t_{Crit}$
Conclude: Sample may have been drawn from population with μ = 3.0 (lack of power)

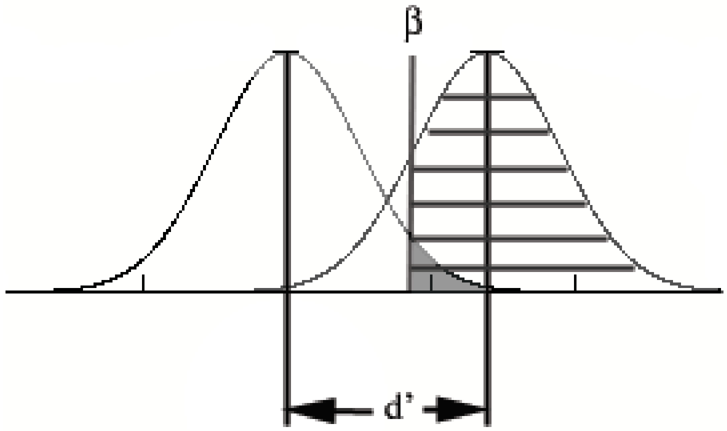
3. In the context of signal detection theory in the lab on z-scores, you learned about the possible outcomes of trials, as seen below: [5 pts]

		Type of Trial	
		Noise Only	Signal + Noise
Participant Reports	Signal Present	False Alarm	Hit
	No Signal Present	Correct Rejection	Miss

It should strike you that this table is very similar to the table used to illustrate the possibilities of decisions in hypothesis testing (e.g., Type I error, Type II error). Set up the table below so that it mirrors the table above in terms of H_0, etc.

		Actual Situation	
		H_0 True	**H_0 False**
Experimenter's Decision	**Reject H_0**	**Type I Error**	**Correct Rejection**
	Retain H_0	**Correct Retention**	**Type II Error**

4. As you saw in that lab, you can use z-scores to determine a measure of sensitivity (d'). Suppose that on a recognition memory test, a person got 80% hits and 10% false alarms. What d' would that person receive? [5 pts]



80% Hits would give you a z-score of -0.84 (in the body, Col. B). 10% False Alarms would give you a z-score of 1.28 (in the tail, Col. C). Thus, d' = 2.12 (1.28 + 0.84).

5. As you know, IQ scores are normally distributed with μ = 100 and σ = 15. Use that information to address the following questions. [10 pts]

a. What proportion (or percentage) of people have IQ scores between 100 and 115?

$z = \frac{115-100}{15} = 1$ and $z = \frac{100-100}{15} = 0$**, so the proportion is .3413 (or 34.13%)**

b. If you took a sample of n = 25, what proportion (or percentage) of such samples would have means between 100 and 115?

$$s_{\overline{X}} \text{ or } s_M = 15/\sqrt{25} = 3$$

$$z = \frac{115-100}{3} = 5 \quad \text{and} \quad z = \frac{100-100}{3} = 0$$

Thus, roughly 50% of the samples would have means between 100 and 115.

c. Briefly explain why you might have gotten a different answer for *a* and *b* above.

In *a*, the distribution is comprised of raw scores, so it would have a standard deviation of 15. In *b*, the distribution is comprised of sample means, so it would have a standard deviation (standard error) of 3. In general, the sampling distribution of the mean will have less variability than the population from which the samples were drawn.

6. A sample of n = 36 quiz scores were obtained from a statistics class. The StatView analysis conducted on these data is seen below. [5 pts]

One Sample t-test
Hypothesized Mean = 8

	Mean	DF	t-Value	P-Value
Quiz Scores	8.222	35	.732	.4692

a. State the null and alternative hypothesis.

H_0: $\mu = 8$

H_1: $\mu \neq 8$

b. What should you conclude about H_0?

Because the P-Value is greater than .05, I would retain H_0.

c. What would you say about the power of this analysis?

Given the failure to reject H_0, there appears to be too little power in this analysis.