Name _____ Date _____ Class _____

WISE Power Tutorial – Answer Sheet

Exercise 1b: Sampling 25 ACE Graduates (Mean = 580)

To simulate drawing a random sample of 25 cases from graduates of the ACE program, enter the following information into the applet below:

- μ_0 = 500 (**null mean**);
- μ_1 = 580 **(alternative mean)**;
- σ = 100 (**standard deviation**);
- α = .05 (**alpha error rate, one tailed**);
- **n** = 25 (**sample size**).

Press enter/return after placing the new values in the appropriate boxes!

	mean	z-score		mean	z-score		mean	z-score		mean	z-score
1			2			3			4		
5			6			7			8		
9			10								

1a. How many times could you reject the null hypothesis in your ten samples? _____
(Use one-tailed alpha α = .05, z = 1.645, so reject H_0 if your z-score is greater than 1.645)

Exercise 1c: Sampling 25 DEUCE Graduates (Mean = 520)

1b. Before drawing samples, consider how the statistical power will differ for a test of DEUCE graduates compared to the power we found for a test of ACE graduates. That is, do you expect you will be more likely or less likely to reject the null hypotheses for a sample of 25 graduates drawn from the DEUCE program compared to a similar test for the ACE program? Explain your response below.

To simulate drawing a sample of 25 from graduates from the DEUCE program, enter the following information into the WISE Power Applet:

- μ_0 = 500 (**null mean**);
- μ_1 = 520 **(alternative mean)**;
- σ = 100 (**standard deviation**);
- α = .05 (**alpha error rate, one tailed**);
- **n** = 25 (**sample size**).

Press enter/return after placing the new values in the appropriate boxes!

Do ten simulations of drawing a sample of 25 cases, and record the results below.

	mean	z-score		mean	z-score		mean	z-score		mean	z-score
1			2			3			4		
5			6			7			8		
9			10								

1c. What is the power for this test as shown in the applet? _____

1d. How many of your ten simulated samples allowed you to reject the null hypothesis? _____
(Use one-tailed alpha α = .05, z = 1.645, so reject H_0 if your z-score is greater than 1.645)

1e. For the ACE program, power was **.991**. Briefly describe your findings from the two simulations and explain how the difference in population means produced the difference in statistical power.

Exercise 2: Power and Variability (Standard Deviation)

To simulate drawing a sample from a DEUCE population with a smaller standard deviation, enter the following values into the WISE Power Applet:

- μ_0 = 500 (**null mean**);
- μ_1 = 520 **(alternative mean)**;
- σ = 50 (**standard deviation**);
- α = .05 (**alpha error rate, one tailed**);
- **n** = 25 (**sample size**).

Press enter/return after placing the new values in the appropriate boxes.

	mean	z-score		mean	z-score		mean	z-score		mean	z-score
1			2			3			4		
5			6			7			8		
9			10								

2a. What is the power for this test (from the applet)? _____

2b. How many of your ten simulated samples allowed you to reject the null hypothesis? _____
(Use one-tailed alpha α = .05, z = 1.645, so reject H_0 if your z-score is greater than 1.645) _____

2c. Below, compare your results from the DEUCE graduates in **Exercise 1** (where the power was .260, and effect size, *d* = .20). Why does a smaller standard deviation lead to greater power?

Question A: Effect Size and Power

Which of the following situations would yield the greatest power (assuming alpha is held constant)?

- ○ Null mean = 500, Alternative mean = 510, Standard Deviation = 40
- ○ Null mean = 500, Alternative mean = 540, Standard Deviation = 160
- ○ Null mean = 500, Alternative mean = 520, Standard Deviation = 60

Exercise 3: Power and Sample Size

To simulate drawing a larger sample, enter the following values into the WISE Power Applet:

- μ_0 = 500 (**null mean**);
- μ_1 = 520 **(alternative mean**);
- σ = 100 (**standard deviation**);
- α = .05 (**alpha error rate, one tailed**);
- **n** = 100 (**sample size**).

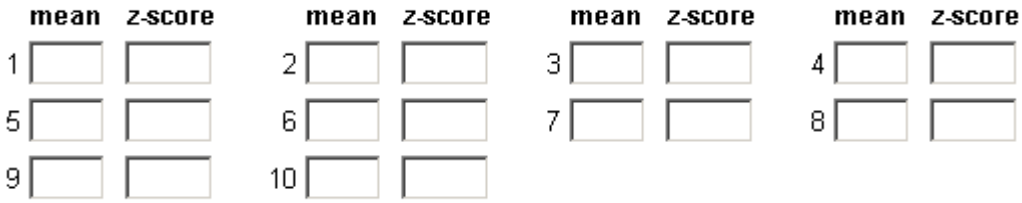
Press enter/return after placing the new values in the appropriate boxes.

Do ten simulations of drawing a sample of 100 cases and record the results below.

	mean	z-score		mean	z-score		mean	z-score		mean	z-score
1			2			3			4		
5			6			7			8		
9			10								

3a. What is the power for this test? _____

Now change **n** to 4. Press **enter** on your keyboard. Do ten simulations with samples of size 4.



3b. What is the power for this test? _____

3c. How many times could you reject the null hypothesis using α = .05 one-tailed (z = 1.645) for:
n = 4: _____
n = 100: _____

3d. What do you conclude about the effect of sample size on power? How is sample size related to effect size? Why?

Question B: The Impact of Sample Size

Consider the shape of the sampling distributions for samples of size n = 4, n = 25, and n = 100. What happens to the sampling distribution of the sample mean when n rises?

- ○ Sampling distribution gets more disperse.
- ○ Sampling distribution gets less disperse.
- ○ Sampling distribution remains the same.

Exercise 4: Power and Alpha

4. For this example, use one-tailed alpha α = .01 (z = 2.326). In this case, we will reject the null hypothesis only if a sample mean is so large that it would occur less than 1% of the time given the null hypothesis is true. You do not need to draw additional samples for this problem; you can use the data recorded for samples drawn in **Exercise 1** (μ_0 = 500, σ = 100, **n** = 25, α = .05, z = 1.645).

4a. Using these criteria, how many times could you reject the null hypothesis for your results in **Exercise 1**?

	α = .05 (from #1)	α = .01
Reject for ACE Program (μ_1 = 580)		
Reject for DEUCE Program (μ_1 = 520)		

4b. Using these criteria, what is the power for each of these tests? You will need to use the applet below to calculate power for the tests using alpha α = .01.

	α = .05 (from #1)	α = .01
Power for ACE Program (μ_1 = 580)	.991	
Power for DEUCE Program (μ_1 = 520)		

You may also examine the effects of changing alpha in the WISE Power Applet.

4c. Does power rise or fall using alpha = .01 compared to .05? Why?

Question C: What Affects Power?

So far you have examined the effect of magnitude of difference between the null mean and the alternative mean, standard deviation, sample size, and alpha level on power. Which of the answers below best summarizes the effect of each on power?

- More power = large magnitude of difference, larger standard deviation, larger sample, larger alpha.
- More power = large magnitude of difference, smaller standard deviation, larger sample, smaller alpha.
- More power = large magnitude of difference, smaller standard deviation, larger sample, larger alpha.
- More power = smaller magnitude of difference, smaller standard deviation, larger sample, smaller alpha.