

1. *Topic Description and Objectives:*

- **PART 1:** Making Sense of Sampling Distributions and the Central Limit Theorem
- Using single samples generated from a given population, the concepts of (1) mean, (2) standard deviation, and (3) estimated standard error are illustrated.

2. *MC2G Program Setup (verify the following input before running analysis):*

	Group 1	Group 2		Value
Population Mean =	100	100	Number of Means to Keep =	1
Population SD =	15	N/A	Statistical Test =	SINGLE T
Group Size =	20	N/A	Correlation bet. Measures =	N/A
Distribution =	UNIFORM	N/A	Directionality of Hypothesis =	TWO-TAILED
Reliability =	1.0	N/A	Alpha Level =	.05
Integer Data =	CHECKED	N/A	Automatically set...Seed... =	UNCHECKED
Minimum =	74.00	N/A	Integer Seed =	2002
Maximum =	126.00	N/A	Number of MC Samples =	1

3. *Steps Necessary to Run Analysis:*

Click **RUN** or press **F5** to run Monte Carlo analysis. Then use File|Save Data (Ctrl-D) for each single sample you run (if you run more than one). Open SPSS or other statistical program and import the comma-delimited DATA text file to examine each single sample. Specifically, obtain descriptive statistics and a histogram. Repeat for several single samples if desired (check **Automatically Set PseudoRandom Seeds for Successive Analyses** to automatically generate new samples when program is **RUN**).

4. *MC2G Program Output (based on Input Above):*

# Rejections =	0	Actual Mean Grp 1 Means =	99.800
Actual ALPHA / POWER =	.00000	Actual Mean Grp 2 Means =	3.6882
Desired =	N/A	Actual SE of Grp 1 Means =	16.0767
		Actual SE of Grp 2 Means =	16.4943

5. *Key Points to Interpret from the Monte Carlo Results:*

- Find **Actual Mean of Scores** for the sample and discuss why it's not equal to population mean
- Find **Actual SD(N-1) of Scores** and discuss why it is not equal to population SD
- Discuss **Estimated Standard Error** and how it is calculated (SD divided by square root of N)
- Interpret statistical test results in "**RESULTS: 2 Tails**" box (t, df, effect size, significance) and compare them to those obtained by analyzing DATA text file in SPSS or other statistical program
- For a single sample, the number of **Rejections** simply corresponds to the decision about the null hypothesis (reported in statistical results box) — 0 means Failed to Reject, 1 means Rejected
- With same seed and Monte Carlo single sample, you can run analysis again to see what happens with One-Tailed test (just click **One-tailed Test** and **Run**)
- Examine sample distribution in SPSS or other statistical program by creating a histogram

1. *Topic Description and Objectives:*

- **PART 2:** Making Sense of Sampling Distributions and the Central Limit Theorem
- Using many Monte Carlo samples generated from the same given population, the concepts of (1) the standard deviation of the mean and (2) the central limit theorem are illustrated.

2. *MC2G Program Setup (verify the following input before running analysis):*

	Group 1	Group 2		Value
Population Mean =	100	100	Number of Means to Keep =	1000
Population SD =	15	N/A	Statistical Test =	SINGLE T
Group Size =	20	N/A	Correlation bet. Measures =	N/A
Distribution =	UNIFORM	N/A	Directionality of Hypothesis =	TWO-TAILED
Reliability =	1.0	N/A	Alpha Level =	.05
Integer Data =	CHECKED	N/A	Automatically set...Seed... =	UNCHECKED
Minimum =	N/A	N/A	Integer Seed =	2002
Maximum =	N/A	N/A	Number of MC Samples =	1000

3. *Steps Necessary to Run Analysis:*

Click **RUN** or press **F5** to run Monte Carlo analysis. Then use **File|Save Means** (Ctrl-M) to save the 1000 means to a text file. Open SPSS or another statistical program and import the comma-delimited MEANS text file to examine the sampling distribution of the means. Specifically, obtain descriptive statistics and a histogram.

4. *MC2G Program Output (based on Input Above):*

# Rejections =	55	Actual Mean Grp 1 Means =	99.795
Actual ALPHA / POWER =	.05500	Actual Mean Grp 2 Means =	3.4289
Desired =	.0500	Actual SE of Grp 1 Means =	14.5073
		Actual SE of Grp 2 Means =	14.8842

5. *Key Points to Interpret from the Monte Carlo Results:*

- Examine the descriptive statistics including (1) mean and (2) standard deviation of the means — explain that the standard deviation of the means *is* Standard Error (emphasize that the data are MEANS not scores)
- Examine the histogram of MEANS data — explain the central limit theorem and why the sampling distribution is relatively normal even though the data were UNIFORM. Point out where the single sample mean(s) from Part 1 of the Lesson is located on the histogram.
- Discuss the properties of the normal curve and why the mean from Part 1 was not considered statistically significantly different from the comparison population mean.
- Discuss that SD(-1) is a better estimate of the population standard deviation than SD(N) — which can be seen in the **Sampling Distribution Info** box