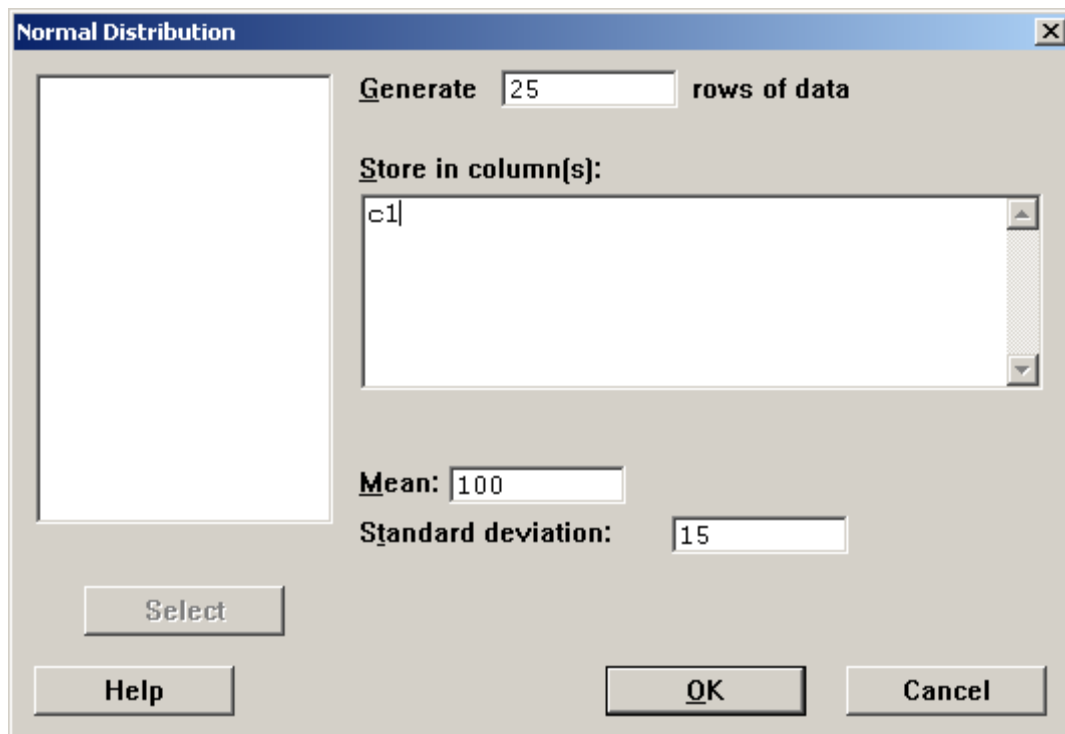


The purpose of this special problem is to investigate the behavior of the means and standard deviations of repeated samples of size 25 taken from normal distributions. The statistics software package, Minitab, has the ability to generate values of variables from various distributions, including normal distributions with specified mean and standard deviation.

For this investigation you will obtain 25 observations from the $N(100, 15)$ distribution, and calculate certain descriptive measures for these observations. You will repeat this procedure a number of times and then study the results.

You will write a report on the activity. The writing of the report must be individual work, not a group effort.

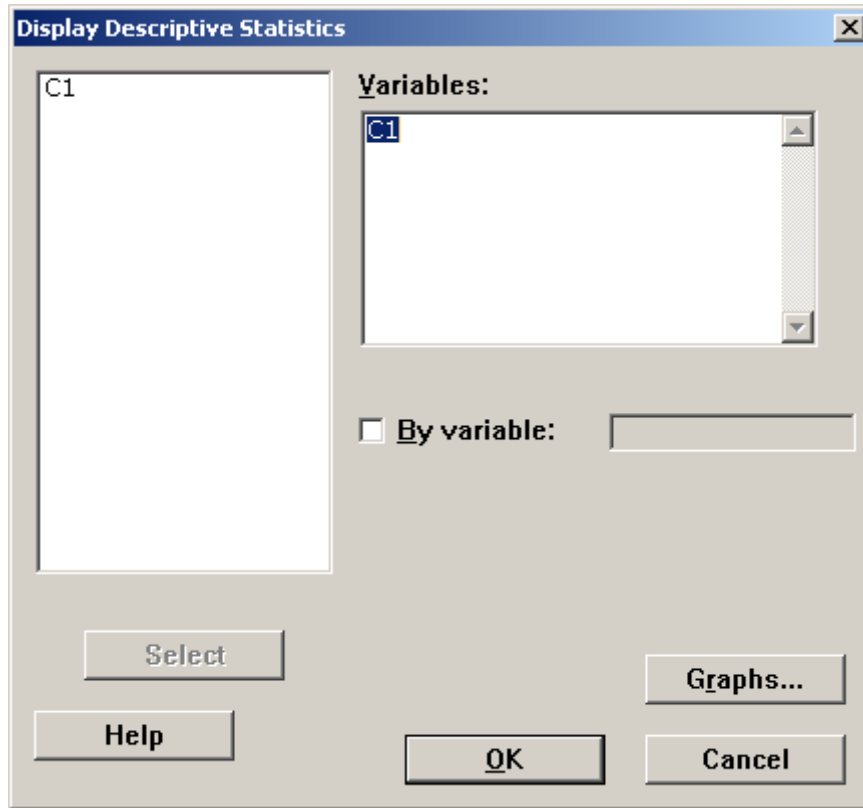
Procedure: Here are the steps for carrying out your investigation with Minitab. After you have launched Minitab, pull down the **Calc > Random Data > Normal**



1. This tells Minitab to generate 25 values from the $N(100, 15)$ distribution and put the values in column 1. The values should be near 100 and will have decimal parts to the numbers.

2. Now calculate one-variable statistics on this data:

Stat > Basic Statistics > Display Descriptive Statistics



The output, the **five-number-summary**, will show up in the upper window, the Session window.

Variable	N	Mean	Median	TrMean	StDev	SE Mean
C1	25	101.18	101.29	101.98	14.09	2.82

Variable	Minimum	Maximum	Q1	Q3
C1	60.93	123.20	91.89	112.14

3. Compare the sample mean \bar{x} for the 25 data values with the population mean, $\mu = 100$, and compare the sample standard deviation, s , to the population standard deviation, $\sigma = 15$.

Build a table with these headings:

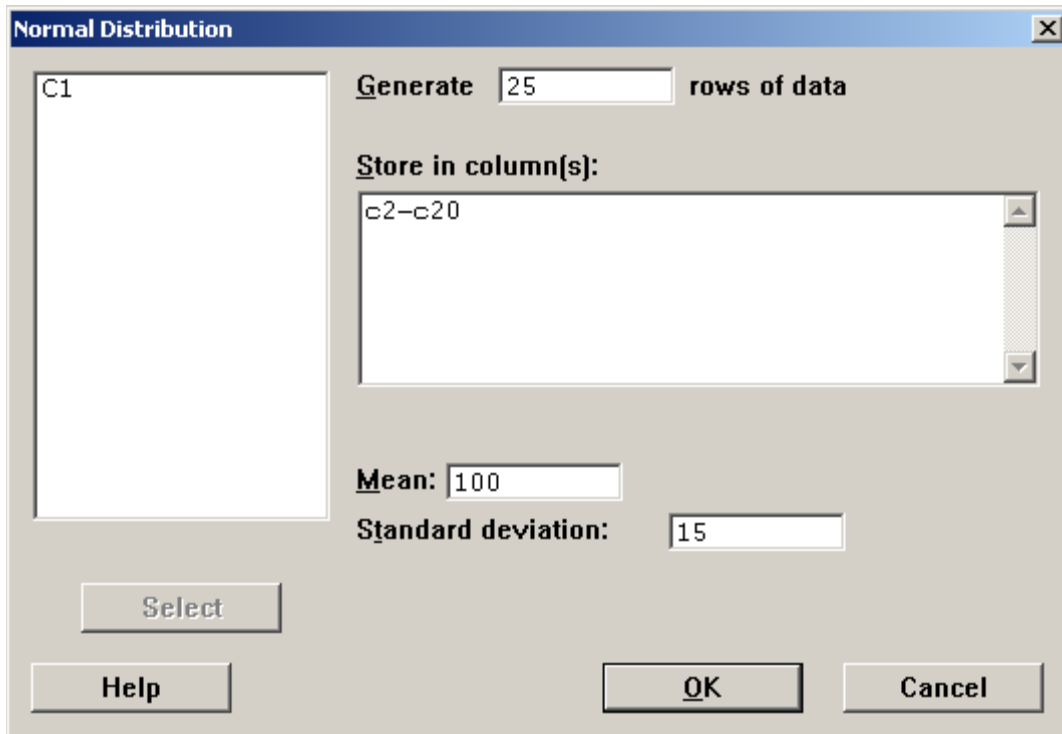
**Sample
Number**

**Sample
Mean**

**Sample
St. Dev.**

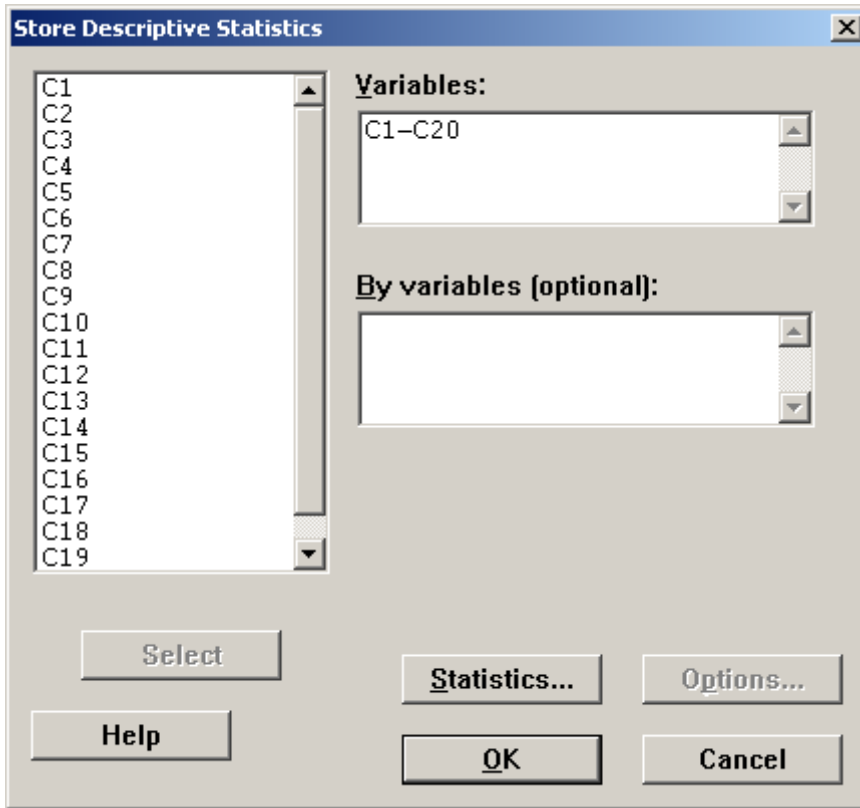
Record the mean and standard deviation for your first sample of 25 observations.

4. Repeat steps 1—3 to create 19 samples from the $N(100,15)$ distribution by entering the following input

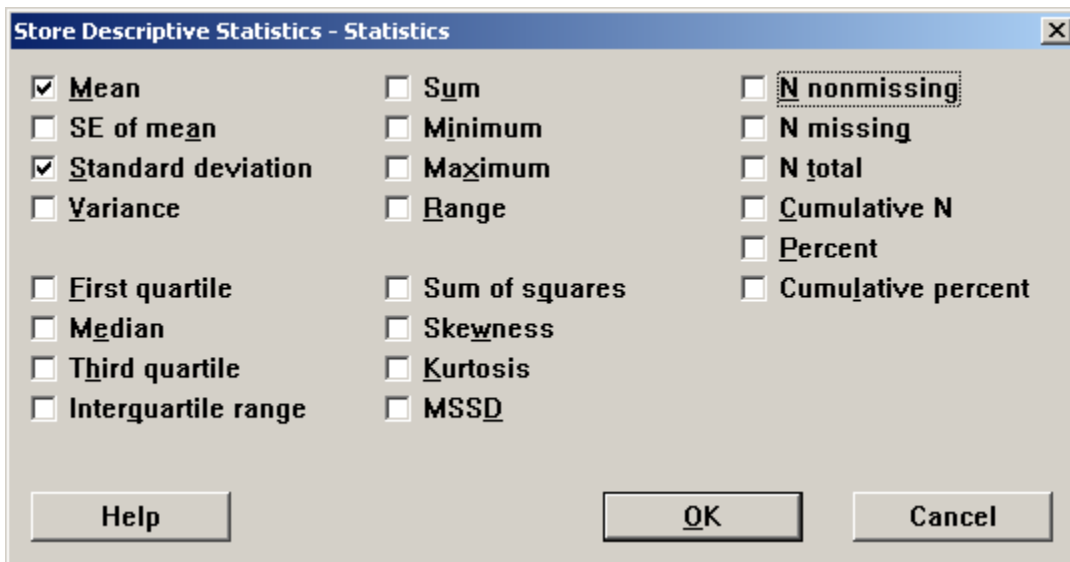


To have Minitab calculate the mean and standard deviation for each of the 20 samples:

Stat > Basic Statistics > Store Descriptive Statistics



Click on Statistics button

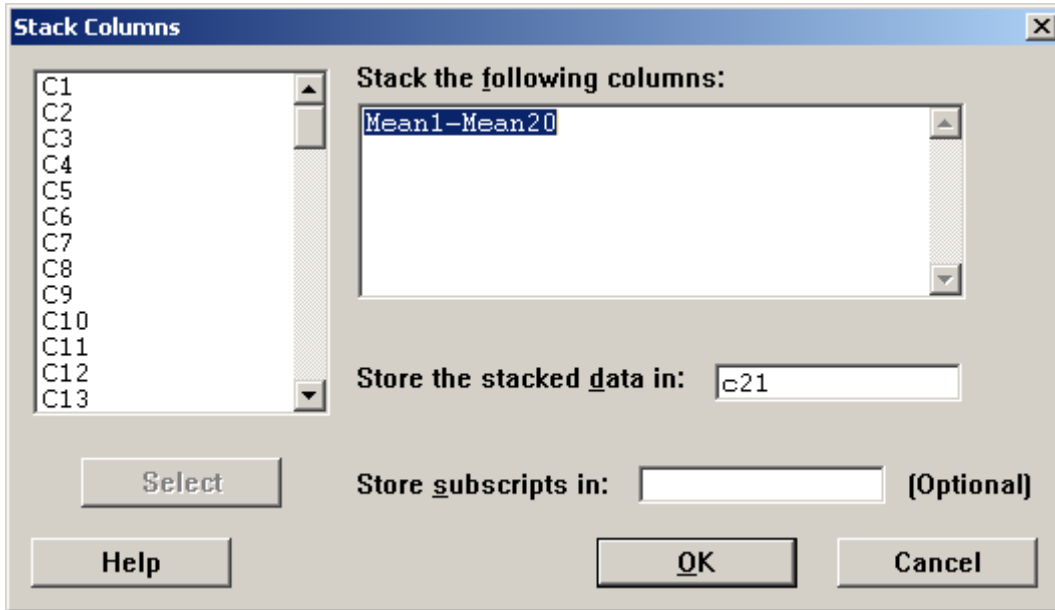


Select Mean and Standard Deviation

You will have 40 columns of two rows. You need to put them into two columns of 20 rows.

Start by stacking the first 20:

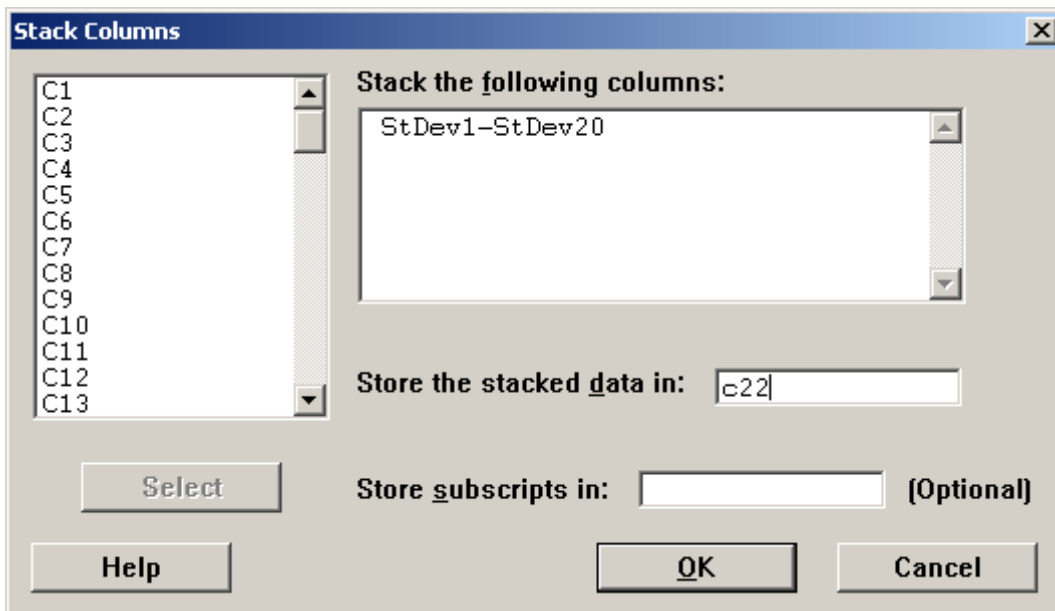
Manip > Stack/Unstack > Unstack Columns



This will take the first 20 elements and place them in column C21. Label this column **Means**.

Do the same for the next 20 elements and store them in C22. Label this column **Std Dev**.

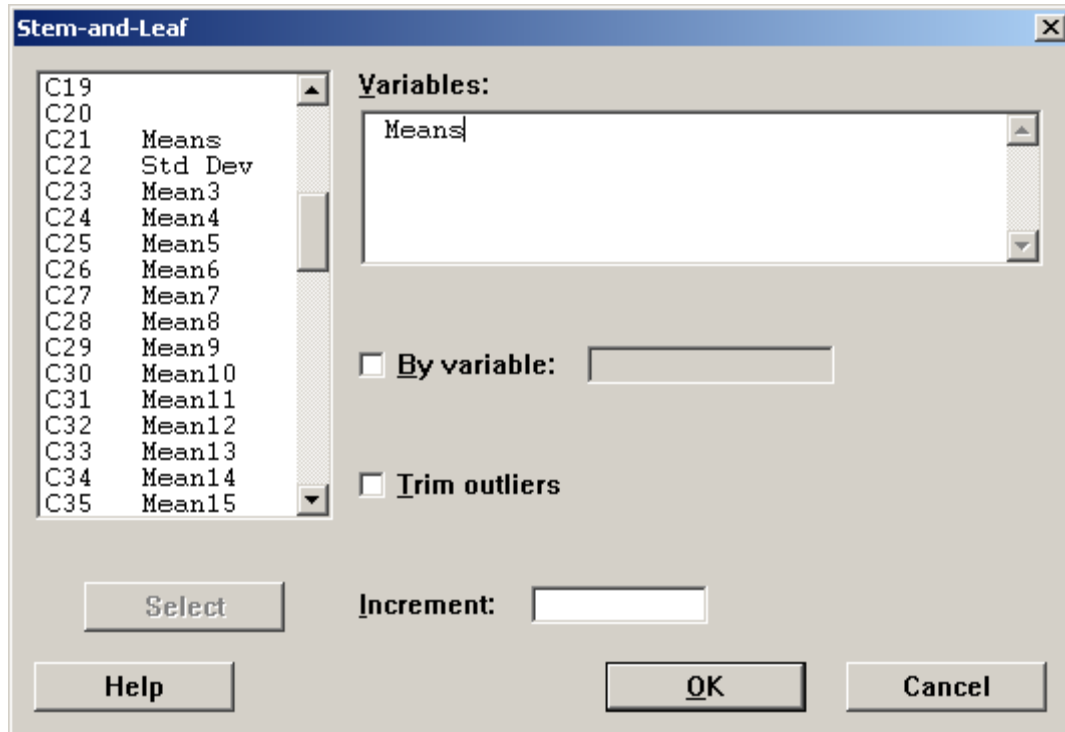
Manip > Stack/Unstack > Unstack Columns



For each of the 20 samples, record the sample number, the sample mean, and the sample standard deviation in your table. (You could copy the columns and past them in your report)

5. Use Minitab to make a stemplot of the 20 values of the mean, \bar{x} , from your table.

Graph > Stem-and-leaf ...



Briefly describe the resulting distribution. Is it skewed or symmetric? Where is its center?

6. Repeat step 5 for the 20 sample standard deviations. Briefly describe the resulting distribution. Is it skewed or symmetric? Where is its center?

7. Have Minitab construct one Normal Probability Plot for your 20 means and a second NPP for the 20 standard deviations. Interpret these plots.

Graph > Probability Plot

Probability Plot

Variables: Means

Frequency columns (optional):

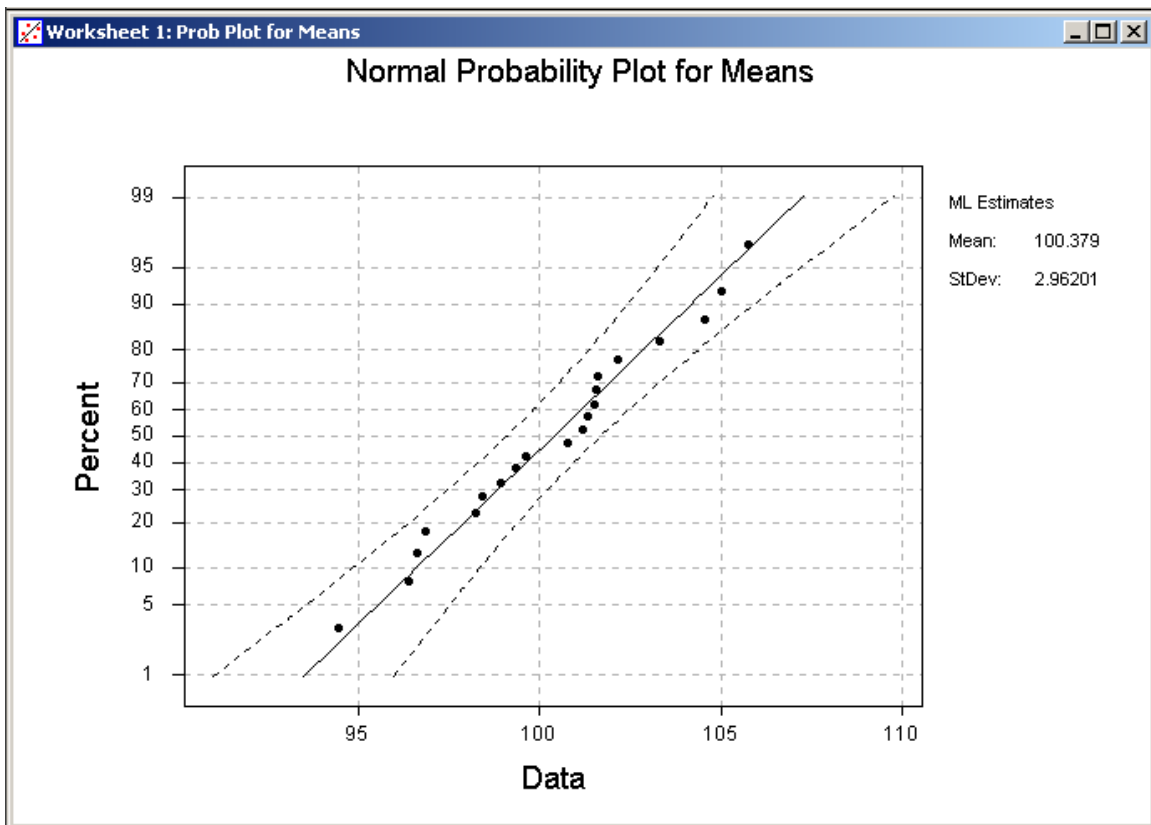
By variable:

Distribution: Normal

Options... OK Cancel

Select Help

C19
C20
C21 Means
C22 Std Dev
C23 Mean3
C24 Mean4
C25 Mean5
C26 Mean6
C27 Mean7
C28 Mean8
C29 Mean9
C30 Mean10
C31 Mean11
C32 Mean12
C33 Mean13
C34 Mean14
C35 Mean15
C36 Mean16
C37 Mean17



Finally, reflect on what you have discovered by doing this investigation. In the final section of your written report, you will be expected to describe what you have learned.

The Report. Refer to the General Special Problem Guidelines for preparing your written report. To reiterate, your report should be word processed, and should begin with a cover sheet that includes the title, your name, and the date. You can format your report to suit your style, but it must include the following components.

- **Introduction** — the purpose of the investigation (Hint: Look at the first paragraph of this sheet).

- **Analysis** — briefly describe what you did to investigate the phenomenon. Don't include the various Minitab commands you typed, but do include the results that you obtained, such as at least an example of one of the samples of 20 randomly generated observations, the descriptive statistics, and any plots that are generated. Ask yourself what details you would want to see if you were reading this report.

- **Summary or Conclusions** — describe the insights that you got from conducting this investigation or the conclusions you drew from it.

Grading. In grading your Special Problem, attention will be given to the following considerations:

- Did you follow instructions for the investigation?
- Are your results reasonable?
- Does your report have all the required components (sections)?
- Are your conclusions reasonable? Justified?
- Is the report clear and unambiguous?
- Is your report grammatically correct and free of spelling errors?
- Did you submit your report on time?

Deadline. This Special Problem will be due no later than tomorrow at the end of class.

Special Problem 2A: Assessment Sheet

Name: _____

Code: 4 Excellent
 3 Good
 2 Satisfactory
 1 Unsatisfactory

General

- | | | | | |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | Followed instructions for the investigation.
Report has all the required components: |
| 1 | 2 | 3 | 4 | Introduction (State the Problem/Background Information) |
| 1 | 2 | 3 | 4 | Analysis |
| 1 | 2 | 3 | 4 | Summary |
| 1 | 2 | 3 | 4 | Report is grammatically correct and free of spelling errors. |
| 1 | 2 | 3 | 4 | Report is clear and unambiguous. |
| 1 | 2 | 3 | 4 | Report was submitted on time. |

Specific

- | | | | | |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | Includes table of 20 means and 20 standard deviations to allow verification of stemplots. |
| 1 | 2 | 3 | 4 | Assesses symmetry or skewness of distributions by some method other than "eyeballing."
•histogram • boxplot •compare mean and median |
| 1 | 2 | 3 | 4 | Constructs normal probability plots to assess normality of sample distributions. |
| 1 | 2 | 3 | 4 | Discusses amount of variation and reason for it.
•refers to sample size as a factor |
| 1 | 2 | 3 | 4 | Compares the mean and standard deviation of distribution of <i>sample means</i> with the mean and standard deviation of N(100,15). |
| 1 | 2 | 3 | 4 | Compares the mean and standard deviation of distribution of <i>standard deviations</i> with the mean and standard deviation of N(100,15). |
| 1 | 2 | 3 | 4 | Conclusions are reasonable. |
| 1 | 2 | 3 | 4 | Conclusions are justified. |

Score: _____