Normal Curve Lab

more hand work practice:
The quantitative subtest of the Graduate Record Exam (GRE) has a mean (*m*) of 500 and a standard deviation (*s*) of 100. Use this information to solve the problems below:

- **What is the percentile rank of a quantitative GRE score of 650?**
- **What is the percentile rank of a quantitative GRE score of 320?**
- **If we tested 300 students randomly drawn from the population of students taking the GRE, how many students could we expect to score 590 or above on the subtest?**
- **If we tested 300 students randomly drawn from the population of students taking the GRE, how many students would we expect to score between 450 and 580 on the quantitative subtest?**
- **What quantitative GRE score corresponds to the 40th percentile rank?**
- **What quantitative GRE scores are so deviant that they occur with a *p* = .06 or less?**

Participants in an employee training program are tested after 1 week. By company policy, employees who score 1 standard deviation or more below the mean are required to take another week of training. Which employees must receive more training, and which are released from the program?

X	*f*
92	1
91	1
88	3

87	3
81	4
79	5
77	5
76	3
71	3
69	2
53	1
51	2
47	1
44	1
39	1

USING SPSS—EXAMPLES AND EXERCISES

SPSS has several procedures that can provide measures of central tendency and dispersion. For example, Frequencies, Descriptives, or Explore can be used. Using a Compute statement, *z* scores can be calculated, or they can be obtained "automatically" as an option under the Descriptives procedure.

Example: We will use SPSS to obtain the three measures of central tendency (mean, median, and mode), measures of dispersion (range, variance, and standard deviation), and *z* scores for all test scores using the data in the problem above. The steps are as follows:

1. **Start SPSS, enter the data, and name the variable test.**
2. **We will use Frequencies to obtain the measures of central tendency and dispersion.**
3. **Go to *Analyze>Descriptive Statistics>Frequencies*.**
4. **Move test to the Variables box; uncheck "display frequency table" so the frequency distribution will not be calculated.**
5. **Click Statistics, select the measures of central tendency and dispersion that you want, and then click *Continue>OK*. This will give the descriptive statistics in the output Viewer window.**

6. **Next we will compute *z* scores using the Compute procedure. To do this we need to know the mean (symbolized by *M* = 74.3333 rather than *X* = 74.3333, as we symbolized it in the text) and standard deviation (*s* = 13.6403) from the output. The formula for any *z* score is *z* = (*X* – *M*)/*s* or *z* = (*X* – 74.3333)/13.6403. We will now put this formula in the Compute box.**
7. **From the Data Editor window, click *Transform*>*Compute*. Then enter "testz" in the Target variable box.**
8. **In the Numeric Expression box, move test in and use the keypad or type and edit so the expression appears as follows: (test – 74.3333)/13.6403.**
9. **Click OK. Check the Data Editor window and find the computed *z* scores.**

Example: Repeat SPSS for the previous example using the Descriptives procedure. Although you will not be able to obtain the median and mode from this procedure, *z* scores can be computed automatically.

1. **Click *Analyze*>*Descriptive Statistics*> *Descriptives*, move test into the Variables box, and click "Save standardized values as variables." This causes the *z* scores to be computed.**
2. **Click Options and select the desired descriptive statistics that are available, then click *Continue*>*OK*.**
3. **The output Viewer shows the descriptive statistics. The Data Editor should show another variable ztest showing the *z* scores again, differing only in the number of decimal places displayed.**

```
FREQUENCIES
  VARIABLES=test  /FORMAT=NOTABLE
  /STATISTICS=STDDEV VARIANCE RANGE MEAN MEDIAN MODE
  /ORDER  ANALYSIS .
```

Frequencies

Statistics

TEST

N	Valid	36
	Missing	0
Mean		74.3333
Median		77.0000
Mode		77.00[a]
Std. Deviation		13.6403
Variance		186.0571
Range		53.00

a. Multiple modes exist. The smallest value is shown.

```
COMPUTE testz = (test - 74.3333)/13.6403 .
EXECUTE .
```

	test	testz
1	92.00	1.30
2	91.00	1.22
3	88.00	1.00
4	88.00	1.00
5	88.00	1.00
6	87.00	.93
7	87.00	.93
8	87.00	.93
9	81.00	.49
10	81.00	.49
11	81.00	.49
12	81.00	.49
13	79.00	.34
14	79.00	.34
15	79.00	.34
16	79.00	.34
17	79.00	.34
18	77.00	.20
19	77.00	.20
20	77.00	.20

SPSS Data Editor window showing *z* scores obtained using the Compute statement (first 20 cases).

```
DESCRIPTIVES
  VARIABLES=test  /SAVE
  /STATISTICS=MEAN STDDEV VARIANCE RANGE MIN MAX .
```

Descriptives

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
TEST	36	53.00	39.00	92.00	74.3333	13.6403	186.057
Valid N (listwise)	36						

SPSS Data Editor window showing *z* scores computed using the Compute statement and using the *z*-score output option for the Descriptives procedure.

	test	testz	ztest
1	92.00	1.30	1.29518
2	91.00	1.22	1.22187
3	88.00	1.00	1.00193
4	88.00	1.00	1.00193
5	88.00	1.00	1.00193
6	87.00	.93	.92862
7	87.00	.93	.92862
8	87.00	.93	.92862
9	81.00	.49	.48875
10	81.00	.49	.48875
11	81.00	.49	.48875
12	81.00	.49	.48875
13	79.00	.34	.34212
14	79.00	.34	.34212
15	79.00	.34	.34212
16	79.00	.34	.34212
17	79.00	.34	.34212
18	77.00	.20	.19550
19	77.00	.20	.19550
20	77.00	.20	.19550

Exercises Using SPSS without the visual cues:

1. **Using the data from the problem below, use the SPSS Descriptives procedure to obtain the mean, standard deviation, variance, and *z* scores for each score.**
2. **Using the same data and the necessary statistics from the previous exercise, employ the SPSS**

Compute procedure to calculate *z*scores again for each score. Use correctz as the target variable name.

In a logic course, 23 students are given 10 word-analogy problems to solve in 5 minutes. The number of problems correctly solved is recorded for each student. The data are as follows:

X	*f*
10	1
9	2
8	1
7	4
6	6
5	5
4	2
3	1
2	1