1. A little history

Gauss – "the law of errors"

Quetelet – applying "the law of errors" to human populations and changes it to the "normal" curve

2. The Standard Normal Distribution – An Ideal Model (table A 82-83 handout)

Used to approximate or describe histograms of many (but not every) types of data. Properties are:

a. Symmetric, bell-shaped, the "bell curve", see page 86-87 of your textbook.

b. Mean 0, SD 1

c. The median is where 50% (half) of the observations are on either side. In this distribution, the mean is equal to the median. The values on the horizontal axis are called "Z SCORES" or "STANDARD UNITS". Values of Z above the average are positive, values of Z below the average are negative.

d. Area under the curve is equal to 100% when expressed as a percentage. The shaded area under the curve represents the percentages of the observations in your data to the left of given values of Z.

e. 68%-95%-99.7% rule (see p. 87) About 68% fall within plus or minus 1 SD of the mean About 95% fall within plus or minus 2 SD of the mean Nearly 100% (99.7%) fall within plus or minus 3 SD

f. The curve never crosses the horizontal axis, it gets very close at the extremes though. It extends to negative and positive infinity.

3. Standard (Deviation) Units – The Normal as a "ruler"

$$z = \frac{(\text{value of interest} - \text{average of all the values})}{\text{standard deviation of all the values}} = \frac{y - \mu}{\sigma}$$ *(page 86)*

you can call this a "normal calculation"

4. Examples of the use of Standard (DEVIATION) Units

Law School Admissions Test scores are normally distributed with a mean of 150 and standard deviation of 10. It's range is 120-180. When last reported, the typical law student at Yale (the #1 law school) had an LSAT score of 171. We could express that in Z scores to give us a sense of "how high"

$$z = \frac{(171-150)}{10} = \frac{21}{10} = 2.10$$

or the typical Yale law student has a Z score of 2.10. This student is 2.10 standard deviations above average in their LSAT score. He or she scored higher than or 98.21% of all LSAT test takers. See Appendix E page A-83,

look up 2.1, go to the first column (labeled "0.00") and focus on the 98.21. The 98.21 is the shaded area or the total area (percentage) to the left of value 2.10.

Regular consideration for admission to law school is usually an LSAT of about 141 or higher at most schools. A student with a 141

$$z = \frac{(141-150)}{10} = \frac{-9}{10} = -0.90$$

and the z score is associated with the number .1841 from the table. We note a few things

- This student scored higher than 18.41% of all LSAT test takers.
- This person is 9/10ths of a standard deviation BELOW average.
- The 30 point difference is 3 standard deviations (a standard deviation is 10 points in this context) it is the same as the difference in the two Z scores 2.10 - -.90 = 3.0. Remember a Z score is a standard (deviation) unit.
- There are 98.21%-18.41% = 79.8% of all LSAT test takers are between the two at this particular section of the normal curve.