http://research.med.umkc.edu/tlwbiostats/variability.html

Computing Standard Deviation

Statistical Indices of Data Variability

Measures of Central Tendency, Mode, Median and Mean, and their Corresponding Measures of Spread

Mode:
: The most frequently occurring score. For example, the May QPE scores for Internal Medicine indicated that the score 26.2 was obtained by eight students in the Year 2 class.

Range:
: The spread of scores is indicated by an expression of the difference between the lowest and highest scores. For example, the Internal Medicine scores ranged from 15 percent correct to 43.9 percent correct; therefore, the range was (43.9-15)=28.9 for this data.

Median:
: The midpoint of a distribution, above which half of the scores occurred and below which half of the scores occurred.

Interquartile Range:
: The difference between the score representing the 75th percentile and the score representing the 25th percentile. For example, the 75th percentile of the Internal Medicine data was 32.6 percent correct and the 25th percentile was 24.2 percent correct; therefore, the interquartile range was (32.6-24.2)=8.4 for this data. Thus, 50% of the Year 2 Internal Medicine scores fell within an 8.4 point range.

Mean:
: More accurately called the arithmetic mean, it is defined as the sum of scores divided by the number of scores. Or, put in other terms, the mean is the sum of measures observed divided by the number of observations.

Standard Deviation:
: The standard deviation is the square root of the average squared deviation from the mean. The standard deviation of the Year 2 Internal Medicine scores was 6.9; therefore, we can conclude that 68% of the class fell within plus or minus 6.9 points of the mean.

Understanding the Standard Deviation

Calculating the Standard Deviation

Computers are used extensively for calculating the standard deviation and other statistics. This course illustrates the use of computer software,JMP IN, to make statistical calculations. Two methods of calculating the standard deviation are desribed in order to elucidate the mathematics involved.

The deviation method is considered first, since it closely parallels the concept of standard deviation. The raw score method is presented as a convenient computation alternative.

Deviation method for calculating standard deviation

Consider the observations 8,25,7,5,8,3,10,12,9.

1. First, calculate the mean and determine N.
2. Remember, the mean is the sum of scores divided by N where N is the number of scores.
3. Therefore, the mean = (8+25+7+5+8+3+10+12+9) / 9 or 9.67
4. Then, calculate the standard deviation as illustrated below.

```
                            squared
score   mean    deviation*   deviation   *deviation from mean=score-mean
 8      9.67    - 1.67         2.79
25      9.67    +15.33       235.01
 7      9.67    - 2.67         7.13
 5      9.67    - 4.67        21.81
 8      9.67    - 1.67         2.79
 3      9.67    - 6.67        44.49
10      9.67    +  .33          .11
12      9.67    + 2.33         5.43
 9      9.67    -  .67          .45
        sum of squared dev=  320.01

Standard Deviation = Square root(sum of squared deviations / (N-1)
                   = Square root(320.01/(9-1))
                   = Square root(40)
                   = 6.32
```

Raw score method for calculating standard deviation

Again, consider the observations 8,25,7,5,8,3,10,12,9.

1. First, square each of the scores.
2. Determine N, which is the number of scores.
3. Compute the sum of X and the sum of Xsquared.
4. Then, calculate the standard deviation as illustrated below.

```
      score(X)   Xsquared
        8           64
       25          625
        7           49                N = 9
        5           25
        8           64         sum of X = 87
        3            9
       10          100   sum of Xsquared = 1161
       12          144
        9           81
       ---         ----
       87          1161

Standard Deviation = square root of[ (sum of Xsquared -((sum of X)*(sum of X)/N))/ (N-1)) ]
                   = square root[(1161)-(87*87)/9)/(9-1)]
                   = square root[(1161-(7569/9)/8)]
                   = square root[(1161-841)/8]
                   = square root[320/8]
                   = square root[40]
                   = 6.32
```

Well, we are all glad that we have computer software like JMP IN to make statistical calculations. Even simple statistics, such as the standard deviation, are tedious to calculate "by hand".