

## Factor Analysis

The sample factor analysis completed below utilizes a data set labeled CANSAS.LAZ. The canonical factor analysis method was used and the varimax rotation method was used.

Shown below is the factor analysis form selected by choosing the factor analysis option under the Statistics / Multivariate menu:

**Factor Analysis**

Available Variables:

Selected Variables:

- weight
- waist
- pulse
- chins
- situps
- jumps

Type of Analysis:

- ☐ Principal Components
- ☐ Parital Image (No Iterations)
- ☐ Gultman Image
- ☐ Harris Scaled Image
- ☒ Canonical (Max. Likelihood)
- ☐ Alpha
- ☐ Principal Factors

Rotation Options:

- ☒ Varimax
- ☐ Oblimax
- ☐ Quartimax
- ☐ Manual (Graphical)
- ☐ Procrustean
- ☐ NO rotation

Output Options:

- ☐ Descriptive Statistics
- ☒ Scree Plot
- ☐ Save Cor. Matrix
- ☐ Correlation Matrix
- ☒ Communalities
- ☐ Save Factor Matrix
- ☒ Unrotated Factors
- ☒ Plot Factors
- ☐ Sort Factors
- ☒ Percent Trace
- ☒ Factor Score:

Min. root size to rotate: 1

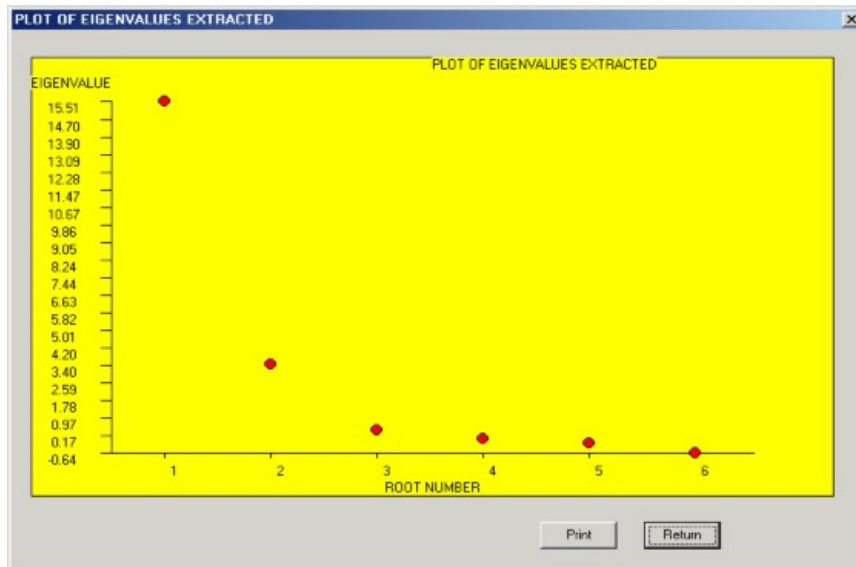
Maximum Iterations: 25

Max. No. Factors:

Reset Cancel Compute Return

**Figure 1. Factor Analysis Dialog**

Note the options elected in the above form. The results obtained are shown below:



**Figure 2. Scree Plot of Eigenvalues**

#### Factor Analysis

See Rummel, R.J., Applied Factor Analysis  
Northwestern University Press, 1970

#### Canonical Factor Analysis

Original matrix trace = 18.56

Roots (Eigenvalues) Extracted:

```

1 15.512
2  3.455
3  0.405
4  0.010
5 -0.185
6 -0.641

```

#### Unrotated Factor Loadings

FACTORS with 20 valid cases.

| Variables | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 |
|-----------|----------|----------|----------|----------|----------|
| weight    | 0.858    | -0.286   | 0.157    | -0.006   | 0.000    |
| waist     | 0.928    | -0.201   | -0.066   | -0.003   | 0.000    |
| pulse     | -0.360   | 0.149    | -0.044   | -0.089   | 0.000    |
| chins     | -0.644   | -0.382   | 0.195    | 0.009    | 0.000    |
| situps    | -0.770   | -0.472   | 0.057    | -0.009   | 0.000    |
| jumps     | -0.409   | -0.689   | -0.222   | 0.005    | 0.000    |

| Variables | Factor 6 |
|-----------|----------|
| weight    | 0.000    |
| waist     | 0.000    |
| pulse     | 0.000    |

|        |       |
|--------|-------|
| chins  | 0.000 |
| situps | 0.000 |
| jumps  | 0.000 |

Percent of Trace In Each Root:

|           |        |          |        |            |        |
|-----------|--------|----------|--------|------------|--------|
| 1 Root := | 15.512 | Trace := | 18.557 | Percent := | 83.593 |
| 2 Root := | 3.455  | Trace := | 18.557 | Percent := | 18.621 |
| 3 Root := | 0.405  | Trace := | 18.557 | Percent := | 2.180  |
| 4 Root := | 0.010  | Trace := | 18.557 | Percent := | 0.055  |
| 5 Root := | -0.185 | Trace := | 18.557 | Percent := | -0.995 |
| 6 Root := | -0.641 | Trace := | 18.557 | Percent := | -3.455 |

COMMUNALITY ESTIMATES

|          |       |
|----------|-------|
| 1 weight | 0.844 |
| 2 waist  | 0.906 |
| 3 pulse  | 0.162 |
| 4 chins  | 0.598 |
| 5 situps | 0.819 |
| 6 jumps  | 0.692 |

Proportion of variance in unrotated factors

|   |        |
|---|--------|
| 1 | 48.364 |
| 2 | 16.475 |

Communality Estimates as percentages:

|   |        |
|---|--------|
| 1 | 81.893 |
| 2 | 90.153 |
| 3 | 15.165 |
| 4 | 56.003 |
| 5 | 81.607 |
| 6 | 64.217 |

Varimax Rotated Loadings with 20 valid cases.

Variables

|        | Factor 1 | Factor 2 |
|--------|----------|----------|
| weight | -0.882   | -0.201   |
| waist  | -0.898   | -0.310   |
| pulse  | 0.385    | 0.059    |
| chins  | 0.352    | 0.660    |
| situps | 0.413    | 0.803    |
| jumps  | -0.009   | 0.801    |

Percent of Variation in Rotated Factors

|        |   |        |
|--------|---|--------|
| Factor | 1 | 33.776 |
| Factor | 2 | 31.064 |

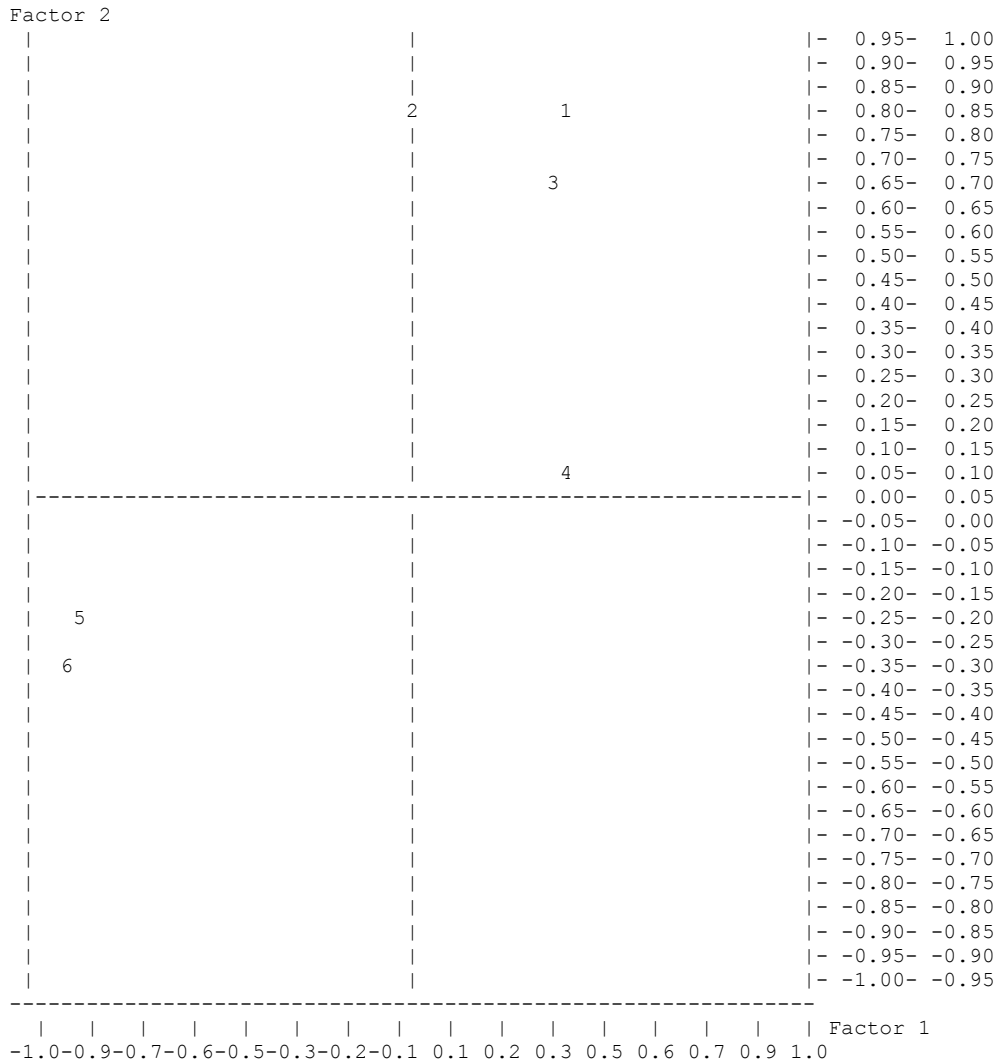
Total Percent of Variance in Factors : 64.840

Communalities as Percentages

|       |        |        |
|-------|--------|--------|
| 1 for | weight | 81.893 |
|-------|--------|--------|

|       |        |        |
|-------|--------|--------|
| 2 for | waist  | 90.153 |
| 3 for | pulse  | 15.165 |
| 4 for | chins  | 56.003 |
| 5 for | situps | 81.607 |
| 6 for | jumps  | 64.217 |

# SCATTERPLOT - FACTOR PLOT



## Labels:

1 = situps  
 2 = jumps  
 3 = chins  
 4 = pulse  
 5 = weight  
 6 = waist

## SUBJECT FACTOR SCORE RESULTS:

Regression Coefficients with 20 valid cases.

| Variables | Factor 1 | Factor 2 |
|-----------|----------|----------|
| weight    | -0.418   | 0.150    |
| waist     | -0.608   | 0.080    |
| pulse     | 0.042    | -0.020   |
| chins     | -0.024   | 0.203    |
| situps    | -0.069   | 0.526    |
| jumps     | -0.163   | 0.399    |

Standard Error of Factor Scores:

Factor 1     0.946  
Factor 2     0.905

We note that two factors were extracted with eigenvalues greater than 1.0 and when rotated indicate that the three body measurements appear to load on one factor and that the performance measures load on the second factor. The data grid also now contains the “least-squares” factor scores for each subject. Hummm! I wonder what a hierarchical grouping of these subjects on the two factor scores would produce!