EDMS 657

Assignment 1: Foundations of factor analysis

1) The dean of Southeastern State University is interested in the relation between students' grades and their part-time work. Data from 14 students who hold part-time jobs were collected on number of hours worked per week (X) and last semester's grade-point average (Y).

X Y

18 3.2

7 3.2

27 2.4

10 3.5

13 3.1

17 2.9

19 2.7

22 2.1

18 3.0

22 2.5

15 3.3

26 2.3

19 2.3

32 1.8

a) Using the method of choice (e.g., hand work, spreadsheet, SPSS), compute the variances of X and Y. Also compute their covariance and their correlation. Show work or paste results. Then write out your answers all together. [3 points]

b) If one were able to plot the standardized variable vectors ZX and ZY in person space, what would be the angle between those two vectors? Show your work. [1 point]

2) If two standardized variable vectors have an angle of 85 degrees between them when plotted in person space, what is the correlation between the two variables? Why does this make sense, logically? [2 points]

3) Taking a geometric approach (e.g., shish kebob skewers in styrofoam balls, pencils in an apple, etc.), which of the following values is NOT possible for r32 given that r21=−0.9 and r31=0.1? Explain.

[2 points]

−0.2 0.0 0.2 0.8

4) Imagine that the SATV (verbal) test scores have a published reliability coefficient of .80, and that the SATM (math) scores have a published reliability coefficient of .90. The observed correlation between SATM and SATV scores is .50. What correlation would we expect between true verbal ability and true math ability if we could measure true verbal ability and true math ability directly?

What would we expect the correlation to be between SATV scores and true verbal ability? [3 points]

5) Imagine that the Maryland state assessment of reading ability has four subtests to it, correlating in the matrix as follows:

V1 V2 V3 V4

1.00

.38 1.00

.42 .53 1.00

.28 .47 .44 1.00

a) Assume that these four tests all attempt to measure (i.e., are influenced by) the same underlying latent skill, and then have unique skills associated with each. Draw a path diagram representing this theory. [2 points]

b) Using Spearman's method of triads, estimate the standardized effect of true reading ability on

V1, on V2, on V3, and on V4 (i.e., the correlation between true reading ability and test scores on each of V1, V2, V3, and V4). [4 points]

c) Based on your triad solution, determine the reproduced correlation matrix and the residual correlation matrix. [3 points]