Project 8

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Use the probe word data of Table 3.6. Conduct a confirmatory factor analysis of the covariance matrix forthe five variables. Use maximum likelihood to determine if the five word probes can be adequately modeled using a single latent factor. In formulating the model, identifiability can be ensured by letting y1 = f1 +e1, yi = lif1 +ei(i=2,3,4,5).

(a) Assess goodness of fit with the criteria discussed in Section 14.3.3.

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```
word <- read.csv("C:\\Users\\Taterthot\\Desktop\\da 410\\a9\\words.csv", fileEncoding = 'UTF-8-B
OM')
```

```
Warning message:
R graphics engine version 14 is not supported by this version of RStudio. The Plots tab will be
disabled until a newer version of RStudio is installed.
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```
word
```

y1 <int>	y2 <int>	y3 <int>	y4 <int>	y5 <int>
51	36	50	35	42
27	20	26	17	27
37	22	41	37	30
42	36	32	34	27
27	18	33	14	29
43	32	43	35	40
41	22	36	25	38
38	21	31	20	16
36	23	27	25	28
26	31	31	32	36

1-10 of 11 rows   Previous **1** 2 Next

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```
library(lavaan)

lm <- 'f =~  NA*y1 + y2 + y3 + y4 + y5
       f ~~ 1*f
'


cfa_word <- cfa(lm, data=word, estimator = "ML")

summary(cfa_word, fit.measures=TRUE)
```

```
lavaan 0.6-8 ended normally after 17 iterations

  Estimator                                        ML
  Optimization method                          NLMINB
  Number of model parameters                       10

  Number of observations                           11

Model Test User Model:

  Test statistic                                7.239
  Degrees of freedom                                5
  P-value (Chi-square)                          0.203

Model Test Baseline Model:

  Test statistic                               35.158
  Degrees of freedom                               10
  P-value                                       0.000

User Model versus Baseline Model:

  Comparative Fit Index (CFI)                   0.911
  Tucker-Lewis Index (TLI)                      0.822

Loglikelihood and Information Criteria:

  Loglikelihood user model (H0)              -173.201
  Loglikelihood unrestricted model (H1)      -169.581

  Akaike (AIC)                                366.401
  Bayesian (BIC)                              370.380
  Sample-size adjusted Bayesian (BIC)         340.270

Root Mean Square Error of Approximation:

  RMSEA                                         0.202
  90 Percent confidence interval - lower        0.000
  90 Percent confidence interval - upper        0.498
  P-value RMSEA <= 0.05                         0.217

Standardized Root Mean Square Residual:

  SRMR                                          0.071

Parameter Estimates:

  Standard errors                            Standard
  Information                                Expected
  Information saturated (h1) model         Structured

Latent Variables:
                   Estimate  Std.Err  z-value  P(>|z|)
```

```
  f =~
    y1                    6.092    2.014    3.024    0.002
    y2                    4.974    1.717    2.897    0.004
    y3                    6.320    1.878    3.366    0.001
    y4                    5.878    1.995    2.947    0.003
    y5                    5.067    2.004    2.529    0.011

Variances:
                    Estimate  Std.Err  z-value  P(>|z|)
    f                  1.000
   .y1                22.065   11.942    1.848    0.065
   .y2                17.146    8.928    1.921    0.055
   .y3                15.229    9.708    1.569    0.117
   .y4                22.556   11.913    1.893    0.058
   .y5                27.252   13.159    2.071    0.038
```

The chi squared statistic being 7.239 with a degrees of freedom of 5, based on 11 unique elements in S in our model. Thus, the p value associated with the hypothesis is 0.203, and we determine that we have insufficient evidence to declare lack of fit. The addition diagnostic metrics yield a mixed verdict about the goodness of fit for the proper model. Bentler's CFI is 0.911 less than the recommended cutoff of 0.95, SRMS value being 0.071 is less than but close to the recommended upper cutoff of 0.080, while the RMSEA is 0.202 being less than the cut off of 0.06. All in all the model still has a good fit.