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PERFORMANCE IN THE SWEDISH SCHOLASTIC
APTITUDE TEST:
Structural Stability Across Background Variables

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ABSTRACT

This paper examines the first three subtests in the Swedish Scholastic Aptitude Test (*Högskoleprovet*) with respect to structural stability across three background variables namely sex, age and educational level of examinees. Analysis of results from the October 1991-test[+] by means of LISREL models shows that while the structure in general, and the error variances in particular, are stable across age groups and educational levels, the factor structure and particularly the factor correlations differ between males and females. Overall the findings of the paper challenge the traditional method of evaluation which is based on the total number of correct scores.

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1. INTRODUCTION

Men and women make different transitions in their life-cycles. The transition from a high-school into a college or a university; from a single status to marriage; from unemployed status to employment are few of the many life-cycle transitions made in the movement from adolescence to adulthood. Understanding the determinants of such transitions and their patterns across background factors, therefore, is an important step towards the development of a theory of such transitions.

Scholastic Aptitude Tests (SAT) of the type administered by the Educational Testing Service (ETS) in New Jersey (USA) have been used by universities and colleges in US and other countries as one of the standard means of selecting among candidates seeking admission to institutions of higher learning.

Since 1977 a similar test, the Swedish Scholastic Aptitude Test has been in use for selection among applicants to colleges and universities in Sweden. When it came into existence as part of the reform of the university system in Sweden, it was thought that it would provide a possible solution to two basic problems:

  i) how to find a method of selection which could be used in the case of applicants who do not have formal qualifications.

  ii) how to reduce the decisive role played by grades in the selection process.

When the test was introduced it was, however, only made available to certain relatively small groups of applicants (mainly those who fulfil the criteria of being at least 25 years old, and having at least 4 years of work experience). From 1991, however, the test is 'expected' to play a much more important role in the selection of students into the university-level educations. (See Gustafsson, Wedman & Westerlund, 1992 and references therein).

The Swedish Scholastic Aptitude Test (**SweSAT**; or '*Hogskol-eprovet*' in Swedish) consists of 6 subtests which measure both verbal and nonverbal abilities, the capacity to make use of information, and knowledge of a general character (For details see Gustafsson & Holmberg, 1992; Gustafsson et al., 1992). These

subtests, all with multiple-choice items are summarized in table 1 below, together with the number of items they contain and the testing time allotted for each.

The test is conducted twice a year (in May for the spring semester and October for the autumn semester) and takes place at the same time all over Sweden and always on a Saturday.

Table 1. The composition of the Swedish Scholastic Aptitude Test

Type of test	Abbreviation	No. of items	Testing Time
Vocabulary	WORD	30	15 min.
Data Sufficiency	DATA	20	40 min.
Reading Comprehension	READ	24	50 min.
Interpretation of Diag.			
Tables and Maps	DTM	20	50 min.
General Information	GI	30	30 min.
Study Techniques	STECH	20	50 min.
Total		144	3 hrs. 55 min.

Source: Gustafsson & Holmberg, 1992, page 194. (DATA appears as DS)

2. PURPOSE OF THE PRESENT STUDY

As mentioned above one of the motives for introducing the Swedish Scholastic Aptitude Test was to find a method of selection from applicants for higher education. To this end, candidates' performance in each subtest (and hence his/her overall performance) has been assessed on the basis of the sum of correct answers in each subtest (and on the total sum of correct answers out of the total 144 items).

This approach of evaluation makes the tacit assumption that all items (at least those in the same subtest) have equal level of difficulty; an assumption that is hardly warranted in real-life situations. If some of the items (questions) are highly correlated, a situation that is not uncommon, the total of correct answers is a poor indicator of performance. Instead a weighted sum of a subset of representative indicators for each subtest must be sought.

Recently, Gebrenegus (1992) has explored issues of this nature by selecting 4 items from each of the first three subtests in the Swedish Scholastic Aptitude Test (SweSAT) of October 26, 1991, as indicators of their respective factors or abilities (WORD, DATA and READ respectively) and examining the reliability of the indicators. Further, the dimensionality issue has been assessed in a confirmatory factor analysis framework, and methodological differences in the analysis of ordinal data have been demonstrated.

Apart from its failure to offer a substantive explanation for the selection of the indicators, the above-mentioned study has conveyed only a partial picture of the story since the background factors age, sex and educational level were excluded from the analysis. This was partly dictated by the very nature of the model; it was difficult to include attributes such as sex as either causes or effects in the analysis (for details see for instance Bollen, 1989; Holland, 1986). The role of background factors like age, education and family background on academic achievement is, however well recognized and has been reported in many studies (Stage, 1992; Undheim & Nordvik, 1992).

The present analysis does a fair job to accommodate such factors, by partitioning the raw data into smaller data sets according to age, sex and educational level, modeling the factor structures in each data set, and eventually comparing structures in the different data sets. No attempt is, however made at completeness or full rigour. Limited partly by its intent, the present paper does not pretend to present an initial contribution to the literature of modeling intelligence structure. For a review of such studies the reader is referred to Linden (1986), Gustafsson & Holmberg (1992), Gustafsson et al. (1992) and references therein.

The immediate goal here is rather demonstrating one's level of appreciation of at least part of the contents of a short course in Categorical Data Analysis and one's proficiency in the accompanying software. The demonstration in this paper involves illustrating the use of LISREL models (Jöreskog, 1973; Jöreskog & Sörbom, 1989, 1992) in the analysis of data with

ordinal observed variables. Further the utility of the model in the simultaneous analysis of different populations (Jöreskog, 1971) is demonstrated. Apart from estimating structural coefficients, error variances and factor correlations in each model the present study explores the extent to which these coefficients and correlations remain stable across different categories of examinees.

The next section deals with the nature and source of the data set. In Section 4 we briefly describe the method used to analyse the data set. Section 5 is devoted to presentation and discussion of the results. The final section summarizes the findings of the paper.

3. THE DATA SET

The data on which our analysis is based come from the Swedish Scholastic Aptitude Test conducted on October 26, 1991. From about 50,000 candidates who sat for the test (the number of registered applicants was about 70,000) a systematic sample of 1059 participants was selected (by selecting every 50th participant). For each participant information was extracted on each of the following 15 variables: (See also Stage, 1992).

1. **Age** with 5 levels (1: < 21 years; 2: 21-24 years; 3: 25-29 years; 4: 30-39 years; 5: > 40 years).
2. **Sex (Gender)** with 2 levels (1: Male; 2: Female)
3. **Educational level** with 7 levels (1: Comprehensive school; 2: Public high school; 3: Upper secondary school; max. 2 years; 4. Vocational school; max. 3 years; 5. Upper secondary school; > 2 years; 6. Higher education; max. 2 years; 7. Higher education; > 2 years)
4. **WORD13**: 13th item in part-I (Vocabulary) of the test.
5. **WORD17**: 17th item in part-I (Vocabulary) of the test.
6. **WORD21**: 21st item in part-I (Vocabulary) of the test.
7. **WORD22**: 22nd item in part-I (Vocabulary) of the test.
8. **DATAS2**: 2nd item in part-II (Data Suffic.) of the test.
9. **DATAS8**: 8th item in part-II (Data Suffic.) of the test.
10. **DATAS14**: 14th item in part-II (Data Suffic.) of the test.

11. **DATAS18**: 18th item in part-II (Data Suffic.) of the test.
12. **READ3**: 3rd item in part-III (Reading) of the test.
13. **READ9**: 9th item in part-III (Reading) of the test.
14. **READ20**: 20th item in part-III (Reading) of the test.
15. **READ23**: 23rd item in part-III (Reading) of the test.

For each of variables 4-15 (for each of the selected items in the first three subtests) a '1' in the input data represents a correct answer and a '0' indicates an incorrect answer.

The complete set of data is saved in a form of (1059 x 15) matrix (15 columns of variables for each of the 1059 selected participants) in a data file called **SWESAT.RAW** which is available (in diskette) from the author. Later some of the levels in the age and educational level factors were combined (collapsed) to give a smaller and feasible number of levels in each factor. It is to be noted that the variables listed above are all measured in the ordinal scale. (we recall that interval and ratio data meet the definitional requirements of ordinal data while the later does not meet the definitional requirements of the former scale.)

4. METHOD OF ANALYSIS

The initial step towards solving the problem at hand involved of using the PRELIS program (Jöreskog & Sörbom, 1986) in order to collapse the levels of age and educational level into a smaller number, compute the matrix of polychoric correlations (Olsson, 1979) among the (ordinal) variables in the new (collapsed) data set and get a summary table of frequencies under different combinations of the variables. In addition the PRELIS program produced (upon request) the matrix of estimates of asymptotic covariances for the polychoric correlations. The inverse of this matrix is used as the weight matrix in applying the Weighted Least Squares method in estimating a LISREL model based on polychoric correlations.

At this stage the levels of the age variable were collapsed (combined) to form only <u>two</u> levels (1: < 21 years; 2: 21+). This was achieved by using the **RE** (REcode) and **SD** (Select and

Delete) options provided by the program. Similar procedure left
the Education variable with only two levels; those with more
than two years of Upper Secondary education and those with other
levels of education. An initial attempt to collapse the Age and
Education variables into three levels each failed because the
sample size in one of the three groups of Education was too
small (70) that Asymptotic variances and covariances could not
be computed. Further, since the Sex variable could be partit-
ioned into only two levels, we have collapsed all three variab-
les into only two levels each for consistency purposes.

The input files for selecting each of the 6 (2 + 2 + 2)
categories and computing the relevant data matrices are saved in
files YOUNG.PRE, OLDER.PRE, MATRIC.PRE, OTHEREDU.PRE, MALES.PRE
AND FEMALES.PRE respectively (see Appendix A), while the
corresponding output files, matrices of polychoric correlations,
and the matrices of their asymptotic covariances are saved in
files called *.OUT, *.COR and *.ACP respectively, where * stands
for the same name as the input file. The .COR and .ACP files
are to be used by the LISREL program later, while the .OUT file
is basically used to give a summary view of the nature of the
data so that data for further analysis can be screened out.

Having obtained the initial input data for LISREL the next
step is to use LISREL program to estimate and test the model. As
mentioned earlier issues of reliability and dimensionality are
not within the scope of this paper. Instead we proceed with
fitting the model in which each set of 4 selected items is
assumed to consist of as pure indicators as possible for the
corresponding factors in each group. (see Figure 1 below). We
recall that one of the aims of measurement models is to screen
out contaminated composite indicators.

A total of 24 nested multi-sample models (8 models for
each of the three variables AGE, EDUC. and SEX) were estimated
and tested. Each set of 8 models consisted of a parent model
(with which other models are to be compared) in which all sets
of parameters are assumed to be equal between groups, and a set
of 7 other models, each relaxing some subsets of the constraints
made in the parent model. Note that in each of the models the
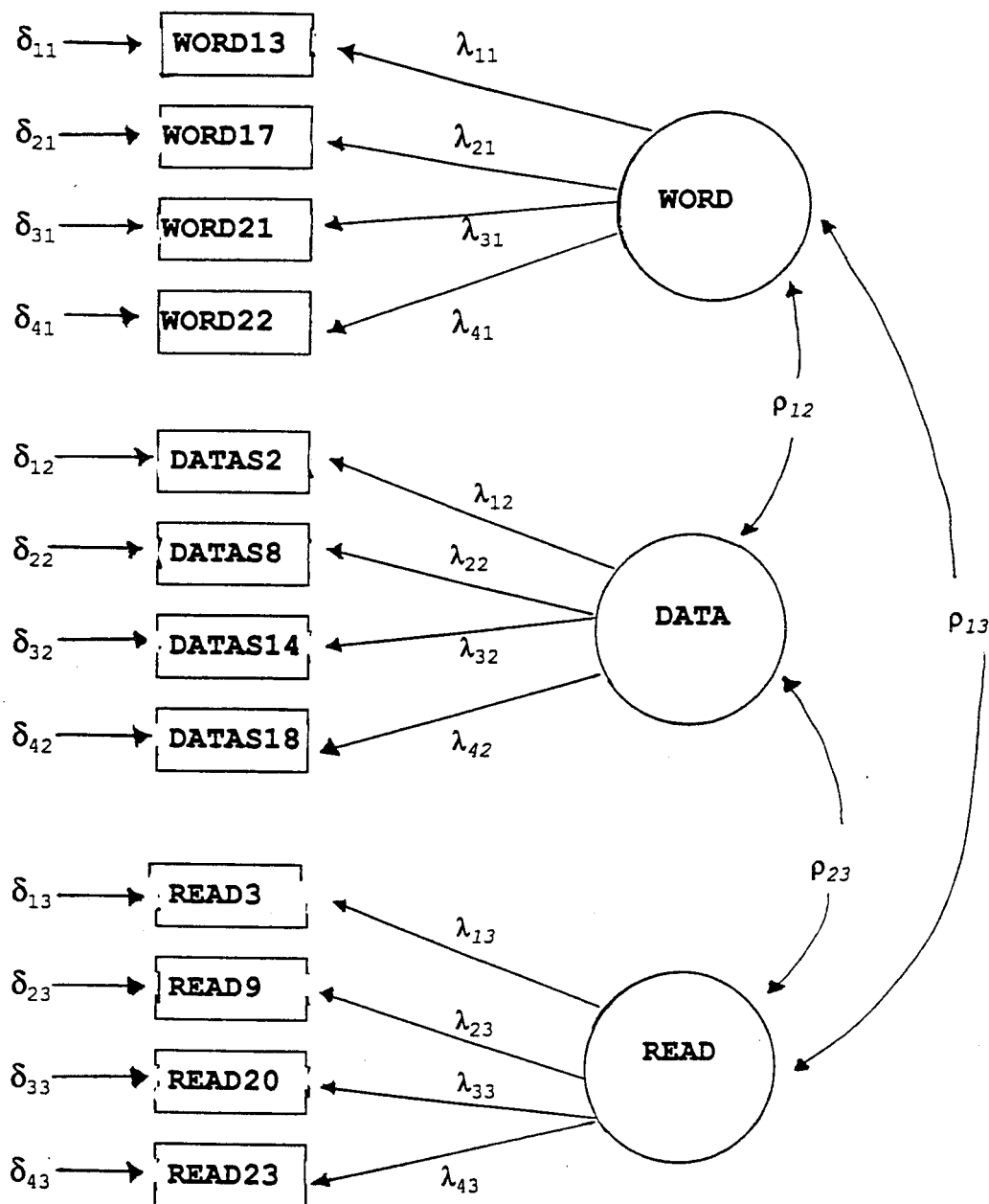
Fig. 1: The 3 one-factor models

two groups are modelled simultaneously. This is one of the properties that make LISREL a powerful analytic method.

The LISREL input files for these purposes are given as files AGE1.LIS,..., AGE8.LIS; EDUC1.LIS,..., EDUC8.LIS; and SEX1.LIS,..., SEX8.LIS. The whole set from the first group and only a sample from the last two sets (EDU1.LIS and EDUC8.LIS from the second and SEX1.LIS and SEX8.LIS from the third set)

are included in Appendix B. We wind up this section by reminding the reader of the following important points.

The input matrix to be analysed has 156 [=2x(12 x 13)/2] elements. From Figure 1, we note that in the absence of any constraint, there are 27 parameters to be estimated in each group (4x3 = 12 factor loadings, 4x3 = 12 error variances and 3 factor correlations). Overall therefore there 54 (= 2x27) parameters to be estimated when none of them is fixed or constrained by a hypothesis.

The difference between the number of elements in the input matrix and the total number of parameters to be estimated, which in the above case is 102 (156-54) is the 'minimum' degrees of freedom. On the other extreme (when all parameters are constrained to be equal in both groups, but there is no fixed parameter in either group), LISREL estimates only the 27 parameters in the first group. This gives the 'maximum' possible degrees of freedom of 129 (156 - 27).

As the models analysed in this study fall somewhere between these two extremes, the corresponding degrees of freedom will fluctuate between 102 and 129 with a maximum difference of 27. We shall make use of these facts without further discussion in the next section.

5. THE RESULTS

The output files from LISREL are usually too large to be fully included here. To get a general picture of the output files, however, we have included in Appendix C, a feasible extract of the most relevant information from two output files of each set of the models. The selected files are AGE1.OUT and AGE8.OUT from the first set, EDUC1.OUT and EDUC8.OUT from the second set, and SEX1.OUT and SEX8.OUT from the last set. Recall that each set consists of eight output files.

Table 2 below gives a summary of the findings from the 24 models. Each of the three panels in the table begins with a model in which all of the parameters are constrained to be equal (none is free to vary) between the two groups, and ends with a model in which all parameters are free to vary between groups.

Table 2: Chi-Square values, degrees of freedom and corresponding p-values under different nested (hierarchical) models which allow selected sets of parameters to vary between groups of populations.[a]

Variable	Varying Parameters	Chi-Square	d.f.	Reduction in Chi-Square[b]	Reduction in d.f.	p-value of Reduction
AGE	None	192.63	129	–	–	–
	Loadings	176.64	117	15.99	12	.190
	Correlations	186.74	126	5.89	3	.120
	Error Var.	192.63	117	0.00	12	1.000
	Load. & Corr.	171.15	114	21.48	15	.120
	Load. & Var.	156.19	105	36.44	24	.050
	Corr. & Var.	186.74	114	5.89	15	.980
	All 3 sets	149.79	102	42.84[c]	27	.027
EDUC.	None	200.46	129	–	–	–
	Loadings	180.01	117	20.45	12	.059
	Correlations	199.84	126	0.62	3	.890
	Error Var.	200.46	117	0.00	12	1.000
	Load. & Corr.	179.51	114	20.95	15	.140
	Load. & Var.	159.01	105	41.45[c]	24	.015
	Corr. & Var.	199.84	114	0.62	15	1.000
	All 3 sets	158.00	102	42.46[c]	27	.030
SEX	None	218.82	129	–	–	–
	Loadings	200.33	117	18.49	12	.100
	Correlations	198.19	126	20.63[d]	3	.00013
	Error Var.	218.82	117	0.00	12	1.000
	Load. & Corr.	181.28	114	37.58[d]	15	.0010
	Load. & Var.	169.32	105	49.50[d]	24	.0016
	Corr. & Var.	198.19	114	20.63	15	.150
	All 3 sets	153.66	102	65.16[d]	27	.0000

a Population Groups:

Variable	Group 1	Group 2
AGE	< 21 Yrs.	21+ Yrs.
EDUC.	Upper Secondary, > 2 Yrs.	Other Educ. levels
SEX	Males	Females

b In each of the three panels of the table, the columns on 'Reduction in Chi-square' and 'Reduction in d.f.' (degrees of freedom) are obtained by subtracting the corresponding values of each model from that of the first model in which none of the 3 sets of parameters is allowed to vary between the two groups.

c Reduction significant at 5% significance level.
d Reduction significant at 1% significance level.

At this stage it is worth mentioning that while in tradit-
ional goodness of fit tests, a good fit is associated with a
smaller values of Chi-square (larger p-values); it is the
difference in Chi-square values (Reductions in Chi-square) that
we are assessing in Table 2. Here therefore, a good contribution
to the fit of the model is associated with a larger reduction in
Chi-square (and hence smaller p-values).

A close look at the top panel of the table shows that
freeing any set or any combination of the sets of parameters
does not lead to any significant improvement in the fit of the
model, though freeing all parameters makes a marginally
significant improvement. Free factor loadings combined with free
error variances also makes a marginal contribution in reducing
the Chi-square.

As opposed to age pattern the pattern across educational
level shows that factor correlations are more stable across
educational groups. The other patterns are not much different
from those across age groups.

The third panel of Table 2 shows interesting results.
Factor correlations, which have been stable across age and
educational groups, are now highly unstable between males and
females. More interesting is the fact that while freeing factor
loadings alone does not help much, significant reduction in Chi-
square is gained when this is combined with freeing either
factor correlations, error variances or both. The degree of
structural instability is stronger among sex (gender) groups
than among any of the other two subgroups.

A point worth emphasizing is the finding that error
variances alone are entirely stable over all subgroups.

The search for the 'best' model was not among our primary
objectives. Therefore, we have not proceeded further in fitting
other models. It is however, worth mentioning that the modific-
ation indices (Sörbom, 1989) in almost all models suggest, among
other things, that an improvement in the fit of the models could
be gained by treating some indicators as composite rather than
pure. The assumption we made right at the outset may therefore

be unwarranted. Interpretation of the coefficients under the various models should therefore be made with caution.

6. SUMMARY

Previous studies (Stage, 1992) have attempted to invest-igate the importance of age and education on sex (gender) diff-erences in the performance of tests of the type considered in the present study. Though such an investigation is beyond the immediate goal of this paper, we have attempted to examine if the set of three one-factor model of section 4 is consistent across subgroups classified according to age, education and sex.

To achieve our task, we have used the LISREL model to simultaneously analyse the different subgroups. The results show that variances of measurement errors are consistently the same across all subgroups considered in the study. On the other hand the correlations between the factors (true abilities) are stable across both age groups and educational groups but vary signif-icantly across sex. Factor loadings are less stable across educational groups as should be expected. The joint effect of any combinations of these three issues on the stability of the structure should, of course, depend upon the relative strength of the constituent elements.

As a final remark we emphasize that, if tests are to provide the expected type of solution as discussed in the introduction, one should take into account issues of structural stability across population subgroups, in making evaluations, rather than implementing traditional methods which are merely based on the total of correct scores.

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APPENDIX A: *PRELIS* INPUT FILES FOR COLLAPSING FACTOR-
LEVELS, COMPUTING MATRICES OF POLYCHORIC
CORRELATION COEFFICIENTS AND THE CORRESPONDING
MATRICES OF ASYMPTOTIC COVARIANCES.

```
        FILE: YOUNG.PRE
        COMPUTING POLYCHORIC CORRELATIONS FOR THE YOUNGEST ONLY
DA NI=15
LA
        AGE SEX EDUC WORD13 WORD17 WORD21 WORD22 DATAS2
        DATAS8 DATAS14 DATAS18 READ3 READ9 READ20 READ23
RA=SWESAT.RAW
RE AGE OLD=2-5 NEW=2
SD AGE = 1
OU MA=PM SM=YOUNG.COR SA=YOUNG.ACP PA


        FILE: OLDER.PRE
        COMPUTING POLYCHORIC CORRELATIONS FOR THE OLDER-AGES
        (21 YEARS AND ABOVE) ONLY
DA NI=15
LA
        AGE SEX EDUC WORD13 WORD17 WORD21 WORD22 DATAS2
        DATAS8 DATAS14 DATAS18 READ3 READ9 READ20 READ23
RA=SWESAT.RAW
RE AGE OLD=2-5 NEW=2
SD AGE=2
OU MA=PM SM=OLDER.COR SA=OLDER.ACP PA


        FILE: MATRIC.PRE
        COMPUTING POLYCHORIC CORRELATIONS FOR THOSE IN UPPER-
        SECONDARY 2+ YEARS, ONLY
DA NI=15
LA
        AGE SEX EDUC WORD13 WORD17 WORD21 WORD22 DATAS2
        DATAS8 DATAS14 DATAS18 READ3 READ9 READ20 READ23
RA=SWESAT.RAW
RE EDUC OLD=1-4 NEW=2
RE EDUC OLD=5 NEW=1
RE EDUC OLD=6-8 NEW=2
SD EDUC=1
OU MA=PM SM=MATRIC.COR SA=MATRIC.ACP PA


        FILE: OTHEREDU.PRE
        COMPUTING POLYCHORIC CORRELATIONS FOR THE OTHER
        LEVELS OF EDUCATION ONLY
DA NI=15
LA
        AGE SEX EDUC WORD13 WORD17 WORD21 WORD22 DATAS2
        DATAS8 DATAS14 DATAS18 READ3 READ9 READ20 READ23
RA=SWESAT.RAW
RE EDUC OLD=5 NEW=1
RE EDUC OLD=1-4 NEW=2
RE EDUC OLD=6-8 NEW=2
```

```
SD EDUC=2
OU MA=PM SM=OTHEREDU.COR SA=OTHEREDU.ACP PA
```

FILE: **MALES.PRE**
```
COMPUTING POLYCHORIC CORRELATIONS FOR MALES ONLY
DA NI=15
LA
     AGE SEX EDUC WORD13 WORD17 WORD21 WORD22 DATAS2
     DATAS8 DATAS14 DATAS18 READ3 READ9 READ20 READ23
RA=SWESAT.RAW
SD SEX=1
OU MA=PM SM=MALES.COR SA=MALES.ACP PA
```

FILE: **FEMALES.PRE**
```
COMPUTING POLYCHORIC CORRELATIONS FOR FEMALES ONLY
DA NI=15
LA
     AGE SEX EDUC WORD13 WORD17 WORD21 WORD22 DATAS2
     DATAS8 DATAS14 DATAS18 READ3 READ9 READ20 READ23
RA=SWESAT.RAW
SD SEX=2
OU MA=PM SM=FEMALES.COR SA=FEMALES.ACP PA
```

APPENDIX B: <u>LISREL</u> INPUT FILES FOR SIMULTANEOUS ESTIMATION
<u>AND TESTING OF THE DIFFERENT MODELS, EACH
CONSISTING OF A PAIR OF POPULATIONS</u>.

GROUP 1: YOUNG (< 21 YEARS): TESTING EQUALITY OF FACTOR
STRUCTURES
FILE: **<u>AGE1.LIS</u>** – FACTOR LOADINGS, FACTOR CORRELATION,
ERROR VARIANCES INVARIANT BETWEEN TEEN-
AGERS AND OLDER GROUP
OBSERVED VARIABLES
SEX EDUC WORD13 WORD17 WORD21 WORD22 DATAS2
DATAS8 DATAS14 DATAS18 READ3 READ9 READ20 READ23
CORRELATION MATRIX FROM FILE YOUNG.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE YOUNG.ACP
SAMPLE SIZE=643
LATENT VARIABLES
WORD DATA READ
RELATIONSHIPS:
WORD13-WORD22 = WORD
DATAS2-DATAS18 = DATA
READ3-READ23 = READ

GROUP 2: OLDER (21+ YEARS)
CORRELATION MATRIX FROM FILE OLDER.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE OLDER.ACP
SAMPLE SIZE=416
END OF PROBLEM

GROUP 1: YOUNG (< 21 YEARS): TESTING EQUALITY OF FACTOR
STRUCTURES
FILE: **<u>AGE2.LIS</u>** – FACTOR LOADINGS VARIANT, FACTOR
CORRELATIONS AND ERROR VARIANCES
INVARIANT BETWEEN TEEN-AGERS AND
THE OLDER GROUP
OBSERVED VARIABLES
SEX EDUC WORD13 WORD17 WORD21 WORD22 DATAS2
DATAS8 DATAS14 DATAS18 READ3 READ9 READ20 READ23
CORRELATION MATRIX FROM FILE YOUNG.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE YOUNG.ACP
SAMPLE SIZE=643
LATENT VARIABLES
WORD DATA READ
RELATIONSHIPS:
WORD13-WORD22 = WORD
DATAS2-DATAS18 = DATA
READ3-READ23 = READ

GROUP 2: OLDER (21+ YEARS)
CORRELATION MATRIX FROM FILE OLDER.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE OLDER.ACP

```
SAMPLE SIZE=416
RELATIONSHIPS:
      WORD13-WORD22 = WORD
      DATAS2-DATAS18 = DATA
      READ3-READ23 = READ
END OF PROBLEM



      GROUP 1: YOUNG (< 21 YEARS): TESTING EQUALITY OF FACTOR
                              STRUCTURES
         FILE: AGE3.LIS - FACTOR CORRELATIONS VARIANT, FACTOR
                          LOADINGS AND ERROR VARIANCES INVARIANT
                          BETWEEN TEEN-AGERS AND OLDER GROUP
OBSERVED VARIABLES
      SEX EDUC WORD13 WORD17 WORD21 WORD22 DATAS2
      DATAS8 DATAS14 DATAS18 READ3 READ9 READ20 READ23
CORRELATION MATRIX FROM FILE YOUNG.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE YOUNG.ACP
SAMPLE SIZE=643
LATENT VARIABLES
      WORD DATA READ
RELATIONSHIPS:
      WORD13-WORD22 = WORD
      DATAS2-DATAS18 = DATA
      READ3-READ23  = READ

GROUP 2: OLDER (21+ YEARS)
CORRELATION MATRIX FROM FILE OLDER.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE OLDER.ACP
SAMPLE SIZE=416
SET THE CORRELATION MATRIX OF WORD-READ FREE
END OF PROBLEM



      GROUP 1: YOUNG (< 21 YEARS): TESTING EQUALITY OF FACTOR
                              STRUCTURES
         FILE: AGE4.LIS - ERROR VARIANCES VARY, FACTOR LOADINGS AND
                          FACTOR CORRELATION INVARIANT BETWEEN
                          TEEN-AGERS AND OLDER GROUP
OBSERVED VARIABLES
      SEX EDUC WORD13 WORD17 WORD21 WORD22 DATAS2
      DATAS8 DATAS14 DATAS18 READ3 READ9 READ20 READ23
CORRELATION MATRIX FROM FILE YOUNG.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE YOUNG.ACP
SAMPLE SIZE=643
LATENT VARIABLES
      WORD DATA READ
RELATIONSHIPS:
      WORD13-WORD22 = WORD
      DATAS2-DATAS18 = DATA
      READ3-READ23  = READ
GROUP 2: OLDER (21+ YEARS)
CORRELATION MATRIX FROM FILE OLDER.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE OLDER.ACP
SAMPLE SIZE=416
```

SET THE ERROR VARIANCES OF WORD13-READ23 FREE
END OF PROBLEM

GROUP 1: YOUNG (< 21 YEARS): TESTING EQUALITY OF FACTOR
STRUCTURES
FILE: **AGE5.LIS** - FACTOR LOADINGS AND FACTOR CORRELATION
VARY, ERROR VARIANCES INVARIANT BETWEEN
TEEN-AGERS AND OLDER GROUP
OBSERVED VARIABLES
SEX EDUC WORD13 WORD17 WORD21 WORD22 DATAS2
DATAS8 DATAS14 DATAS18 READ3 READ9 READ20 READ23
CORRELATION MATRIX FROM FILE YOUNG.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE YOUNG.ACP
SAMPLE SIZE=643
LATENT VARIABLES
WORD DATA READ
RELATIONSHIPS:
WORD13-WORD22 = WORD
DATAS2-DATAS18 = DATA
READ3-READ23 = READ

GROUP 2: OLDER (21+ YEARS)
CORRELATION MATRIX FROM FILE OLDER.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE OLDER.ACP
SAMPLE SIZE=416
RELATIONSHIPS:
WORD13-WORD22 = WORD
DATAS2-DATAS18 = DATA
READ3-READ23 = READ
SET THE CORRELATION MATRIX OF WORD-READ FREE
END OF PROBLEM

GROUP 1: YOUNG (< 21 YEARS): TESTING EQUALITY OF FACTOR
STRUCTURES
FILE: **AGE6.LIS** - FACTOR LOADINGS AND ERROR VARIANCES VARY,
FACTOR CORRELATIONS INVARIANT BETWEEN
TEEN-AGERS AND OLDER GROUP
OBSERVED VARIABLES
SEX EDUC WORD13 WORD17 WORD21 WORD22 DATAS2
DATAS8 DATAS14 DATAS18 READ3 READ9 READ20 READ23
CORRELATION MATRIX FROM FILE YOUNG.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE YOUNG.ACP
SAMPLE SIZE=643
LATENT VARIABLES
WORD DATA READ
RELATIONSHIPS:
WORD13-WORD22 = WORD
DATAS2-DATAS18 = DATA
READ3-READ23 = READ

GROUP 2: OLDER (21+ YEARS)
CORRELATION MATRIX FROM FILE OLDER.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE OLDER.ACP
SAMPLE SIZE=416
RELATIONSHIPS:

```
        WORD13-WORD22 = WORD
        DATAS2-DATAS18 = DATA
        READ3-READ23 = READ
SET THE ERROR VARIANCES OF WORD13-READ23 FREE
END OF PROBLEM
```

GROUP 1: YOUNG (< 21 YEARS): TESTING EQUALITY OF FACTOR
                              STRUCTURES
     FILE: **AGE7.LIS** - FACTOR CORRELATIONS AND ERROR VARIANCES
                          VARY, FACTOR LOADINGS INVARIANT BETWEEN
                          TEEN-AGERS AND OLDER GROUP
OBSERVED VARIABLES
        SEX EDUC WORD13 WORD17 WORD21 WORD22 DATAS2
        DATAS8 DATAS14 DATAS18 READ3 READ9 READ20 READ23
CORRELATION MATRIX FROM FILE YOUNG.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE YOUNG.ACP
SAMPLE SIZE=643
LATENT VARIABLES
        WORD DATA READ
RELATIONSHIPS:
        WORD13-WORD22 = WORD
        DATAS2-DATAS18 = DATA
        READ3-READ23 = READ

GROUP 2: OLDER (21+ YEARS)
CORRELATION MATRIX FROM FILE OLDER.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE OLDER.ACP
SAMPLE SIZE=416
SET THE ERROR VARIANCES OF WORD13-READ23 FREE
SET THE CORRELATION MATRIX OF WORD-READ FREE
END OF PROBLEM

GROUP 1: YOUNG (< 21 YEARS): TESTING EQUALITY OF FACTOR
                              STRUCTURES
     FILE: **AGE8.LIS** - FACTOR LOADINGS, FACTOR CORRELATION AND
                          ERROR VARIANCES ALL VARY BETWEEN TEEN-
                          AGERS AND OLDER GROUP
OBSERVED VARIABLES
        SEX EDUC WORD13 WORD17 WORD21 WORD22 DATAS2
        DATAS8 DATAS14 DATAS18 READ3 READ9 READ20 READ23
CORRELATION MATRIX FROM FILE YOUNG.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE YOUNG.ACP
SAMPLE SIZE=643
LATENT VARIABLES
        WORD DATA READ
RELATIONSHIPS:
        WORD13-WORD22 = WORD
        DATAS2-DATAS18 = DATA
        READ3-READ23 = READ

GROUP 2: OLDER (21+ YEARS)
CORRELATION MATRIX FROM FILE OLDER.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE OLDER.ACP

```
SAMPLE SIZE=416
RELATIONSHIPS:
      WORD13-WORD22 = WORD
      DATAS2-DATAS18 = DATA
      READ3-READ23 = READ
SET THE ERROR VARIANCES OF WORD13-READ23 FREE
SET THE CORRELATION MATRIX OF WORD-READ FREE
END OF PROBLEM
```

        GROUP 1: UPPER SECONDARY: > 2 YRS.: TESTING EQUALITY OF
                                          FACTOR STRUCTURES
        FILE: **EDUC1.LIS** - FACTOR LOADINGS, FACTOR CORRELATION,
                       ERROR VARIANCES INVARIANT BETWEEN THE
                       TWO CATEGORIES OF EDUCATION

```
OBSERVED VARIABLES
      SEX EDUC WORD13 WORD17 WORD21 WORD22 DATAS2
      DATAS8 DATAS14 DATAS18 READ3 READ9 READ20 READ23
CORRELATION MATRIX FROM FILE MATRIC.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE MATRIC.ACP
SAMPLE SIZE=838
LATENT VARIABLES
      WORD DATA READ
RELATIONSHIPS:
      WORD13-WORD22 = WORD
      DATAS2-DATAS18 = DATA
      READ3-READ23  = READ

GROUP 2: OTHER LEVELS OF EDUCATION
CORRELATION MATRIX FROM FILE OTHEREDU.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE OTHEREDU.ACP
SAMPLE SIZE=221
END OF PROBLEM
```

        GROUP 1: UPPER SECONDARY, > 2 YRS.: TESTING EQUALITY OF
                                          FACTOR STRUCTURES
        FILE: **EDUC8.LIS** - FACTOR LOADINGS, FACTOR CORRELATION AND
                       ERROR VARIANCES ALL VARY BETWEEN THE TWO
                       CATEGORIES OF EDUCATION

```
OBSERVED VARIABLES
      SEX EDUC WORD13 WORD17 WORD21 WORD22 DATAS2
      DATAS8 DATAS14 DATAS18 READ3 READ9 READ20 READ23
CORRELATION MATRIX FROM FILE MATRIC.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE MATRIC.ACP
SAMPLE SIZE=838
LATENT VARIABLES
      WORD DATA READ
RELATIONSHIPS:
      WORD13-WORD22 = WORD
      DATAS2-DATAS18 = DATA
      READ3-READ23  = READ

GROUP 2: OTHER LEVELS OF EDUCATION
CORRELATION MATRIX FROM FILE OTHEREDU.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE OTHEREDU.ACP
```

```
SAMPLE SIZE=221
RELATIONSHIPS:
      WORD13-WORD22 = WORD
      DATAS2-DATAS18 = DATA
      READ3-READ23 = READ
SET THE ERROR VARIANCES OF WORD13-READ23 FREE
SET THE CORRELATION MATRIX OF WORD-READ FREE
END OF PROBLEM
```

```
      GROUP 1: MALES: TESTING EQUALITY OF FACTOR STRUCTURES
      FILE: SEX1.LIS - FACTOR LOADINGS, FACTOR CORRELATION,
                       ERROR VARIANCES INVARIANT BETWEEN MALES
                       AND FEMALES
OBSERVED VARIABLES
      SEX EDUC WORD13 WORD17 WORD21 WORD22 DATAS2
      DATAS8 DATAS14 DATAS18 READ3 READ9 READ20 READ23
CORRELATION MATRIX FROM FILE MALES.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE MALES.ACP
SAMPLE SIZE=553
LATENT VARIABLES
      WORD DATA READ
RELATIONSHIPS:
      WORD13-WORD22 = WORD
      DATAS2-DATAS18 = DATA
      READ3-READ23  = READ

GROUP 2: FEMALES
CORRELATION MATRIX FROM FILE FEMALES.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE FEMALES.ACP
SAMPLE SIZE=506
END OF PROBLEM


      GROUP 1: MALES: TESTING EQUALITY OF FACTOR STRUCTURES

      MODEL: SEX8.LIS - FACTOR LOADINGS, FACTOR CORRELATION AND
                        ERROR VARIANCES ALL VARY BETWEEN MALES
                        AND FEMALES
OBSERVED VARIABLES
      SEX EDUC WORD13 WORD17 WORD21 WORD22 DATAS2
      DATAS8 DATAS14 DATAS18 READ3 READ9 READ20 READ23
CORRELATION MATRIX FROM FILE MALES.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE MALES.ACP
SAMPLE SIZE=553
LATENT VARIABLES
      WORD DATA READ
RELATIONSHIPS:
      WORD13-WORD22 = WORD
      DATAS2-DATAS18 = DATA
      READ3-READ23  = READ

GROUP 2: FEMALES
CORRELATION MATRIX FROM FILE FEMALES.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE FEMALES.ACP
```

```
SAMPLE SIZE=506
RELATIONSHIPS:
     WORD13-WORD22 = WORD
     DATAS2-DATAS18 = DATA
     READ3-READ23 = READ
SET THE ERROR VARIANCES OF WORD13-READ23 FREE
SET THE CORRELATION MATRIX OF WORD-READ FREE
END OF PROBLEM
```

APPENDIX C: EXTRACTS FROM THE *LISREL OUTPUT* FILES

FILE: AGE1.OUT
The following lines were read from file age1.lis:

GROUP 1: YOUNG (< 21 YEARS): TESTING EQUALITY OF FACTOR
STRUCTURES
MODEL: AGE1.LIS - FACTOR LOADINGS, FACTOR CORRELATION,
ERROR VARIANCES INVARIANT BETWEEN TEEN-
AGERS AND OLDER GROUP
OBSERVED VARIABLES
SEX EDUC WORD13 WORD17 WORD21 WORD22 DATAS2
DATAS8 DATAS14 DATAS18 READ3 READ9 READ20 READ23
CORRELATION MATRIX FROM FILE YOUNG.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE YOUNG.ACP
SAMPLE SIZE=643
LATENT VARIABLES
WORD DATA READ
RELATIONSHIPS:
WORD13-WORD22 = WORD
DATAS2-DATAS18 = DATA
READ3-READ23 = READ

GROUP 2: OLDER (21+ YEARS)
CORRELATION MATRIX FROM FILE OLDER.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE OLDER.ACP
SAMPLE SIZE=416
END OF PROBLEM

Sample Size = 1059

1GROUP 1: YOUNG (< 21 YEARS): TESTING EQUALITY OF FACTOR
STRUCTURES
Number of Iterations = 10

LISREL ESTIMATES (WEIGHTED LEAST SQUARES)

WORD13 = 0.47*WORD, Errorvar.= 0.77 , R = 0.22
(0.040)   (0.058)
11.71   13.38

WORD17 = 0.76*WORD, Errorvar.= 0.41 , R = 0.58
(0.043)   (0.079)
17.41   5.22

WORD21 = 0.71*WORD, Errorvar.= 0.48 , R = 0.51
(0.035)   (0.067)
20.04   7.25

WORD22 = 0.59*WORD, Errorvar.= 0.64 , R = 0.35
(0.033)   (0.059)

                17.51   10.92

  DATAS2 = 0.78*DATA, Errorvar.= 0.38 , R = 0.61
         (0.037)   (0.072)
          20.97   5.30

  DATAS8 = 0.72*DATA, Errorvar.= 0.47 , R = 0.52
         (0.034)   (0.066)
          21.16   7.18

 DATAS14 = 0.62*DATA, Errorvar.= 0.61 , R = 0.38
         (0.032)   (0.059)
          19.14   10.41

 DATAS18 = 0.67*DATA, Errorvar.= 0.54 , R = 0.45
         (0.031)   (0.060)
          21.69   9.08

   READ3 = 0.73*READ, Errorvar.= 0.45 , R = 0.54
         (0.049)   (0.084)
          14.98   5.39

   READ9 = 0.77*READ, Errorvar.= 0.40 , R = 0.60
         (0.038)   (0.074)
          20.01   5.40

  READ20 = 0.64*READ, Errorvar.= 0.58 , R = 0.41
         (0.038)   (0.066)
          16.56   8.87

  READ23 = 0.69*READ, Errorvar.= 0.51 , R = 0.48
         (0.037)   (0.067)
          18.81   7.61

     CORRELATION MATRIX OF INDEPENDENT VARIABLES

            WORD   DATA   READ
          --------   --------   --------
   WORD   1.00

   DATA   .62   1.00
            (.04)
            15.57

   READ   .86   .75   1.00
            (.04)   (.04)
            23.90   19.75

           GOODNESS OF FIT STATISTICS
         CONTRIBUTION TO CHI-SQUARE = 105.95
    PERCENTAGE CONTRIBUTION TO CHI-SQUARE = 55.00

THE MODIFICATION INDICES SUGGEST TO ADD THE

PATH TO	FROM	DECREASE IN CHI-SQUARE	NEW ESTIMATE
DATAS8	DATA	9.8	.66 IN GROUP 1
DATAS8	READ	8.5	-.15 IN GROUP 1

THE MODIFICATION INDICES SUGGEST TO ADD AN ERROR COVARIANCE

BETWEEN	AND	DECREASE IN CHI-SQUARE	NEW ESTIMATE
WORD21	WORD17	14.8	-.27 IN GROUP 1
WORD22	WORD17	16.8	.29 IN GROUP 1
DATAS18	DATAS8	8.3	-.18 IN GROUP 1
READ9	WORD21	10.5	.21 IN GROUP 1
READ23	READ3	9.4	-.20 IN GROUP 1

1GROUP 2: OLDER (21+ YEARS)
Number of Iterations = 10

LISREL ESTIMATES (WEIGHTED LEAST SQUARES)

WORD13 = 0.47*WORD, Errorvar.= 0.77 , R = 0.22
(0.040)   (0.058)
11.71   13.38

WORD17 = 0.76*WORD, Errorvar.= 0.41 , R = 0.58
(0.043)   (0.079)
17.41   5.22

WORD21 = 0.71*WORD, Errorvar.= 0.48 , R = 0.51
(0.035)   (0.067)
20.04   7.25

WORD22 = 0.59*WORD, Errorvar.= 0.64 , R = 0.35
(0.033)   (0.059)
17.51   10.92

DATAS2 = 0.78*DATA, Errorvar.= 0.38 , R = 0.61
(0.037)   (0.072)
20.97   5.30

DATAS8 = 0.72*DATA, Errorvar.= 0.47 , R = 0.52
(0.034)   (0.066)
21.16   7.18

DATAS14 = 0.62*DATA, Errorvar.= 0.61 , R = 0.38
(0.032)   (0.059)
19.14   10.41

DATAS18 = 0.67*DATA, Errorvar.= 0.54 , R = 0.45
(0.031)   (0.060)
21.69   9.08

READ3 = 0.73*READ, Errorvar.= 0.45 , R = 0.54
(0.049)   (0.084)
14.98   5.39

READ9 = 0.77*READ, Errorvar.= 0.40 , R = 0.60

```
         (0.038)                  (0.074)
          20.01                     5.40

READ20 = 0.64*READ, Errorvar.= 0.58  , R  = 0.41
         (0.038)                  (0.066)
          16.56                     8.87

READ23 = 0.69*READ, Errorvar.= 0.51  , R  = 0.48
         (0.037)                  (0.067)
          18.81                     7.61
```

CORRELATION MATRIX OF INDEPENDENT VARIABLES

	WORD	DATA	READ
WORD	1.00		
DATA	.62	1.00	
	(.04)		
	15.57		
READ	.86	.75	1.00
	(.04)	(.04)	
	23.90	19.75	

GOODNESS OF FIT STATISTICS
CHI-SQUARE WITH 129 DEGREES OF FREEDOM = 192.63 (P = 0.00024)
CONTRIBUTION TO CHI-SQUARE = 86.68
PERCENTAGE CONTRIBUTION TO CHI-SQUARE = 45.00
THE MODIFICATION INDICES SUGGEST TO ADD THE

PATH TO	FROM	DECREASE IN CHI-SQUARE	NEW ESTIMATE
DATAS8	WORD	11.3	.18 IN GROUP 2
DATAS8	READ	10.0	.16 IN GROUP 2

THE MODIFICATION INDICES SUGGEST TO ADD AN ERROR COVARIANCE

BETWEEN	AND	DECREASE IN CHI-SQUARE	NEW ESTIMATE
DATAS8	WORD13	7.9	.17 IN GROUP 2
DATAS18	DATAS8	10.9	.19 IN GROUP 2
READ3	WORD17	14.9	.29 IN GROUP 2
READ23	WORD22	9.0	-.18 IN GROUP 2
READ23	READ20	11.6	.22 IN GROUP 2

THE PROBLEM USED   59072 BYTES (= 33.4% OF AVAILABLE WORKSPACE)
        TIME USED: 630.8 SECONDS

FILE: **AGE8.OUT**
  The following lines were read from file age8.lis:

    GROUP 1: YOUNG (< 21 YEARS): TESTING EQUALITY OF FACTOR
                          STRUCTURES
      MODEL: AGE8.LIS - FACTOR LOADINGS, FACTOR CORRELATION AND
                  ERROR VARIANCES ALL VARY BETWEEN TEEN-
                  AGERS AND OLDER GROUP
OBSERVED VARIABLES
    SEX EDUC WORD13 WORD17 WORD21 WORD22 DATAS2
    DATAS8 DATAS14 DATAS18 READ3 READ9 READ20 READ23
CORRELATION MATRIX FROM FILE YOUNG.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE YOUNG.ACP
SAMPLE SIZE=643
LATENT VARIABLES
    WORD DATA READ
RELATIONSHIPS:
    WORD13-WORD22 = WORD
    DATAS2-DATAS18 = DATA
    READ3-READ23 = READ

GROUP 2: OLDER (21+ YEARS)
CORRELATION MATRIX FROM FILE OLDER.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE OLDER.ACP
SAMPLE SIZE=416
RELATIONSHIPS:
    WORD13-WORD22 = WORD
    DATAS2-DATAS18 = DATA
    READ3-READ23 = READ
SET THE ERROR VARIANCES OF WORD13-READ23 FREE
SET THE CORRELATION MATRIX OF WORD-READ FREE
END OF PROBLEM

    Sample Size = 1059

    1GROUP 1: YOUNG (< 21 YEARS): TESTING EQUALITY OF FACTOR
                          STRUCTURES
    Number of Iterations = 11

    LISREL ESTIMATES (WEIGHTED LEAST SQUARES)

      WORD13 = 0.44*WORD, Errorvar.= 0.80 , R = 0.19
             (0.052)   (0.072)
              8.37   11.05

      WORD17 = 0.78*WORD, Errorvar.= 0.38 , R = 0.61
             (0.055)   (0.10)
              14.20   3.74

      WORD21 = 0.65*WORD, Errorvar.= 0.56 , R = 0.43
             (0.046)   (0.083)
              14.07   6.84

WORD22 = 0.65*WORD, Errorvar.= 0.57 , R = 0.42
        (0.043)   (0.079)
        15.01   7.25

DATAS2 = 0.78*DATA, Errorvar.= 0.38 , R = 0.61
        (0.056)   (0.10)
        13.84   3.63

DATAS8 = 0.51*DATA, Errorvar.= 0.73 , R = 0.26
        (0.055)   (0.079)
        9.34   9.21

DATAS14 = 0.61*DATA, Errorvar.= 0.62 , R = 0.37
         (0.045)   (0.078)
         13.52   7.89

DATAS18 = 0.63*DATA, Errorvar.= 0.59 , R = 0.40
         (0.045)   (0.080)
         14.10   7.40

READ3 = 0.61*READ, Errorvar.= 0.61 , R = 0.38
        (0.069)   (0.10)
        8.95   6.03

READ9 = 0.75*READ, Errorvar.= 0.42 , R = 0.57
        (0.055)   (0.10)
        13.59   4.17

READ20 = 0.54*READ, Errorvar.= 0.70 , R = 0.30
         (0.056)   (0.083)
         9.62   8.37

READ23 = 0.65*READ, Errorvar.= 0.56 , R = 0.43
         (0.053)   (0.089)
         12.27   6.31

CORRELATION MATRIX OF INDEPENDENT VARIABLES

	WORD	DATA	READ
WORD	1.00		
DATA	.65	1.00	
	(.06)		
	11.62		
READ	.94	.76	1.00
	(.05)	(.06)	
	17.90	12.84	

GOODNESS OF FIT STATISTICS
CONTRIBUTION TO CHI-SQUARE = 83.28

PERCENTAGE CONTRIBUTION TO CHI-SQUARE = 55.62
THE MODIFICATION INDICES SUGGEST TO ADD THE

PATH TO	FROM	DECREASE IN CHI-SQUARE	NEW ESTIMATE
WORD22	READ	8.4	-1.33 IN GROUP 1

THE MODIFICATION INDICES SUGGEST TO ADD AN ERROR COVARIANCE

BETWEEN	AND	DECREASE IN CHI-SQUARE	NEW ESTIMATE
WORD21	WORD17	11.3	-.24 IN GROUP 1
WORD22	WORD17	13.7	.31 IN GROUP 1
DATAS2	WORD21	8.2	-.18 IN GROUP 1

1GROUP 2: OLDER (21+ YEARS)
Number of Iterations = 11

LISREL ESTIMATES (WEIGHTED LEAST SQUARES)

WORD13 = 0.55*WORD, Errorvar.= 0.69 , R = 0.30
    (0.068)   (0.10)
    8.03   6.75

WORD17 = 0.73*WORD, Errorvar.= 0.45 , R = 0.54
    (0.080)   (0.13)
    9.21   3.32

WORD21 = 0.76*WORD, Errorvar.= 0.41 , R = 0.58
    (0.061)   (0.11)
    12.50   3.58

WORD22 = 0.50*WORD, Errorvar.= 0.74 , R = 0.25
    (0.058)   (0.091)
    8.73   8.15

DATAS2 = 0.79*DATA, Errorvar.= 0.37 , R = 0.62
    (0.052)   (0.10)
    15.02   3.41

DATAS8 = 0.85*DATA, Errorvar.= 0.27 , R = 0.72
    (0.044)   (0.10)
    19.26   2.68

DATAS14 = 0.64*DATA, Errorvar.= 0.58 , R = 0.41
    (0.048)   (0.093)
    13.16   6.29

DATAS18 = 0.71*DATA, Errorvar.= 0.48 , R = 0.51
    (0.043)   (0.093)
    16.45   5.26

READ3 = 0.80*READ, Errorvar.= 0.35 , R = 0.64
    (0.070)   (0.13)
    11.43   2.70

READ9 = 0.78*READ, Errorvar.= 0.39 , R = 0.61
    (0.059)   (0.11)

```
           13.20                            3.37
```

$$READ20 = 0.69*READ,\ Errorvar.= 0.52\ ,\ R\ =\ 0.47$$

```
           (0.053)                       (0.10)
            12.85                          5.11
```

$$READ23 = 0.74*READ,\ Errorvar.= 0.44\ ,\ R\ =\ 0.55$$

```
           (0.054)                       (0.10)
            13.69                          4.22
```

CORRELATION MATRIX OF INDEPENDENT VARIABLES

	WORD	DATA	READ
WORD	1.00		
DATA	.58	1.00	
	(.06)		
	9.47		
READ	.74	.76	1.00
	(.06)	(.05)	
	12.64	14.60	

GOODNESS OF FIT STATISTICS
CHI-SQUARE WITH 102 DEGREES OF FREEDOM = 149.72 (P = 0.0014)
CONTRIBUTION TO CHI-SQUARE = 66.44
PERCENTAGE CONTRIBUTION TO CHI-SQUARE = 44.38

THE MODIFICATION INDICES SUGGEST TO ADD AN ERROR COVARIANCE

BETWEEN	AND	DECREASE IN CHI-SQUARE	NEW ESTIMATE
READ3	WORD17	12.3	.30 IN GROUP 2
READ23	READ20	9.3	.25 IN GROUP 2

THE PROBLEM USED   69872 BYTES (= 39.5% OF AVAILABLE WORKSPACE)
TIME USED: 500.3 SECONDS

FILE: **EDUC1.OUT**

The following lines were read from file educ1.lis:

GROUP 1: UPPER SECONDARY: > 2 YRS.: TESTING EQUALITY OF
FACTOR STRUCTURES
MODEL: EDU1.LIS - FACTOR LOADINGS, FACTOR CORRELATION,
ERROR VARIANCES INVARIANT BETWEEN THE
TWO CATEGORIES OF EDUCATION
OBSERVED VARIABLES
SEX EDUC WORD13 WORD17 WORD21 WORD22 DATAS2
DATAS8 DATAS14 DATAS18 READ3 READ9 READ20 READ23
CORRELATION MATRIX FROM FILE MATRIC.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE MATRIC.ACP
SAMPLE SIZE=838
LATENT VARIABLES
WORD DATA READ
RELATIONSHIPS:
WORD13-WORD22 = WORD
DATAS2-DATAS18 = DATA
READ3-READ23 = READ

GROUP 2: OTHER LEVELS OF EDUCATION
CORRELATION MATRIX FROM FILE OTHEREDU.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE OTHEREDU.ACP
SAMPLE SIZE=221
END OF PROBLEM

Sample Size = 1059

1GROUP 1: UPPER SECONDARY: > 2 YRS.: TESTING EQUALITY OF
FACTOR STRUCTURES
Number of Iterations = 11

LISREL ESTIMATES (WEIGHTED LEAST SQUARES)

WORD13 = 0.50*WORD, Errorvar.= 0.74 , R = 0.25
(0.041)   (0.060)
12.30   12.25

WORD17 = 0.73*WORD, Errorvar.= 0.45 , R = 0.54
(0.043)   (0.077)
17.00   5.92

WORD21 = 0.71*WORD, Errorvar.= 0.48 , R = 0.51
(0.036)   (0.067)
19.94   7.17

WORD22 = 0.60*WORD, Errorvar.= 0.63 , R = 0.36
(0.034)   (0.059)
17.68   10.62

DATAS2 = 0.81*DATA, Errorvar.= 0.33 , R = 0.66
(0.040)   (0.079)

```
            20.24                           4.19

  DATAS8 = 0.68*DATA, Errorvar.= 0.52  , R  = 0.47
           (0.037)                (0.067)
            18.32                   7.80


 DATAS14 = 0.58*DATA, Errorvar.= 0.65  , R  = 0.34
           (0.034)                (0.059)
            16.79                  11.04


 DATAS18 = 0.64*DATA, Errorvar.= 0.58  , R  = 0.41
           (0.032)                (0.060)
            19.74                   9.63


   READ3 = 0.72*READ, Errorvar.= 0.48  , R  = 0.52
           (0.050)                (0.085)
            14.20                   5.64


   READ9 = 0.77*READ, Errorvar.= 0.40  , R  = 0.59
           (0.040)                (0.076)
            19.02                   5.35


  READ20 = 0.60*READ, Errorvar.= 0.63  , R  = 0.36
           (0.040)                (0.065)
            14.83                   9.66


  READ23 = 0.68*READ, Errorvar.= 0.52  , R  = 0.47
           (0.038)                (0.068)
            17.86                   7.68
```

CORRELATION MATRIX OF INDEPENDENT VARIABLES

	WORD	DATA	READ
WORD	1.00		
DATA	.59 (.04) 13.94	1.00	
READ	.82 (.04) 20.40	.74 (.04) 18.36	1.00

GOODNESS OF FIT STATISTICS

CONTRIBUTION TO CHI-SQUARE = 96.51
PERCENTAGE CONTRIBUTION TO CHI-SQUARE = 48.15

THE MODIFICATION INDICES SUGGEST TO ADD AN ERROR COVARIANCE
BETWEEN   AND   DECREASE IN CHI-SQUARE   NEW ESTIMATE

WORD21	WORD17	8.7	-.19 IN GROUP 1
WORD22	WORD17	8.2	.19 IN GROUP 1
READ23	READ3	8.0	-.19 IN GROUP 1
READ23	READ20	11.7	.21 IN GROUP 1

1GROUP 2: OTHER LEVELS OF EDUCATION
Number of Iterations = 11

LISREL ESTIMATES (WEIGHTED LEAST SQUARES)

WORD13 = 0.50*WORD, Errorvar.= 0.74 , R = 0.25
        (0.041)   (0.060)
         12.30   12.25

WORD17 = 0.73*WORD, Errorvar.= 0.45 , R = 0.54
        (0.043)   (0.077)
         17.00   5.92

WORD21 = 0.71*WORD, Errorvar.= 0.48 , R = 0.51
        (0.036)   (0.067)
         19.94   7.17

WORD22 = 0.60*WORD, Errorvar.= 0.63 , R = 0.36
        (0.034)   (0.059)
         17.68   10.62

DATAS2 = 0.81*DATA, Errorvar.= 0.33 , R = 0.66
        (0.040)   (0.079)
         20.24   4.19

DATAS8 = 0.68*DATA, Errorvar.= 0.52 , R = 0.47
        (0.037)   (0.067)
         18.32   7.80

DATAS14 = 0.58*DATA, Errorvar.= 0.65 , R = 0.34
         (0.034)   (0.059)
          16.79   11.04

DATAS18 = 0.64*DATA, Errorvar.= 0.58 , R = 0.41
         (0.032)   (0.060)
          19.74   9.63

READ3 = 0.72*READ, Errorvar.= 0.48 , R = 0.52
        (0.050)   (0.085)
         14.20   5.64

READ9 = 0.77*READ, Errorvar.= 0.40 , R = 0.59
        (0.040)   (0.076)
         19.02   5.35

READ20 = 0.60*READ, Errorvar.= 0.63 , R = 0.36
        (0.040)   (0.065)
         14.83   9.66

READ23 = 0.68*READ, Errorvar.= 0.52 , R = 0.47

```
      (0.038)                    (0.068)
       17.86                      7.68
```

CORRELATION MATRIX OF INDEPENDENT VARIABLES

	WORD	DATA	READ
WORD	1.00		
DATA	.59 (.04) 13.94	1.00	
READ	.82 (.04) 20.40	.74 (.04) 18.36	1.00

GOODNESS OF FIT STATISTICS

CHI-SQUARE WITH 129 DEGREES OF FREEDOM = 200.46 (P = 0.000056)
CONTRIBUTION TO CHI-SQUARE = 103.95
PERCENTAGE CONTRIBUTION TO CHI-SQUARE = 51.85

THE MODIFICATION INDICES SUGGEST TO ADD THE

PATH TO	FROM	DECREASE IN CHI-SQUARE	NEW ESTIMATE
READ3	WORD	8.5	.19 IN GROUP 2
READ3	DATA	10.8	.23 IN GROUP 2

THE MODIFICATION INDICES SUGGEST TO ADD AN ERROR COVARIANCE

BETWEEN	AND	DECREASE IN CHI-SQUARE	NEW ESTIMATE
DATAS8	WORD21	13.1	.25 IN GROUP 2
READ3	WORD17	19.1	.36 IN GROUP 2
READ9	DATAS18	8.7	-.24 IN GROUP 2

THE PROBLEM USED   59072 BYTES (= 33.4% OF AVAILABLE WORKSPACE)
TIME USED: 629.3 SECONDS

FILE: **EDUC8.OUT**

The following lines were read from file educ8.lis:

GROUP 1: UPPER SECONDARY, > 2 YRS.: TESTING EQUALITY OF
FACTOR STRUCTURES
MODEL: EDUC8.LIS - FACTOR LOADINGS, FACTOR CORRELATION
AND ERROR VARIANCES ALL VARY BETWEEN
THE TWO CATEGORIES OF EDUCATION
OBSERVED VARIABLES
SEX EDUC WORD13 WORD17 WORD21 WORD22 DATAS2
DATAS8 DATAS14 DATAS18 READ3 READ9 READ20 READ23
CORRELATION MATRIX FROM FILE MATRIC.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE MATRIC.ACP
SAMPLE SIZE=838
LATENT VARIABLES
WORD DATA READ
RELATIONSHIPS:
WORD13-WORD22 = WORD
DATAS2-DATAS18 = DATA
READ3-READ23 = READ

GROUP 2: OTHER LEVELS OF EDUCATION
CORRELATION MATRIX FROM FILE OTHEREDU.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE OTHEREDU.ACP
SAMPLE SIZE=221
RELATIONSHIPS:
WORD13-WORD22 = WORD
DATAS2-DATAS18 = DATA
READ3-READ23 = READ
SET THE ERROR VARIANCES OF WORD13-READ23 FREE
SET THE CORRELATION MATRIX OF WORD-READ FREE
END OF PROBLEM

Sample Size = 1059

1GROUP 1: UPPER SECONDARY, > 2 YRS.: TESTING EQUALITY OF
FACTOR STRUCTURES
Number of Iterations = 13

LISREL ESTIMATES (WEIGHTED LEAST SQUARES)

WORD13 = 0.44*WORD, Errorvar.= 0.80 , R = 0.19
(0.052)   (0.067)
8.38   11.88

WORD17 = 0.75*WORD, Errorvar.= 0.42 , R = 0.57
(0.059)   (0.10)
12.70   4.17

WORD21 = 0.66*WORD, Errorvar.= 0.56 , R = 0.43
(0.043)   (0.075)
15.12   7.38

WORD22 = 0.62*WORD, Errorvar.= 0.61 , R = 0.38
       (0.040)   (0.070)
        15.27   8.69

DATAS2 = 0.81*DATA, Errorvar.= 0.34 , R = 0.66
       (0.050)   (0.095)
        16.21   3.58

DATAS8 = 0.64*DATA, Errorvar.= 0.58 , R = 0.41
       (0.046)   (0.077)
        13.83   7.62

DATAS14 = 0.60*DATA, Errorvar.= 0.63 , R = 0.37
        (0.042)   (0.070)
         14.44   8.90

DATAS18 = 0.64*DATA, Errorvar.= 0.57 , R = 0.42
        (0.039)   (0.070)
         16.62   8.23

READ3 = 0.49*READ, Errorvar.= 0.75 , R = 0.24
      (0.075)   (0.089)
       6.47   8.52

READ9 = 0.68*READ, Errorvar.= 0.53 , R = 0.46
      (0.058)   (0.093)
       11.66   5.71

READ20 = 0.66*READ, Errorvar.= 0.56 , R = 0.43
       (0.052)   (0.084)
        12.71   6.68

READ23 = 0.68*READ, Errorvar.= 0.52 , R = 0.47
       (0.048)   (0.082)
        14.17   6.34

CORRELATION MATRIX OF INDEPENDENT VARIABLES

	WORD	DATA	READ
WORD	1.00		
DATA	.59	1.00	
	(.05)		
	11.28		
READ	.85	.73	1.00
	(.06)	(.05)	
	15.48	13.89	

GOODNESS OF FIT STATISTICS
CONTRIBUTION TO CHI-SQUARE = 77.73
PERCENTAGE CONTRIBUTION TO CHI-SQUARE = 49.20

```
                   THE MODIFICATION INDICES SUGGEST TO ADD THE
PATH TO    FROM          DECREASE IN CHI-SQUARE      NEW ESTIMATE
WORD22     READ                9.8                   -.71 IN GROUP 1


THE MODIFICATION INDICES SUGGEST TO ADD AN ERROR COVARIANCE
BETWEEN      AND         DECREASE IN CHI-SQUARE      NEW ESTIMATE
WORD21     WORD17               9.4                   -.22 IN GROUP 1
WORD22     WORD17               8.3                    .22 IN GROUP 1
READ23     READ20              11.6                    .25 IN GROUP 1
```

1GROUP 2: OTHER LEVELS OF EDUCATION
Number of Iterations = 13

LISREL ESTIMATES (WEIGHTED LEAST SQUARES)

```
WORD13 = 0.66*WORD, Errorvar.= 0.55 , R  = 0.44
         (0.068)                 (0.13)
          9.79                    4.23


WORD17 = 0.71*WORD, Errorvar.= 0.48 , R  = 0.51
         (0.062)                 (0.13)
         11.51                    3.70


WORD21 = 0.79*WORD, Errorvar.= 0.37 , R  = 0.62
         (0.064)                 (0.14)
         12.29                    2.67


WORD22 = 0.56*WORD, Errorvar.= 0.67 , R  = 0.32
         (0.069)                 (0.12)
          8.11                    5.48


DATAS2 = 0.76*DATA, Errorvar.= 0.41 , R  = 0.59
         (0.071)                 (0.14)
         10.78                    2.83


DATAS8 = 0.79*DATA, Errorvar.= 0.36 , R  = 0.63
         (0.065)                 (0.14)
         12.30                    2.56


DATAS14 = 0.51*DATA, Errorvar.= 0.74 , R  = 0.26
          (0.066)                 (0.11)
           7.62                    6.31


DATAS18 = 0.66*DATA, Errorvar.= 0.55 , R  = 0.44
          (0.063)                 (0.12)
          10.54                    4.40


READ3 = 0.85*READ, Errorvar.= 0.27 , R  = 0.72
        (0.070)                 (0.15)
        12.12                    1.78


READ9 = 0.88*READ, Errorvar.= 0.21 , R  = 0.79
        (0.059)                 (0.14)
        15.06                    1.48
```

```
READ20 = 0.52*READ, Errorvar.= 0.72 , R  = 0.28
         (0.068)                  (0.12)
          7.73                     6.01


READ23 = 0.70*READ, Errorvar.= 0.50 , R  = 0.49
         (0.064)                  (0.13)
         10.88                     3.84
```

CORRELATION MATRIX OF INDEPENDENT VARIABLES

	WORD	DATA	READ
WORD	1.00		
DATA	.66	1.00	
	(.07)		
	8.81		
READ	.82	.75	1.00
	(.06)	(.07)	
	13.80	11.4	

GOODNESS OF FIT STATISTICS

CHI-SQUARE WITH 102 DEGREES OF FREEDOM = 158.00 (P = 0.00031)
     CONTRIBUTION TO CHI-SQUARE = 80.27
     PERCENTAGE CONTRIBUTION TO CHI-SQUARE = 50.80

     THE MODIFICATION INDICES SUGGEST TO ADD THE

PATH TO	FROM	DECREASE IN CHI-SQUARE	NEW ESTIMATE
READ20	WORD	10.1	-.86 IN GROUP 2

THE MODIFICATION INDICES SUGGEST TO ADD AN ERROR COVARIANCE

BETWEEN	AND	DECREASE IN CHI-SQUARE	NEW ESTIMATE
DATAS8	WORD21	8.3	.24 IN GROUP 2
READ3	WORD17	10.2	.30 IN GROUP 2

THE PROBLEM USED   69872 BYTES (= 39.5% OF AVAILABLE WORKSPACE)
       TIME USED: 560.1 SECONDS

FILE: **SEX1.OUT**
        The following lines were read from file sex1.lis:
        GROUP 1: MALES: TESTING EQUALITY OF FACTOR STRUCTURES
        MODEL: SEX1.LIS - FACTOR LOADINGS, FACTOR CORRELATION,
                            ERROR VARIANCES INVARIANT BETWEEN MALES
                            AND FEMALES
OBSERVED VARIABLES
        SEX EDUC WORD13 WORD17 WORD21 WORD22 DATAS2
        DATAS8 DATAS14 DATAS18 READ3 READ9 READ20 READ23
CORRELATION MATRIX FROM FILE MALES.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE MALES.ACP
SAMPLE SIZE=553
LATENT VARIABLES
        WORD DATA READ
RELATIONSHIPS:
        WORD13-WORD22 = WORD
        DATAS2-DATAS18 = DATA
        READ3-READ23 = READ

GROUP 2: FEMALES
CORRELATION MATRIX FROM FILE FEMALES.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE FEMALES.ACP
SAMPLE SIZE=506
END OF PROBLEM

        Sample Size = 1059

    1GROUP 1: MALES: TESTING EQUALITY OF FACTOR STRUCTURES
        Number of Iterations = 11

        LISREL ESTIMATES (WEIGHTED LEAST SQUARES)

            WORD13 = 0.49*WORD, Errorvar.= 0.75 , R = 0.24
                    (0.040)   (0.059)
                     12.19   12.75

            WORD17 = 0.80*WORD, Errorvar.= 0.35 , R = 0.64
                    (0.042)   (0.080)
                     18.97   4.46

            WORD21 = 0.68*WORD, Errorvar.= 0.53 , R = 0.46
                    (0.036)   (0.065)
                     18.89   8.08

            WORD22 = 0.59*WORD, Errorvar.= 0.64 , R = 0.35
                    (0.034)   (0.059)
                     17.38   10.88

            DATAS2 = 0.80*DATA, Errorvar.= 0.34 , R = 0.65
                    (0.041)   (0.079)
                     19.59   4.34

            DATAS8 = 0.60*DATA, Errorvar.= 0.62 , R = 0.37
                    (0.038)   (0.063)

```
         15.89                    9.84

DATAS14 = 0.57*DATA, Errorvar.= 0.66  , R  = 0.33
          (0.034)               (0.058)
           17.02                 11.34

DATAS18 = 0.64*DATA, Errorvar.= 0.59  , R  = 0.41
          (0.031)               (0.059)
           20.08                  9.89

  READ3 = 0.69*READ, Errorvar.= 0.52  , R  = 0.47
          (0.046)               (0.077)
           14.74                  6.73

  READ9 = 0.70*READ, Errorvar.= 0.50  , R  = 0.49
          (0.036)               (0.067)
           19.00                  7.54

 READ20 = 0.68*READ, Errorvar.= 0.53  , R  = 0.46
          (0.037)               (0.066)
           18.38                  8.01

 READ23 = 0.67*READ, Errorvar.= 0.54  , R  = 0.45
          (0.036)               (0.065)
           18.67                  8.39
```

CORRELATION MATRIX OF INDEPENDENT VARIABLES

	WORD	DATA	READ
WORD	1.00		
DATA	.55	1.00	
	(.04)		
	12.28		
READ	.90	.80	1.00
	(.04)	(.04)	
	23.93	19.48	

GOODNESS OF FIT STATISTICS

CONTRIBUTION TO CHI-SQUARE = 120.59
PERCENTAGE CONTRIBUTION TO CHI-SQUARE = 55.11
THE MODIFICATION INDICES SUGGEST TO ADD THE

PATH TO	FROM	DECREASE IN CHI-SQUARE	NEW ESTIMATE
WORD17	DATA	13.7	.24 IN GROUP 1

THE MODIFICATION INDICES SUGGEST TO ADD A COVARIANCE

BETWEEN	AND	DECREASE IN CHI-SQUARE	NEW ESTIMATE
READ	WORD	8.3	.98 IN GROUP 1

DATAS2	WORD17	8.5	.15	IN GROUP 1
DATAS14	WORD17	9.9	-.23	IN GROUP 1
READ3	WORD17	41.3	.42	IN GROUP 1
READ3	DATAS2	8.5	-.23	IN GROUP 1
READ23	READ20	20.4	.29	IN GROUP 1

1GROUP 2: FEMALES
Number of Iterations = 11

LISREL ESTIMATES (WEIGHTED LEAST SQUARES)

WORD13 = 0.49*WORD, Errorvar.= 0.75 , R = 0.24
      (0.040)   (0.059)
       12.19   12.75

WORD17 = 0.80*WORD, Errorvar.= 0.35 , R = 0.64
      (0.042)   (0.080)
       18.97   4.46

WORD21 = 0.68*WORD, Errorvar.= 0.53 , R = 0.46
      (0.036)   (0.065)
       18.89   8.08

WORD22 = 0.59*WORD, Errorvar.= 0.64 , R = 0.35
      (0.034)   (0.059)
       17.38   10.88

DATAS2 = 0.80*DATA, Errorvar.= 0.34 , R = 0.65
      (0.041)   (0.079)
       19.59   4.34

DATAS8 = 0.60*DATA, Errorvar.= 0.62 , R = 0.37
      (0.038)   (0.063)
       15.89   9.84

DATAS14 = 0.57*DATA, Errorvar.= 0.66 , R = 0.33
      (0.034)   (0.058)
       17.02   11.34

DATAS18 = 0.64*DATA, Errorvar.= 0.59 , R = 0.41
      (0.031)   (0.059)
       20.08   9.89

READ3 = 0.69*READ, Errorvar.= 0.52 , R = 0.47
      (0.046)   (0.077)
       14.74   6.73

READ9 = 0.70*READ, Errorvar.= 0.50 , R = 0.49
      (0.036)   (0.067)
       19.00   7.54

READ20 = 0.68*READ, Errorvar.= 0.53 , R = 0.46
      (0.037)   (0.066)
       18.38   8.01

READ23 = 0.67*READ, Errorvar.= 0.54 , R = 0.45
       (0.036)   (0.065)
        18.67   8.39

CORRELATION MATRIX OF INDEPENDENT VARIABLES

	WORD	DATA	READ
WORD	1.00		
DATA	.55 (.04) 12.28	1.00	
READ	.90 (.04) 23.93	.80 (.04) 19.48	1.00

GOODNESS OF FIT STATISTICS
CHI-SQUARE WITH 129 DEGREES OF FREEDOM = 218.82 (P = 0.0000013)
     CONTRIBUTION TO CHI-SQUARE = 98.23
     PERCENTAGE CONTRIBUTION TO CHI-SQUARE = 44.89

THE MODIFICATION INDICES SUGGEST TO ADD A COVARIANCE

BETWEEN	AND	DECREASE IN CHI-SQUARE	NEW ESTIMATE
READ	WORD	16.7	.74 IN GROUP 2
READ23	READ3	10.4	-.23 IN GROUP 2

THE PROBLEM USED   59072 BYTES (= 33.4% OF AVAILABLE WORKSPACE)
          TIME USED: 344.9 SECONDS

FILE: **SEX8.OUT**
        The following lines were read from file SEX8.LIS:

        GROUP 1: MALES: TESTING EQUALITY OF FACTOR STRUCTURES
        MODEL: SEX8.LIS - FACTOR LOADINGS, FACTOR CORRELATION AND
                          ERROR VARIANCES ALL VARY BETWEEN MALES
                          AND FEMALES
OBSERVED VARIABLES
        SEX EDUC WORD13 WORD17 WORD21 WORD22 DATAS2
        DATAS8 DATAS14 DATAS18 READ3 READ9 READ20 READ23
CORRELATION MATRIX FROM FILE MALES.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE MALES.ACP
SAMPLE SIZE=553
LATENT VARIABLES
        WORD DATA READ
RELATIONSHIPS:
        WORD13-WORD22 = WORD
        DATAS2-DATAS18 = DATA
        READ3-READ23 = READ

GROUP 2: FEMALES
CORRELATION MATRIX FROM FILE FEMALES.COR
ASYMPTOTIC COVARIANCE MATRIX FROM FILE FEMALES.ACP
SAMPLE SIZE=506
RELATIONSHIPS:
        WORD13-WORD22 = WORD
        DATAS2-DATAS18 = DATA
        READ3-READ23 = READ
SET THE ERROR VARIANCES OF WORD13-READ23 FREE
SET THE CORRELATION MATRIX OF WORD-READ FREE
END OF PROBLEM

        Sample Size = 1059

        1GROUP 1: MALES: TESTING EQUALITY OF FACTOR STRUCTURES
        Number of Iterations = 13

        LISREL ESTIMATES (WEIGHTED LEAST SQUARES)

            WORD13 = 0.48*WORD, Errorvar.= 0.76 , R = 0.23
                     (0.057)   (0.082)
                      8.45   9.28

            WORD17 = 0.99*WORD, Errorvar.= 0.0090, R = 0.99
                     (0.069)   (0.15)
                     14.43   0.060

            WORD21 = 0.59*WORD, Errorvar.= 0.64 , R = 0.35
                     (0.049)   (0.084)
                     12.17   7.63

            WORD22 = 0.46*WORD, Errorvar.= 0.78 , R = 0.21
                     (0.046)   (0.074)
                      9.94   10.55

```
DATAS2  = 0.90*DATA,  Errorvar.= 0.18 , R  = 0.81
          (0.055)               (0.11)
           16.30                 1.55

DATAS8  = 0.63*DATA,  Errorvar.= 0.59  , R  = 0.40
          (0.054)               (0.091)
           11.71                 6.55

DATAS14 = 0.54*DATA,  Errorvar.= 0.70  , R  = 0.29
          (0.045)               (0.078)
           12.00                 8.96

DATAS18 = 0.69*DATA,  Errorvar.= 0.52  , R  = 0.47
          (0.039)               (0.080)
           17.72                 6.44

 READ3  = 0.78*READ,  Errorvar.= 0.37 , R  = 0.62
          (0.064)               (0.11)
           12.15                 3.17

 READ9  = 0.77*READ,  Errorvar.= 0.40  , R  = 0.59
          (0.049)               (0.097)
           15.52                 4.20

 READ20 = 0.77*READ,  Errorvar.= 0.39  , R  = 0.60
          (0.047)               (0.095)
           16.44                 4.16

 READ23 = 0.65*READ,  Errorvar.= 0.56  , R  = 0.43
          (0.048)               (0.087)
           13.70                 6.46
```

CORRELATION MATRIX OF INDEPENDENT VARIABLES

	WORD	DATA	READ
WORD	1.00		
DATA	.69	1.00	
	(.07)		
	10.57		
READ	.98	.76	1.00
	(.05)	(.06)	
	21.40	12.76	

GOODNESS OF FIT STATISTICS
CONTRIBUTION TO CHI-SQUARE = 88.01
PERCENTAGE CONTRIBUTION TO CHI-SQUARE = 57.27

```
THE MODIFICATION INDICES SUGGEST TO ADD AN ERROR COVARIANCE
BETWEEN     AND      DECREASE IN CHI-SQUARE    NEW ESTIMATE
READ3       WORD17            18.8                .43 IN GROUP 1
READ23      READ20            14.7                .29 IN GROUP 1
```

1GROUP 2: FEMALES
Number of Iterations = 13

LISREL ESTIMATES (WEIGHTED LEAST SQUARES)

```
    WORD13 = 0.54*WORD, Errorvar.= 0.70  , R  = 0.29
             (0.056)                (0.087)
              9.51                   8.06


    WORD17 = 0.66*WORD, Errorvar.= 0.55 , R  = 0.44
             (0.059)                (0.10)
             11.23                   5.51


    WORD21 = 0.73*WORD, Errorvar.= 0.46  , R  = 0.53
             (0.052)                (0.099)
             13.88                   4.62


    WORD22 = 0.73*WORD, Errorvar.= 0.46  , R  = 0.53
             (0.051)                (0.098)
             14.21                   4.74


    DATAS2 = 0.76*DATA, Errorvar.= 0.41 , R  = 0.59
             (0.058)                (0.11)
             13.06                   3.73


    DATAS8 = 0.61*DATA, Errorvar.= 0.62  , R  = 0.37
             (0.054)                (0.091)
             11.35                   6.84


   DATAS14 = 0.59*DATA, Errorvar.= 0.64  , R  = 0.35
             (0.052)                (0.088)
             11.50                   7.26


   DATAS18 = 0.56*DATA, Errorvar.= 0.67  , R  = 0.32
             (0.052)                (0.086)
             10.82                   7.81


     READ3 = 0.67*READ, Errorvar.= 0.54 , R  = 0.45
             (0.068)                (0.11)
              9.83                   4.92


     READ9 = 0.73*READ, Errorvar.= 0.45 , R  = 0.54
             (0.058)                (0.10)
             12.59                   4.24


    READ20 = 0.50*READ, Errorvar.= 0.74  , R  = 0.25
             (0.065)                (0.091)
              7.71                   8.20
```

```
READ23 = 0.68*READ, Errorvar.= 0.53 , R  = 0.46
        (0.059)                    (0.10)
         11.37                      5.24
```

CORRELATION MATRIX OF INDEPENDENT VARIABLES

	WORD	DATA	READ
WORD	1.00		
DATA	.44	1.00	
	(.06)		
	7.05		
READ	.72	.82	1.00
	(.07)	(.05)	
	10.54	15.12	

GOODNESS OF FIT STATISTICS

CHI-SQUARE WITH 102 DEGREES OF FREEDOM = 153.66 (P = 0.00072)
    CONTRIBUTION TO CHI-SQUARE = 65.65
    PERCENTAGE CONTRIBUTION TO CHI-SQUARE = 42.73

```
THE MODIFICATION INDICES SUGGEST TO ADD AN ERROR COVARIANCE
BETWEEN    AND     DECREASE IN CHI-SQUARE    NEW ESTIMATE
READ23     READ3            10.9              -.24 IN GROUP 2

THE PROBLEM USED   69872 BYTES (= 39.5% OF AVAILABLE WORKSPACE)

    TIME USED:   530.6 SECONDS
```