

Introduction to *Mplus*

- Q. *The Mplus analysis concerns a first, basic analysis of the LSAY math data. Run the type=basic run. The assignment is to create the input file and run a type=basic run and create a few graphics using the LSAY data.*

Below is the *M-plus* output file:

```
Mplus VERSION 3.0 DEMO
MUTHEN & MUTHEN
04/11/2004 12:25 PM
```

INPUT INSTRUCTIONS

```
TITLE: This is a partial input file for HW1.
       The variable names are for the data set lsay.dat
       (Input File Name: LSAY_asgn01.inp)
       ! TITLE is the only command that does not require a
       ! semi-colon (;) at the end.

DATA:   FILE IS C:\Ed.231E\Assignment_01\lsay.dat;
       ! The location of the data file should be the same as
       ! that of the input file (*.inp).
       !
       ! In addition to raw data, matrices can also be
       ! read into the program for analysis.

       ! The VARIABLE command reads in all the variables that are
       ! present in the dataset.
       !
       ! Maximum length of variable name is 8.
       !
       ! The variables must be listed in the same order as in the
       ! original dataset.
VARIABLE: NAMES ARE lsayid schcode
           !lsayid = student id
           !schcode = 7th grade school code

           classize urban tracking ntracks
           !classize = 7th grade school size
           !urban = 7th grade community type
           ! (1=urban, 2=suburban, 3=rural)
           !tracking = 7th grade math tracking indicator
```

```

!      (0=no ability grouping, 1=ability grouping)
!ntracks = # of 7th grade math ability levels

mthlvl female mthflg7-mthflg12 method fathed mothsei
fathsei homeres race
!mthlvl = 7th grade ability ranking
!      (0 = no groups, 1=low, 2=middle, 3=high)
!female
!      (0=male, 1=female)
!mthflg7-mthflg12 = math test availability
!      (0=not available, 1=available)
!method = mother's education
!      (1=LT HS diploma, 2=HS diploma, 3=Some college,
!      4=4yr college degree, 5=advanced degree)
!fathed = father's education
!      (1=LT HS diploma, 2=HS diploma, 3=Some college,
!      4=4yr college degree, 5=advanced degree)
!mothsei = mother's SEI
!fathsei = father's SEI
!homeres = Home math and science resources
!race
!      (1=Hispanic, 2=Black, 3=White, 4=Asian,
!      5=Native American, 6=other)

expect parapsh parcpsh parmpsh peerapsh peermpsh
!expect = Student's educational expectations
!      (1=HS only, 2=Vocational training,
!      3=some college, 4=Bachelor's,
!      5=Master's, 6=Dr,PhD)      (7th grade)
!parapsh = parent academic push (7th grade)
!parcpsh = parant college push (7th grade)
!parmpsh = parent math push (7th grade)
!peerapsh = peer academic push (7th grade)
!peermpsh = peer math push (7th grade)

bas7 basse7 alg7 algse7 geo7 geose7
qlt7 qltse7 mth7 mthse7 mtha7 mthase7
bas8 basse8 alg8 algse8 geo8 geose8
qlt8 qltse8 mth8 mthse8 mtha8 mthase8
bas9 basse9 alg9 algse9 geo9 geose9
qlt9 qltse9 mth9 mthse9 mtha9 mthase9
bas10 basse10 alg10 algse10 geo10 geose10
qlt10 qltse10 mth10 mthse10 mtha10 mthase10
bas11 basse11 alg11 algse11 geo11 geose11
qlt11 qltse11 mth11 mthse11 mtha11 mthase11
bas12 basse12 alg12 algse12 geo12 geose12
qlt12 qltse12 mth12 mthse12 mtha12 mthase12
!bas7-bas12      = Basic math IRT scores
!basse7-12      = Basic math SE of IRT
!alg7-alg12     = Algebra IRT score
!algse7-12     = Algebra SE of IRT
!geo7-geo12    = Geometry IRT score
!geose7-geose12 = Geometry SE of IRT
!qlt7-qlt12    = Quantitative Literacy IRT
!qltse7-qltse12 = Quantitative Literacy SE of IRT

```

```

!mth7-mth12      = Aggregate math IRT, w/o aberrants
!mthse7-mthse12 = Aggreagte math IRT, w/o aberrants
!mtha7-matha12  = Aggregate math IRT, w/ aberrants
!mtha7-mtha12   = Aggregate math SE of IRT, w/
!                aberrants

```

```

mthcrs7-mthcrs12 mtrk10-mtrk12
!mthcrs7-mthcrs12 = Highest math course taken
!                during each grade
!                (0 = no course,
!                1 = low,basic, 2 = average,
!                3 = high,      4 = pre-algebra,
!                5 = algebra I, 6 = geometry,
!                7 = algebra II, 8 = pre-calc,
!                9 = calculus)
!
!mtrk10-mtrk12 = Highest math course taken through
!                grades 10-12
!                (1 = low,
!                2 = algebra I,
!                3 = algebra I & II,
!                4 = algebra and geometry,
!                5 = algebra I, II, and geometry,
!                6 = pre-calc,
!                7 = calculus)

```

```

totstud
lchfull lchpart parvis
!totstud = total # of students
!                (9th)
!
!lchfull = % of student eligible for full lunch
!                assitance
!                (9th)
!lchpart = % of student eligible for partial
!                lunch assitance
!                (9th)
!parvis  = % of parents that visit the school
!                (9th)

```

```

mcirr mclub strat mstrat comp mcomp
!Mcirr = school provides math curriculum guide
!                (1=yes, 2=no)
!                (9th)
!Mclub = school has math club
!                (1=yes, 2=no)
!                (9th)
!STrat = ratio of student to Full Time teachers
!                (9th)
!MSTrat= ratio of students to Full Time Math
!                teachers
!                (9th)
!comp  = ratio of students to computers for
!                instructional use
!                (9th)

```

```

!Mcomp = ratio of students to computers for
!      math instruction use
!      (9th)

african hispan asian
!african = percent of african american students
!      (9th)
!hispan  = percent of hispanic students
!      (9th)
!asian   = percent of asian students
!      (9th)

expel arrest dropout
!expel  = Ever been expelled from school
!      (0=no, 1=yes)
!      (used in PROBLEM VAR)
!      (7th Grd)
!arrest = Ever been arrested
!      (0=no, 1=yes)
!      (used in PROBLEM VAR)
!      (7th grd)
!dropout = Have you EVER thought about dropping out
!      (0=no, 1=yes)
!      (used in PROBLEM VAR)
!      (7th grd)

self worth other
!self = positive attitude toward self
!      (1=strongly agree, 2=agree,
!      3=not sure, 4=disagree,
!      5=strongly disagree)
!      (7th Grd)
!worth = person of worth
!      (1=strongly agree, 2=agree,
!      3=not sure, 4=disagree,
!      5=strongly disagree)
!      (7th Grd)
!other = able to do things as well as others
!      (1=strongly agree, 2=agree,
!      3=not sure, 4=disagree,
!      5=strongly disagree)
!      (7th grd)

satisf respect failure esteem problem cloctn
!satisf = generally satisfied w/self
!      (1=strongly agree, 2=agree,
!      3=not sure, 4=disagree,
!      5=strongly disagree)
!      (7th Grd)
!respect = wish I respected myself more
!      (1=strongly agree, 2=agree,
!      3=not sure, 4=disagree,
!      5=strongly disagree)
!      (7th Grd)
!failure = feel I am a failure

```

```

!           (1=strongly agree, 2=agree,
!             3=not sure, 4=disagree,
!             5=strongly disagree)
!           (7th Grd)
!esteem = average of self, worth, other, satisf,
!           respect, failure
!problem = 1 if (expel=1 or arrest=1 or dropout=1),
!           0 otherwise
!           (7th Grd)
!cloctn = Fall 88 respondent location
!           (1=In original School,
!             2=Moved another school,
!             3=moved, not located,
!             4=dropped out of school,
!             5=early graduation,
!             6=Quit Study)

```

```

dloctn eloctn floctn gloctn hloctn iloctn jloctn
kloctn lloctn
!dloctn = Spring 89 respondent location
!eloctn = Fall 89 respondent location
!floctn = Spring 90 respondent location
!gloctn = Fall 90 respondent location
!hloctn = spring 91 respondent location
!iloctn = fall 91 respondent location
!jloctn = spring 92 respondent location
!kloctn   = fall 92 respondent location
!lloctn = spring 93 respondent location

```

```

drink runawa suicid alc7 alc10 alc11 alc12
!drink = "Have you ever taken a drink alcohol"
!           (7th grade)
!runawa = "Have you ever thought about running
!           away"
!           (7th grade)
!suicid = "Have you ever considered suicide"
!           (7th grade)
!alc7   = "Last summer, I had 6+ drinks."
!           (7th grade)
!alc10-12 = "Last summer, I had 6+ drinks."

```

```

arest7
runa8 runa9 runa10 runa11 run12
suic8 suic9 suic10 suic11 suic12
drop7 drop8 drop9 drop10 drop11 drop12
fdrop8 fdrop9 fdrop10 fdrop11 fdrop12
!arest7 = "Last summer, I was picked up
!           and arrested"
!           (7th grade)
!runa8-12 = "Last summer, I thought about
!           running away"
!           (Asked in Fall)
!suic8-12 = "Last summer, I considered suicide"
!           (Asked in FALL)
!drop7-12 = "This school yr, thought seriously

```

```

!           about dropping out."
!           (Asked in Spring)
!fdrop8-12 = "How many of your friends will
!           drop out before graduating
!           from high school"

enj7 good7 und7 useboy7 nerv7 wor7
scar7 use7 logic7 boybet7 job7 often7
enj8 good8 und8 useboy8 nerv8 wor8
scar8 use8 logic8 boybet8 job8 often8
enj9 good9 und9 useboy9 nerv9 wor9
scar9 use9 logic9 boybet9 job9 often9
enj10 good10 und10 useboy10 nerv10 wor10
scar10 use10 logic10 boybet10 job10 often10;
!enj7-10   = "I ENJOY MATH"
!good7-10  = "I AM GOOD AT MATH"
!und7-10   = "USUALLY UNDERSTAND MATH"
!useboy7-10 = "MATH MORE USEFUL FOR BOYS"
!nerv7-10  = "MATH MAKES ME NERVOUS"
!wor7-10   = "WORRY ABOUT MATH TEST GRADES"
!scar7-10  = "SCARED WHEN I OPEN MATH BOOK"
!use7-10   = "MATH USEFUL IN EVERYDAY PROBLEMS"
!logic7-10 = "MATH HELPS LOGICAL THINKING"
!boybet7-10 = "BOYS BETTER AT MATH THAN GIRLS"
!job7-10   = "NEED MATH FOR A GOOD JOB"
!often7-10 = "WILL USE MATH OFTEN AS AN ADULT"

!
!
! End of Variable List
!

USEVAR = mothed fathed bas7 bas8 bas9 bas10;
! USEVAR command specifies which of the variables read
! into the program will be used for analysis.
! The order of the variables have to follow that of the
! original dataset.

! AUXILIARY = female;
! Specifies auxiliary vairiables to be used
! for mixture modeling.

MISSING ARE ALL(9999);
! Specifies missing values.
! To specify missing values for individual varialbes:
!   MISSING = VARNAME(MISVALUE);
! If there are multiple missing values associated with
! a given variable:
!   MISSING = VARNAME(MISVALUE1 MISVALUE2)

ANALYSIS:  type = basic missing;
! "TYPE = basic" command produces sumamry statistics
! of the dataset.
!
! It is a good idea to compare the output with the

```

```

! summary statistics obtained from the original dataset
! in the original statistical package.
!
! MISSING command request for a plot of missing data
! pattern.

```

```
PLOT:      TYPE IS plot1 plot2 plot3;
```

*** WARNING

```

Data set contains cases with missing on all variables.
These cases were not included in the analysis.
Number of cases with missing on all variables:  4
  1 WARNING(S) FOUND IN THE INPUT INSTRUCTIONS

```

```

This is a partial input file for HW1.
The variable names are for the data set lsay.dat
(Input File Name: LSAY_asgn01.inp)

```

SUMMARY OF ANALYSIS

```

Number of groups                1
Number of observations          3112

Number of dependent variables    6
Number of independent variables  0
Number of continuous latent variables  0

```

Observed dependent variables

```

Continuous
  MOTHEd      FATHED      BAS7      BAS8      BAS9      BAS10

```

```

Estimator                      ML
Information matrix              OBSERVED
Maximum number of iterations    1000
Convergence criterion           0.500D-04
Maximum number of steepest descent iterations  20
Maximum number of iterations for H1  2000
Convergence criterion for H1    0.100D-03

```

```

Input data file(s)
  C:\Ed.231E\Assignment_01\lsay.dat

```

```
Input data format  FREE
```

SUMMARY OF DATA

```
Number of patterns  41
```

SUMMARY OF MISSING DATA PATTERNS

MISSING DATA PATTERNS

| | | | | | | | | | | | | | | | | | | | | | |
|--------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | |
| MOTHEd | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | |
| FATHED | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | | | | | |
| BAS7 | x | x | x | x | x | x | x | x | | | | | | | | | | x | x | x | x |
| BAS8 | x | x | x | x | | | | | x | x | x | x | | | | | | x | x | x | x |
| BAS9 | x | x | | | x | x | | | x | x | | | x | x | | | | x | x | | |
| BAS10 | x | | x | | x | | x | | x | | x | | x | | x | | x | | x | | |
| | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | |
| MOTHEd | x | x | x | x | x | x | x | | | | | | | | | | | | | | |
| FATHED | | | | | | | | x | x | x | x | x | x | x | | | | | | | |
| BAS7 | x | x | x | x | | | | x | x | x | x | x | x | x | x | x | x | x | x | x | |
| BAS8 | | | | | x | x | | x | x | x | x | | | | x | x | x | | | | |
| BAS9 | x | x | | | x | | | x | x | | | x | | | x | x | | | x | x | |
| BAS10 | x | | x | | x | | | x | | x | | x | x | | x | | | x | | x | |
| | 41 | | | | | | | | | | | | | | | | | | | | |
| MOTHEd | | | | | | | | | | | | | | | | | | | | | |
| FATHED | | | | | | | | | | | | | | | | | | | | | |
| BAS7 | x | | | | | | | | | | | | | | | | | | | | |
| BAS8 | | | | | | | | | | | | | | | | | | | | | |
| BAS9 | | | | | | | | | | | | | | | | | | | | | |
| BAS10 | | | | | | | | | | | | | | | | | | | | | |

MISSING DATA PATTERN FREQUENCIES

| Pattern | Frequency | Pattern | Frequency | Pattern | Frequency |
|---------|-----------|---------|-----------|---------|-----------|
| 1 | 1526 | 15 | 2 | 29 | 2 |
| 2 | 320 | 16 | 9 | 30 | 1 |
| 3 | 151 | 17 | 95 | 31 | 1 |
| 4 | 331 | 18 | 32 | 32 | 1 |
| 5 | 124 | 19 | 8 | 33 | 2 |
| 6 | 45 | 20 | 33 | 34 | 5 |
| 7 | 43 | 21 | 13 | 35 | 22 |
| 8 | 210 | 22 | 7 | 36 | 1 |
| 9 | 15 | 23 | 9 | 37 | 11 |
| 10 | 6 | 24 | 20 | 38 | 6 |
| 11 | 1 | 25 | 2 | 39 | 4 |
| 12 | 4 | 26 | 3 | 40 | 2 |
| 13 | 1 | 27 | 1 | 41 | 24 |
| 14 | 3 | 28 | 16 | | |

COVARIANCE COVERAGE OF DATA

Minimum covariance coverage value 0.100

PROPORTION OF DATA PRESENT

| | Covariance Coverage | | | | |
|--------|---------------------|--------|-------|-------|-------|
| | MOTHED | FATHED | BAS7 | BAS8 | BAS9 |
| | ----- | ----- | ----- | ----- | ----- |
| MOTHED | 0.969 | | | | |
| FATHED | 0.897 | 0.906 | | | |
| BAS7 | 0.953 | 0.893 | 0.985 | | |
| BAS8 | 0.812 | 0.763 | 0.819 | 0.829 | |
| BAS9 | 0.703 | 0.662 | 0.711 | 0.655 | 0.720 |
| BAS10 | 0.639 | 0.605 | 0.649 | 0.590 | 0.585 |

| | Covariance Coverage | |
|-------|---------------------|--|
| | BAS10 | |
| | ----- | |
| BAS10 | 0.656 | |

RESULTS FOR BASIC ANALYSIS

ESTIMATED SAMPLE STATISTICS

| | Means | | | | |
|---|--------|--------|--------|--------|--------|
| | MOTHED | FATHED | BAS7 | BAS8 | BAS9 |
| | ----- | ----- | ----- | ----- | ----- |
| 1 | 2.349 | 2.623 | 50.376 | 54.803 | 59.362 |

| | Means | |
|---|--------|--|
| | BAS10 | |
| | ----- | |
| 1 | 63.118 | |

| | Covariances | | | | |
|--------|-------------|--------|---------|---------|---------|
| | MOTHED | FATHED | BAS7 | BAS8 | BAS9 |
| | ----- | ----- | ----- | ----- | ----- |
| MOTHED | 1.087 | | | | |
| FATHED | 0.606 | 1.562 | | | |
| BAS7 | 3.250 | 3.545 | 104.740 | | |
| BAS8 | 3.222 | 3.830 | 89.633 | 132.627 | |
| BAS9 | 4.110 | 4.787 | 99.727 | 124.874 | 178.350 |
| BAS10 | 4.265 | 5.032 | 100.104 | 120.635 | 155.931 |

| | Covariances | |
|--|-------------|--|
| | BAS10 | |
| | ----- | |
| | | |

BAS10 188.954

| | Correlations | | | | |
|--------|--------------|--------|-------|-------|-------|
| | MOTHEd | FATHED | BAS7 | BAS8 | BAS9 |
| | ----- | ----- | ----- | ----- | ----- |
| MOTHEd | 1.000 | | | | |
| FATHED | 0.465 | 1.000 | | | |
| BAS7 | 0.305 | 0.277 | 1.000 | | |
| BAS8 | 0.268 | 0.266 | 0.760 | 1.000 | |
| BAS9 | 0.295 | 0.287 | 0.730 | 0.812 | 1.000 |
| BAS10 | 0.298 | 0.293 | 0.712 | 0.762 | 0.849 |

| | Correlations |
|-------|--------------|
| | BAS10 |
| | ----- |
| BAS10 | 1.000 |

MAXIMUM LOG-LIKELIHOOD VALUE FOR THE UNRESTRICTED (H1) MODEL IS -43443.242

PLOT INFORMATION

The following plots are available:

Histograms (sample values)
Scatterplots (sample values)

Beginning Time: 12:25:28
Ending Time: 12:25:30
Elapsed Time: 00:00:02

Mplus VERSION 3.0 DEMO has the following limitations:

Maximum number of y-variables: 6
Maximum number of x-variables: 2
Maximum number of between variables: 2
Maximum number of latent class indicators: 4

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Based on the data, some histograms/scatter plots were created:

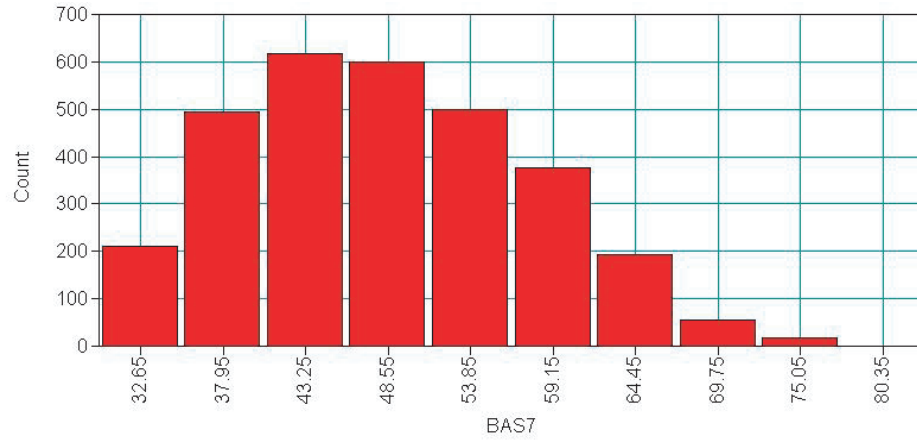


Figure 1: Histogram of Basic Math IRT scores at Grade 7

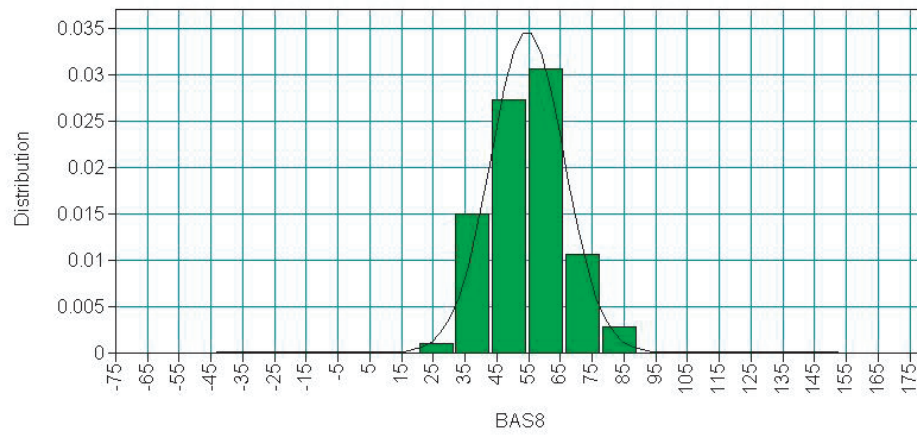


Figure 2: Histogram/Density Plot of Basic Math IRT scores at Grade 8

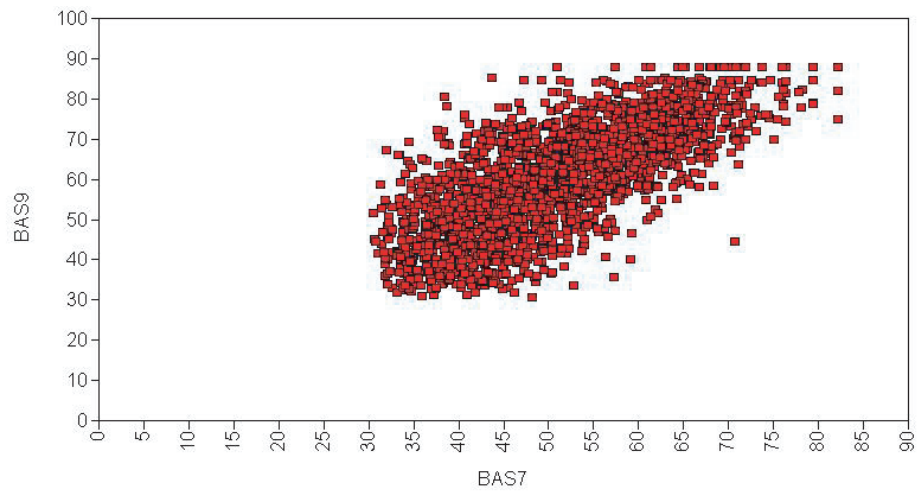


Figure 3: Scatter Plot of Basic Math IRT scores at Grade 7 on Grade 9