SCHOOL COMPUTING SYSTEM

BY

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GRADUATE PROJECT

submitted to
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MASTER OF SCIENCE
in
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SECTION ONE — INTRODUCTION

INTRODUCTION

Education system in Taiwan is divided into four levels:
1) Primary school level (grade 1-6)
2) Junior middle school level (grade 7-9)
3) Senior middle school level (grade 10-12)
4) College level

The School Computing System is designed for the junior middle school, but it can be modified for the primary school and the senior middle school easily.

Since the primary education and the junior education are compulsory now, there are many schools and students in Taiwan. Normally, it contains 50 students in one class, and 50 to 100 classes in one school, some large schools even have 120 classes. The traditional way of calculating average and rank position are using simple calculation or abacus. Even though it has been improved by using calculator, it still takes one month to work through 120 classes.

The School Computing System is designed to substitute those clumsy ways of calculating, to leave schools much time to improve teaching.

There are seven programs in the system, each fulfills a particular function. The functions are as follows:
1) Create an ISAM File to store student's scores
2) Get semester and graduate test scores
3) Calculate average and rank position in one class
4) Update data
5) Make decision of pass, fail or retest
6) Print reports
7) Statistical analysis, predict and evaluate

The system is coded in ANSI COBOL, hardware is IBM 4331 with DOS/VSE. Since the programs are structured form, they can be modified with more advanced functions without difficulties. Besides, file capacities can be increased limited only by hardware.
**FORMULAS USED FOR CALCULATION:**

1) For semester and year average

\[
\text{Average}(I) = \frac{\sum_{J=1}^{N} (\text{Score}(I,J) \times \text{Credit-Hour}(I,J))}{\text{Total-Credit-Hour}(I)}
\]

<table>
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<th></th>
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<td>1</td>
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</table>

**Remarks:**

(\text{Name of Course})

Grade 1: 1(Health Education), 2(Chinese), 3(English), 4(Mathematics), 5(Biology), 6(History), 7(Geography), 8(Music), 9(Drawing), 10(Physical Education)

Grade 2: 1(Chinese), 2(English), 3(Mathematics), 4(Chemistry),

Grade 3: 1(Health Education), 2(Chinese), 3(English), 4(Mathematics), 5(Natural Science), 6(History), 7(Geography)

Graduate: 1(Health Education), 2(Chinese), 3(English), 4(Mathematics), 5(Natural Science), 6(Social Science), 7(Music), 8(Drawing), 9(Physical Education)
2) For graduation scores

a. Health Education

\[
GD\text{-Score} = HE\text{-Year}\text{-Score} \times 0.8 + HE\text{-GT}\text{-Score} \times 0.2
\]

b. Chinese, English and Mathematics

\[
GD\text{-Score} = \frac{\sum_{i=1}^{N=3} Year\text{-Score}(I)}{3} \times 0.8 + GT\text{-Score} \times 0.2
\]

c. Natural Science (Biology, Chemistry and Physics)

\[
GD\text{-Score} = \frac{(BIO\text{-Year}\text{-Score} + \sum_{i=2}^{N=3} (CHE\text{-Year}\text{-Score}(I) + PHY\text{-Year}\text{-Score}(I)))}{5} \times 0.8 + NS\text{-GT}\text{-Score} \times 0.2
\]

d. Social Science (History and Geography)

\[
GD\text{-Score} = \frac{\sum_{i=1}^{N=3} (HST\text{-Year}\text{-Score}(I) + GGR\text{-Year}\text{-Score}(I))}{6} \times 0.8 + SS\text{-GT}\text{-Score} \times 0.2
\]

e. Music, Drawing and Physical Education

\[
GD\text{-Score} = \sum_{i=1}^{N=3} Year\text{-Score}(I) / 3
\]

FORMULAS USED FOR STATISTICS AND PREDICTION:

1) Mean

\[
\text{Mean} = \frac{\sum_{i=1}^{N} \text{Score}}{N}
\]

2) Standard Deviation

\[
SD = \frac{1}{N} \sqrt{\sum_{i=1}^{N} \text{Score}(I)^2 - \left(\sum_{i=1}^{N} \text{Score}(I)\right)^2}
\]

3) Correlation

\[
r_{XY} = \frac{(\sum XY - 1/N\sum X\sum Y)}{\left(\sum X^2 - 1/N(\sum X)^2\right)\left(\sum Y^2 - 1/N(\sum Y)^2\right)}
\]

4) Slope (Regression coefficient)

a. 1 Predictor

\[
b_{yx} = \frac{(\sum XY - 1/N\sum X\sum Y)}{\left(\sum X^2 - 1/N(\sum X)^2\right)}
\]
b. 2 Predictors
\[ \beta_2 = \frac{r_{12} - r_{13} r_{23}}{(1 - r_{23}^2)} \]
\[ \beta_3 = \frac{r_{13} - r_{12} r_{23}}{(1 - r_{23}^2)} \]
\[ b_2 = \beta_2 \times SD_1 / SD_2 \]
\[ b_3 = \beta_3 \times SD_1 / SD_3 \]

5) Intercept
   a. 1 Predictor
   \[ a_yx = \overline{Y} - b_{yx} \overline{X} \]
   b. 2 Predictors
   \[ A = \overline{X_1} - b_2 \overline{X_2} - b_3 \overline{X_3} \]

6) Coefficient of multiple correlation
\[ R = \sqrt{\beta_2 r_{12} + \beta_3 r_{13}} \]

7) Standard error of estimate
   a. 1 Predictor
   \[ \hat{\sigma} = SD_y \sqrt{1 - \frac{r_{xy}^2}{R^2}} \]
   b. 2 Predictors
   \[ \hat{\sigma} = SD_y \sqrt{1 - R^2} \]

8) Regression equation
   a. 1 Predictor
   \[ \hat{Y} = b_{yx} X + a_{yx} \]
   b. 2 Predictors
   \[ \hat{X_1} = B_2 X_2 + B_3 X_3 + A \]

FORMULAS USED FOR DECISION OF PASS, FAIL AND RETEST:

1) Pass
   Courses of score below 60 less than or equal to three

2) Retest
   Courses of score below 60 less than five and greater than three

3) Fail
   Courses of score below 60 greater than five
1 ISAM File

a MISAMF

Student scores information. Created at the beginning of the system been used. Loaded with student number, class number and record status.

Key : M-NUMBER (student number)
Record length : 300
File capacity : 180

(b) SISAMF

Same information as MISAMF. Used to sequential access MISAMF. (read only)

(c) RISAMF

Same information as MISAMF. Used to random access MISAMF. (read, write and rewrite)

Once the Master ISAM File (MISAMF) has been created, it can be accessed either sequentially or randomly. The system used SISAMF and RISAMF thereafter for sequential and random processing the Master ISAM File instead of the MISAMF. Both of the SISAMF and RISAMF belonged to the MISAMF.
2 Sequential Files

a SORTIO

Stored student semester or year scores and average before and after sorted average in descending order
Record length : 65
File capacity : 128

b IOSAVE

Saved student number and record status before rewrite into RISAMF.
Record length : 5
File capacity : 167

c IOSEGTF

Kept student number and rank data (P=Pass, W=Down and T=Retest) before rewrite into RISAMF
Record length : 5
File capacity : 167

d SORTIO2

Held student number, scores and class number for class process or grade process to print out the reports
Record length : 83
File capacity : 100

e SORTWK1

Sorted work area

<table>
<thead>
<tr>
<th>GAVGPST</th>
<th>PRTRPT</th>
<th>STANDEVA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Record length : 65</td>
<td>Record length : 83</td>
<td>Record length : 34</td>
</tr>
<tr>
<td>File capacity : 128</td>
<td>File capacity : 100</td>
<td>File capacity : 245</td>
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</table>
PROGRAMS

1. GIGAMF
   Create an ISAM File for storing student score data within three years.
   Load the MISAMF with student number and class number. Offer the record
   status with "A".

2. GITSCTN
   Input student scores (semester or graduate test) into MISAMF.

3. GAVCPST
   Calculate the average for every semester, year, graduate test and
   graduation. Sort the average in descending order and assign the position
   in class.

4. UPDATE
   Perform update MISAMF which include:
   Add a new record
   Update class number
   Update scores
   Update IQ
   Delete old record
   Update record status

5. DECISION
   Make the decision of passing, failure or retest according to the year
   scores.

6. PRTRPT
   Perform print out reports:
   Student Semester Score Report
   Student Year Score Report
   Student Semester and Year Score Report
   Score Notification
   Transcript of Record

7. STANDSYS
   Compute mean and standard deviation for every course in one class and
   the grade. Predict the average based on IQ and last average. Compare
   the predict average to the real average and rank the position with
   real average, predict average and error of estimate.
<table>
<thead>
<tr>
<th></th>
<th>GENE</th>
<th>GLOUPS</th>
<th>GAVRFIT</th>
<th>UPDATE</th>
<th>DECISION</th>
<th>HRPTFL</th>
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<td>x</td>
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</tbody>
</table>
SECTION THREE -- OPERATING GUIDES

Most of the programs in this system are multiple used, the best way to get rid of compiling every time is to store the programs in the library. To catalog a program in the permanent core-image library, the OPTION card must specify CATAL instead of LINK, and a PHASE card must follow the OPTION card. Thus the object deck for the program can be stored in the permanent core-image library as follows:

// JOB CATALOG EXAMPLE
// OPTION CATAL
   PHASE C13AMF,*
   INCLUDE
   object deck
/
// EXEC LINKEDIT
/

After the program is cataloged, it can be executed using the PHASE name as follows:

// JOB EXECUTE
// EXEC C13AMF
   data deck (if needed)
/
/

The processing flow chart is provided on the next pages, user would be recommended to follow the direction to execute the exact program without errors.
Every program needs a proper JCL Card to access the stored data. It also needs an ID Card to execute the program, it may or may not need data cards.

**RUN #1 CISAMP**

1 File JCL Card
   // DLBL HICAMP, 'CGSU.CS595D.SHIH', 32/365, iOS
   // EXTENT SYS018, SYSS333, 4, 1, 8328, 1
   // EXTENT SYS018, SYSS333, 1, 2, 8340, 12
   // DLBL HICAMP, 'CGSU.CS595D.SHIH', 0, IOS
   // EXTENT SYS018, SYSS333, 4, 1, 8328, 1
   // EXTENT SYS018, SYSS333, 1, 2, 8340, 12

2 Job ID Card
   Col 1-6 Code      Value = "J1CID1"
   Col 7-20 Filler

3 Data Card
   Col 1-4 Number   
   Col 5 Filler     
   Col 6 Class Number
   Col 7-30 Filler  Occurs 10 times in one card

4 Error Messages
   ERROR : NO ID CARD
   ERROR : WRONG ID CARD
   ERROR : NO STUDENT NUMBER CARD
   ERROR : STUDENT NUMBER NOT NUMERIC
   ERROR : STUDENT NUMBER DUPLICATED

5 Output
   Report: Student Score Master File
1 File JCL Card
   // DDLX LNAME,03050,S5950,SHLH,1,3325,43
   // LNAME,SYCO16,SYXS33,4,1,3325,1
   // LNAME,SYCO16,SYXS33,1,2,3340,12

2 Job ID Card
   Col 1-6    Code     Value "J2CID1"
   Col 7-10   Filler
   Col 11-12  Year
   Col 13-15  Filler
   Col 16     Semester  Value 1 = Fall
              2 = Spring
              3 = Grad-Test
   Col 17-20  Filler
   Col 21     Grade     Value 1 = Grade 1
              2 = Grade 2
              3 = Grade 3
   Col 22-25  Filler
   Col 26     Class     Value 1 = Class 1
              2 = Class 2
              3 = Class 3
   Col 27-30  Filler

3 Data Card
   Col 1-4    Number
   Col 5-10   Filler
   Col 11-12  Score
   Col 13-15  Filler  \} Occurs 10 times in one card

4 Error Messages
   ERROR : NO ID CARD
   ERROR : WRONG ID CARD
   ERROR : ID CARD NOT NUMERIC
   ERROR : WRONG SEMESTER CODE
   ERROR : NO STUDENT SCORE CARD
   NUMBER   ERROR
   SCORE     ERROR

5 Output
   Report: Student Score Log File
1   File JCL Card
   // DRLF DISKFILE,’C3SU.C3595D.SH3R’,82/365,ISH
   // EXTENT SY3013,SY3333,4,1,3328,1
   // EXTENT SY3013,SY3333,1,2,3340,12
   // ASSIGN SY3001,DISK,Vol=SY3333,SHR
   // DRLF SORTMK1,,0
   // EXTENT SY3001,SY3333,1,0,8316,3
   // DRLF SORTMC,’C3SU.C3595D.B.SHIRH’,0,3D
   // EXTENT SY3013,SY3333,1,0,8319,3

2   Job ID Card
   Col  1- 6  Code Value "J3CID1" = Grade process
               "J3CID2" = Class process
   Col  7-10 Filler
   Col  11  Grade
   Col 12-15 Filler
   Col 16  Semester Value 1 = Fall
               2 = Spring
               3 = Year
               4 = Graduate test
               5 = Graduation
   Col 17-20 Filler
   Col  21  Class Value 1 = Class 1
               2 = Class 2
               3 = Class 3
   Col 22-30  Filler

3   Error Messages
   ERROR : NO CARD ID CARD
   ERROR : WRONG CARD-ID CARD
   ERROR : PRE-EOF OF SORT-IO-FILE
   JOBS HAVE BEEN PROCESSED

4   Output
   Display:  Student Number, Position, Average
1. File JOB Card

   // JOBNAME,'GGSU,G595D,SHERR',02/365,112
   // EXIST SY2018,SY3333,4,1,3328,1
   // EXIST SY2018,SY3333,1,2,3340,12
   // JOB ID SAV,,GGSU,G595D,SHERR5',0,3D
   // EXIST SY2018,SY3333,1,0,3328,3

2. Job ID Card

   Col  1- 6   Code
   Col  7-10  Filler
   Col 11-12  Number
   Col 12-15  Filler
   Col 16    Grade
   Col 17-30  Filler

   Value "J4CID1" = Add a new record
   "J4CID2" = Update class number
   "J4CID3" = Update scores
   "J4CID4" = Update ID
   "J4CID5" = Delete an old record
   "J4CID6" = Update record status

   (process cases in one particular job)

3. Data Card

   a. J4CID1 (add a new record)

      Col  1- 4  Number
      Col   5  Filler
      Col   6  Grade
      Col   7  Filler
      Col   8  Semester
      Col   9  Filler
      Col  10  Filler
      Col 11-12 Score  \{ Occurs 10 times \ (semester) \}
      Col 14-41  Filler  \{ Occurs 2 times \ (year) \}
      Col  72  Filler
      Col 73-74  Position  \{ Occurs 3 times \}

   b. J4CID2 (update class number)

      Col  1- 4  Number
      Col  5-12  Filler
b. JACIDS (update class number)
   Col 1-4  Number
   Col 5   Filler
   Col 6   Class
   Col 7-9  Filler
   \[\text{Occurs 10 times}\]

c. JACIDS (update scores)
   Col 1-4  Number
   Col 5   Filler
   Col 6   Grade
   Value 1 = Grade 1
   2 = Grade 2
   3 = Grade 3
   4 = Graduate test
   Col 7   Filler
   Col 8   Semester
   Col 9-10 Filler
   Col 11-12 Subject Number
   Col 13  Filler
   Col 14-15 Score
   Col 16-17 Filler
   \[\text{Occurs 10 times}\]

d. JACIDS (update IC)
   Col 1-4  Number
   Col 5-7  IC
   Col 8   Filler
   \[\text{Occurs 10 times}\]

e. JACIDS (delete an old record)
   Col 1-4  Number
   Col 5   Filler
   Col 51-50 Filler
   \[\text{Occurs 10 times}\]

4 Error Messages
   \[\text{ERROR: NO ID CARD}\]
   \[\text{ERROR: WRONG ID CARD}\]
   \[\text{ERROR: NO DATA CARD}\]
   \[\text{ERROR: WRONG NUMBER}\]
   \[\text{ERROR: NUMBER DUPLICATED (KEY)}\]
   \[\text{JOB PROCESS COMPLETE}\]

5 Output
   Report: Update Log File
1 File JCL Card
// DCL  JCL,F,'CSUS.CS595D.SHEL',32/365,ISL
// EXTENT SYS018,SY333,4,1,8328,1
// EXTENT SYS018,SY333,1,2,8340,12
// DCL IOS.IF,'CSUS.CS595D.SHEL3',0,SD
// EXTENT SYS018,SY333,1,0,8322,3

2 Job ID Card
Col 1-6 Code Value "J5CID1"
Col 7-10 Filler
Col 11 Grade Value 1 = Grade 1
Col 12-30 Filler 2 = Grade 2
Col 12-30 Filler 3 = Grade 3
Col 12-30 Filler 4 = Graduation

3 Error Messages
ERROR : NO ID CARD
ERROR : WRONG ID CARD
ERROR : WRONG NUMBER FOR RISAM-FILE
ERROR : WRONG NUMBER FOR REWRITE-FILE

4 Output
Report: Student Rank Report
1. File JCL Card

// DIEL .JSM6F, 'CSSU.S3595D.SHM3',0,12
// EXTENT SY3016,SY3333,1,1,3328,1
// EXTENT SY3018,SY3433,1,2,3340,12
// ASSCO SY3001,DISK,VOL=SY3333,SHR
// DIEL SORTWK1',G
// EXTENT SY3001,SY3333,1,0,3319,3
// DIEL SORTIO2,'CSSU.S3595DSHLM3',0,3B
// EXTENT SY3018,SY3333,1,0,3322,3

2. Job ID Card 1

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<td>&quot;J6CID2&quot;</td>
<td>Class process score report for semester or year or both</td>
</tr>
<tr>
<td></td>
<td>&quot;J6CID3&quot;</td>
<td>Grade process score notification for semester or year or both</td>
</tr>
<tr>
<td></td>
<td>&quot;J6CID4&quot;</td>
<td>Class process score notification for semester or year or both</td>
</tr>
<tr>
<td></td>
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<td>Col 7-10</td>
<td>Filler</td>
<td></td>
</tr>
<tr>
<td>Col 11-12</td>
<td>Year</td>
<td></td>
</tr>
<tr>
<td>Col 13-15</td>
<td>Filler</td>
<td></td>
</tr>
<tr>
<td>Col 16</td>
<td>Semester</td>
<td>Value 1 = Fall 4 = Graduate test</td>
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<tr>
<td></td>
<td></td>
<td>2 = Spring 5 = Graduation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 = Year 6 = Fall, Spring and Year</td>
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<tr>
<td>Col 17-20</td>
<td>Filler</td>
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<tr>
<td>Col 21</td>
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3.15

Job ID Card 2

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<tr>
<td>11-14</td>
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<td></td>
</tr>
<tr>
<td>15-20</td>
<td>Miller</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Y1</td>
<td>Value &quot;Y&quot; = Print score of year 1 Fall</td>
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<tr>
<td>22</td>
<td>Miller</td>
<td></td>
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<tr>
<td>23</td>
<td>S1</td>
<td>Value &quot;X&quot; = Print score of year 1 Spring</td>
<td></td>
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<tr>
<td>24</td>
<td>Miller</td>
<td></td>
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<tr>
<td>25</td>
<td>Y1</td>
<td>Value &quot;X&quot; = Print score of year 1 Fall Spring Year</td>
<td></td>
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<tr>
<td>26-30</td>
<td>Miller</td>
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<tr>
<td>31</td>
<td>P2</td>
<td>Value &quot;X&quot; = Print score of year 2 Fall</td>
<td></td>
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<tr>
<td>32</td>
<td>Miller</td>
<td></td>
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<tr>
<td>33</td>
<td>S2</td>
<td>Value &quot;X&quot; = Print score of year 2 Spring</td>
<td></td>
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<tr>
<td>34</td>
<td>Miller</td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Y2</td>
<td>Value &quot;X&quot; = Print score of year 2 Fall Spring Year</td>
<td></td>
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<tr>
<td>36-40</td>
<td>Miller</td>
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<tr>
<td>41</td>
<td>P3</td>
<td>Value &quot;X&quot; = Print score of year 2 Fall</td>
<td></td>
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<tr>
<td>42</td>
<td>Miller</td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>S3</td>
<td>Value &quot;X&quot; = Print score of year 2 Spring</td>
<td></td>
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<tr>
<td>44</td>
<td>Miller</td>
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<tr>
<td>45</td>
<td>Y3</td>
<td>Value &quot;X&quot; = Print score of year 3 Fall Spring Year</td>
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<tr>
<td>46-50</td>
<td>Miller</td>
<td></td>
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</tr>
<tr>
<td>51</td>
<td>CT</td>
<td>Value &quot;X&quot; = Print score of Graduate Test</td>
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<tr>
<td>52-55</td>
<td>Miller</td>
<td></td>
<td></td>
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<tr>
<td>56</td>
<td>GD</td>
<td>Value &quot;X&quot; = Print score of Graduation</td>
<td></td>
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<tr>
<td>57-80</td>
<td>Miller</td>
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</table>

4. Error Messages

ERROR : NO ID CARD
ERROR : WRONG ID CARD
ERROR : ID CARD NOT NUMERIC
ERROR : WRONG CODE IN ID CARD
Output

Report:  Student Semester Score Report
         Student Year Score Report
         Student Semester and Year Report
         Score Notification
         Transcript of Record
1 File JCL Card
   // EXEC DSN=RSU.QS595D.RERTL,32/365,15
   // EXEC CSE018,SY333,4,1,3333,1
   // EXEC CSE018,SY333,1,2,340,12
   // ASSGN SY3001,DISK,vol=SY333,SHR
   // EXEC CORT:K1,,0
   // EXEC CSE001,SY333,1,0,3316,3

2 Job ID Card
   Col 1-6   Code       Value "J7C1D1"
   Col 7-10  Filler
   Col 11    Grade
   Col 12-15 Filler
   Col 16-17 Year of Fall
   Col 18-20 Filler
   Col 21-22 Year of Spring
   Col 23-30 Filler

3 Error Messages
   ERROR : NO ID CARD
   ERROR : WRONG ID CODE
   ERROR : PRG. EOF

4 Output
   Report: Score Statistical Analysis Report
   a. Mean and Standard Deviation
   b. Correlation and Prediction
   c. Summary
These programs have been tested many times, and no problems were encountered. Most common problems were

1. Use wrong File JCL Card
2. No Job ID Card
3. Wrong Job ID Card
4. Input scores are not numeric
5. Input number is not numeric
6. Use wrong number as search key
7. Input data (scores and numbers) from cards in wrong column