THE WEST AFRICAN EXAMINATIONS COUNCIL

SCORES REGRESSION

USER OPERATIONAL MANUAL AND TECHNICAL DOCUMENTATION

Abstract

This manual shall serve as a guide for the user in carrying out all the operations in the SCORES PREDICTION program. The application must be installed on the User's computer and the manual should be studied carefully. Note that every step is carefully explained for category of user.

SCORES PREDICTION PROGRAM

Introduction

The scores prediction subsystem is an application for processing missing scores on candidates as certified by the Council. Such missing scores of candidates must be certified that they are truly missing through appropriate channels before prediction can be carried out. The prediction process is based on the regression line equation (to be described in the subsequent sections) for different number of paper cases.

Program Specification

Program Name: Scores Prediction

Programming Language: C#/.NET

Input:

i. Main SR File: The SR file that contains the list of all candidates with complete scores in the respective States and Subjects
ii. Main Transaction SR File: The SR file containing the list of all the candidates whose scores are to be predicted
iii. Subjects Index File: The Subjects Index file which contains the required Subject Code pointer for candidates scores slotting

Hence all data required for processing must be made available on State and Subjects basis

Output:

i. Candidate Scores File: This file holds the Scores of candidates predicted using the regression constants on state, paper and candidate basis.
ii. Log File: The log file keeps track of all prediction history for all prediction carried out by the user.

Processing

i. Select the type of prediction to be performed. Prediction could be grouped into two paper, three paper, four paper or centralized prediction. Centralized prediction takes cares of all missing scores in all states in all subjects.
ii. Deduce the constants using the regression equation shown below:
$Y_i = a + b_1x_1 + b_2x_2 + b_3x_3 + \ldots b_kx_k$
Where

x_1, x_2, x_3, etc are the independent variables and the coefficients b_1, b_2, b_3, etc can be obtained using the least square method, which represent the regression model coefficients determined in the analysis.
y is the dependent variable (estimated streamflow statistics) for a specific paper *i.*

iii. For two papers case:
$y = a + bx$
where $b = C_{xy}/C_{xx} = (\Sigma xy - n\ddot{x}\bar{y})/(\Sigma x^2 - n\ddot{x}^2)$, $a = \bar{y} - b\ddot{x}$, where $\ddot{x}$ and $\bar{y}$ are the mean of x and y respectively.

iv. For three variables, the equation is:
$Y = a + b_1x_1 + b_2x_2$
Where $b_1 = \dfrac{(C_{x2x2})(C_{x1y}) - (C_{x1x2})(C_{x2y})}{(C_{x1x1})(C_{x2x2}) - (C_{x1x2})(C_{x1x2})}$
$b_2 = \dfrac{(C_{x1x1})(C_{x2y}) - (C_{x1x2})(C_{x1y})}{(C_{x1x1})(C_{x2x2}) - (C_{x1x2})(C_{x1x2})}$
$a = \bar{y} - b_1\ddot{x}_1 - b_2\ddot{x}_2$

See illustration below:

ILLUSTRATION

Two variable problem

Consider the following arbitrary scores of ten candidates in General Mathematics

Paper 1 (x)	Paper 2 (y)	x^2	y^2	xy
2	3	4	9	6
3	2	9	4	6
5	5	25	25	25
6	4	36	16	24
7	6	49	36	42
8	8	64	64	64
9	7	81	49	63
10	9	100	81	90
11	11	121	121	121
14	12	196	144	168
$\Sigma x = 75$	$\Sigma y = 67$	$\Sigma x^2 = 685$	$\Sigma y^2 = 549$	$\Sigma xy = 609$

Here, $n = 10$, $\bar{x} = \frac{\Sigma x}{n} = \frac{75}{10} = 7.5$, $\bar{y} = \frac{\Sigma y}{n} = \frac{67}{10} = 6.7$

$Cxx = \Sigma x^2 - n\bar{x}^2 = 685 - (10)(7.5)^2 = 122.5$

$Cyy = \Sigma y^2 - n\bar{y}^2 = 549 - (10)(6.7)^2 = 100.1$

$Cxy = \Sigma xy - n\bar{x}\bar{y} = 609 - (10)(7.5)(6.7) = 106.5$

Therefore

$b = \frac{C_{xy}}{C_{xx}} = \frac{106.5}{122.5} = 0.87$

$a = \bar{y} - b\bar{x} = 6.7 - 0.87(7.5) = 0.18$

equation of the line of regression given by

$y = 0.18 + 0.87x.$

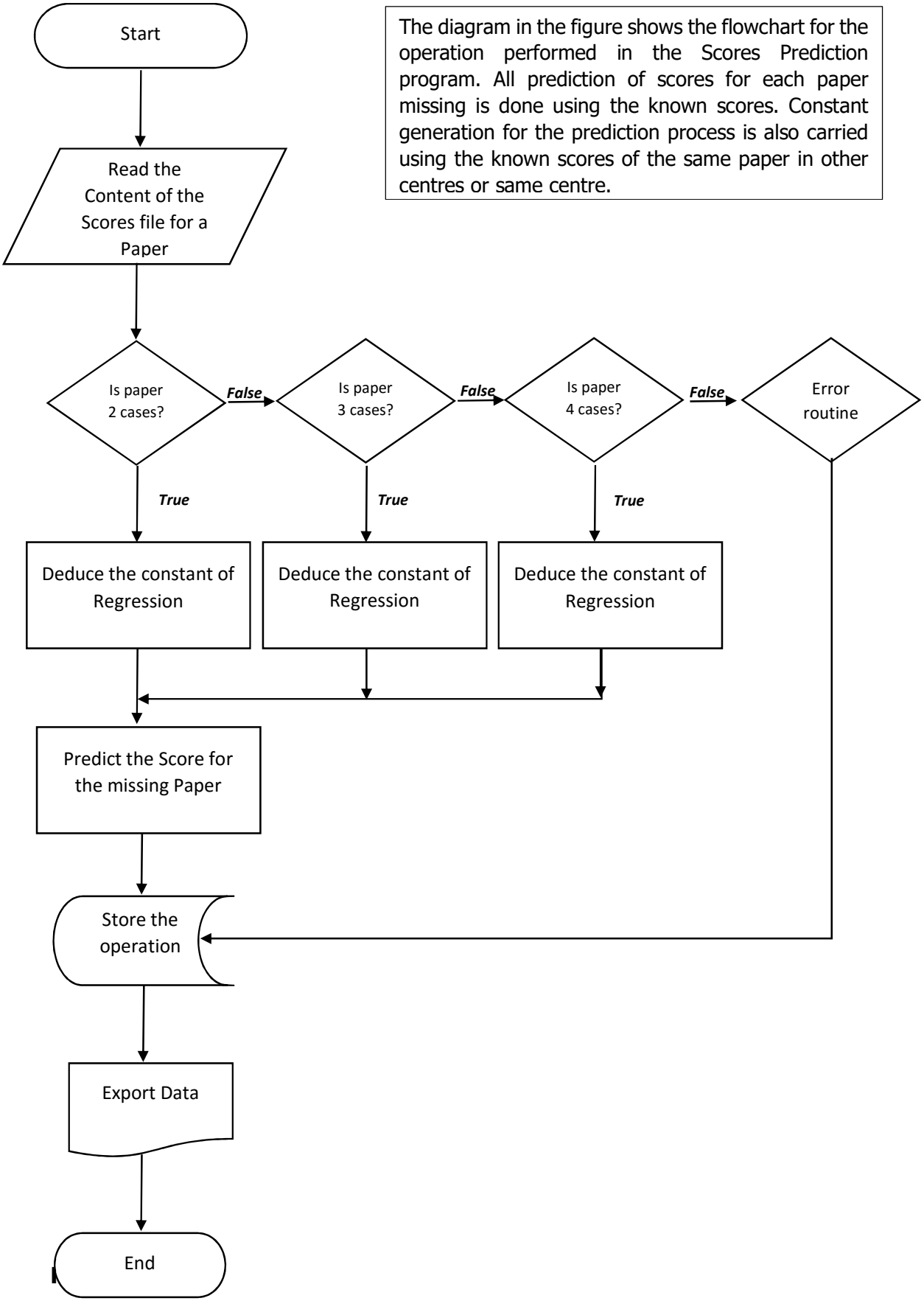
Suppose we wish to predict a score in paper 2 for a candidate who scored 13 in paper 1, then the predicted score would be gotten by substituting 13 for x in the equation. i. e.

$Y = 0.18 + 0.87(13) = 11.49$ which is approximately 11.

Hence the candidate score would be 11.

v. Calculate the missing score using the description above and store data in the candidate scores table

Program Flowchart



The diagram in the figure shows the flowchart for the operation performed in the Scores Prediction program. All prediction of scores for each paper missing is done using the known scores. Constant generation for the prediction process is also carried using the known scores of the same paper in other centres or same centre.

The sections of the pseudocode described below perform specified operations which control the operation in the program. They are described under; general block logic, DoPrediction block logic, TwoPaperPrediction, ThreePaperPrediction and FourPaperPrediction block logics.

1. **General block logic**

```
BEGIN
        Login USING staff
        PERFORM DoCentralizedPrediction
        EXPORT PredictedScores
        PRINT ReportOfPrediction
END
```

2. **Block logic for DoPrediction**

```
BEGIN
        READ statesData FROM source
        FOREACH state IN statesData
        BEGIN
                COMMENT: The papers data to be read are only the ones to be
                predicted
                READ papersData FROM source(state)
                FOREACH paper IN paperData
                BEGIN
                        IF paper IS TwoPaperCases
                                THEN
                                PERFORM TwoPaperPrediction(state, paper)
                        ELSE IF paper IS ThreePaperCases
                                THEN
                                PERFORM ThreePaperPrediction(state, paper)
                        ELSE IF paper IS FourPaperCases
                                THEN
                                PERFORM FourPaperPrediction(state, paper)
                        ELSE
                                RETURN
                END
        END
END
```

The block logic for all paper cases uses the same functional requirement and hence only the two paper scenario will be provided:

3. **Block logic for TwoPaperPrediction(state, paper)**

```
BEGIN

        PERFORM GetCoefficientConstants(state, paper)

        IF coefficientConstants EXISTS

                THEN

                READ MainTransactionSRFileData FROM source
```

```
            FOREACH record IN MainTransactionSRFileData
            BEGIN
                GET pointerOftheMissingPaper INTO variables
                GET AbsenteeStatesOftheRecord INTO variables
                CALCULATE missingPaper
                WRITE data TO CandidateScores
            END
        ELSE
            RETURN
END
```

The GetCoefficientConstant block logic will use the regression equations to deduce the constant for the paper and return the constants to the main program.

DATABASE DESIGN

Database Name: RegressionDB

Database Server: Microsoft SQL Server 2008 Management Studio

1. User Table: Stores the list of users required to use the system

Column Name	Data Type	Allow Nulls
username	varchar(50)	☐
password	varbinary(MAX)	☑
fullname	varchar(70)	☑

2. States Table: Stores the list of all states in the federation

Column Name	Data Type	Allow Nulls
State_Name	varchar(255)	☑
State_Code	varchar(2)	☐

3. Main SR Table: Stores the list of all known scores for the diet being predicted

Column Name	Data Type	Allow Nulls
RECTYPE	varchar(2)	☑
SUBJCODE	varchar(6)	☐
CANDNO	varchar(10)	☐
CASSYR1	varchar(3)	☑
CASSYR2	varchar(3)	☑
CASSYR3	varchar(3)	☑
CASSYR4	varchar(3)	☑
AVMODSCORE	varchar(3)	☑
MODSCORE	varchar(5)	☑
TASSPAP1	varchar(3)	☑
TASSPAP2	varchar(3)	☑
TASSPAP3	varchar(3)	☑
TASSPAP4	varchar(3)	☑

4. Main Transaction SR Table: Stores the list of all unknown scores to be predicted

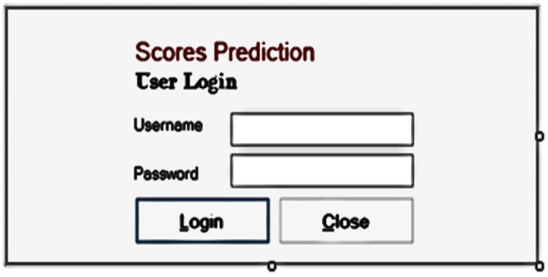
Column Name	Data Type	Allow Nulls
RECTYPE	varchar(2)	☑
SUBJCODE	varchar(6)	☐
CANDNO	varchar(10)	☐
CASSYR1	varchar(3)	☑
CASSYR2	varchar(3)	☑
CASSYR3	varchar(3)	☑
CASSYR4	varchar(3)	☑
AVMODSCORE	varchar(3)	☑
MODSCORE	varchar(5)	☑
TASSPAP1	varchar(3)	☑
TASSPAP2	varchar(3)	☑
TASSPAP3	varchar(3)	☑
TASSPAP4	varchar(3)	☑

5. Predicted Scores Table: Stores the list of all predicted scores

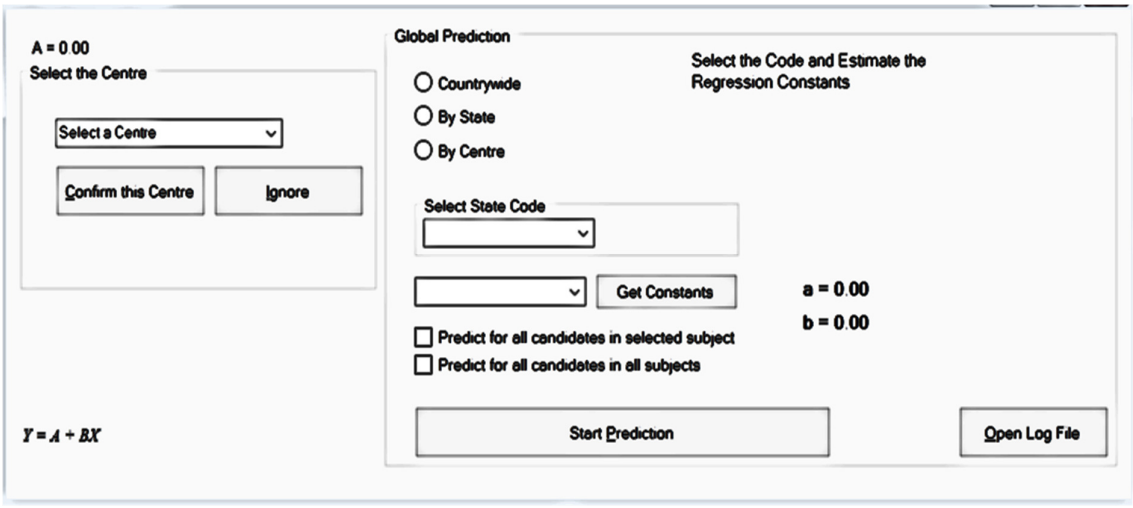
Column Name	Data Type	Allow Nulls
id	int	☐
[REC-TYPE]	varchar(2)	☑
[PAPER-CODE]	varchar(6)	☐
[CAND-NO]	varchar(10)	☐
SCORE	varchar(3)	☑
FILLER	varchar(9)	☑

MODULE DESIGN

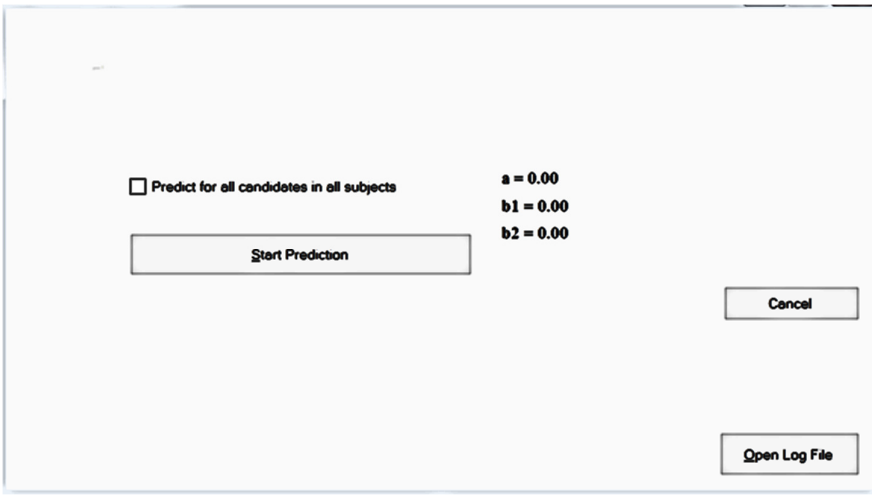
1. **Login Module Design**: The module shall be used to validate user access to the systems. It will use:
   DISPLAY AND INPUT Controls
   i. Two label for User Name and Password display
   ii. Two Text inputs for User Name and Password entries
   iii. Two command buttons for Login and Close operation



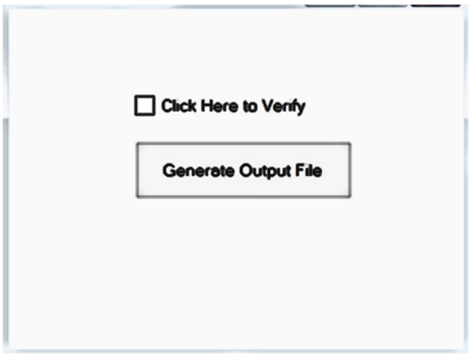
2. **N Paper Prediction Module Design:** Where *N* is the number of paper cases. For cases where the user need to use the *N* paper cases prediction singly. The controls used in the design process include: labels, option buttons, check boxes, drop down and command buttons
   i. Dropdown to load from source: centres, state of centres
   ii. Labels: to display information to the user
   iii. Check controls: for user to specify the level of prediction to be carried out
   iv. Buttons: To initiate the prediction process



3. **Centralized Prediction Module Design:** Here prediction is carried centrally and the process automates its inputs to deduce its constant from state to state, paper to paper and centre to centre The controls used in the design process include: labels, check box and command buttons
   i. Labels: to display information to the user
   ii. Check controls: for user to specify the level of prediction to be carried out
   iii. Buttons: To initiate the prediction process



4. **Generate Output Module Design:** This module allows the user to generate a text file in the structure of the score file. The controls used in the design process include: a check box and a command button
   i. Check control: for user to verify the export of file process
   ii. Button: To initiate the export process



Operational Manual of the Scores Prediction Subsystem

Recommended System Requirement –

Hardware Specification:

Processor	:	Pentium IV and above
Speed	:	2.4 GHz (Recommended)
Memory Capacity	:	8 GB (Recommended)
Hard Disk Capacity	:	120 GB Minimum
Display	:	15” (1024 x 768)

Software Specification

Operating System	:	Windows 2007 and above

NOTE: When the application is installed on you PC, the following dependencies must be installed for the optimum performance:

Microsoft .NET Framework (3.5) minimum

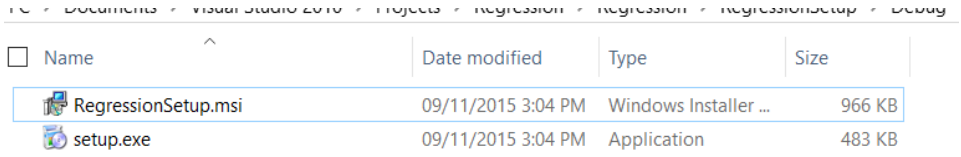
SCORES PREDICTION APPLICATION INSTALLATION

Installation overview

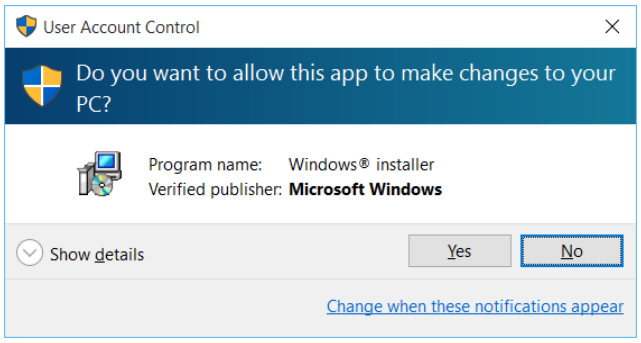
All required components for installation would be included in the installation CD or pen drive. Ensure that Microsoft SQL Server 2008 Management Studio is installed on the server computer.

Installation steps

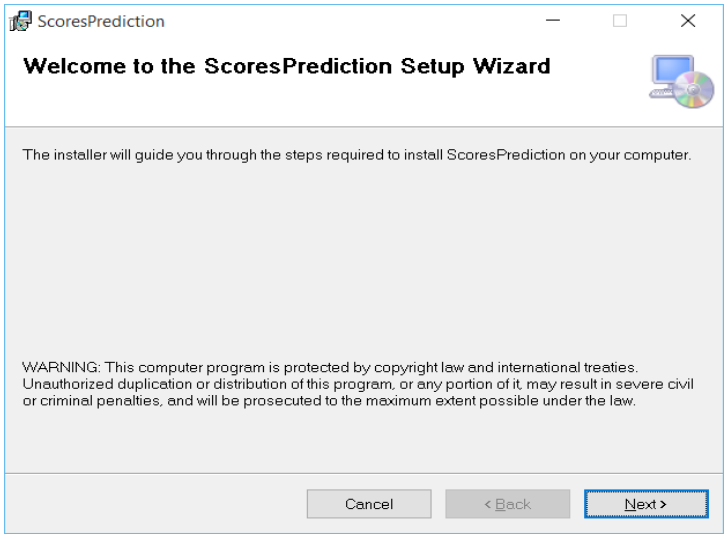
i. Locate the folder containing the installation components as shown below:



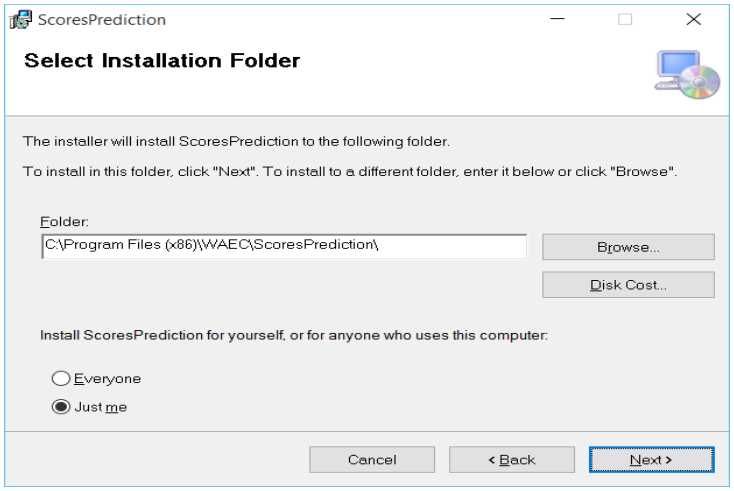
ii. Double click setup.exe . If the User Access Control dialog appears as shown below



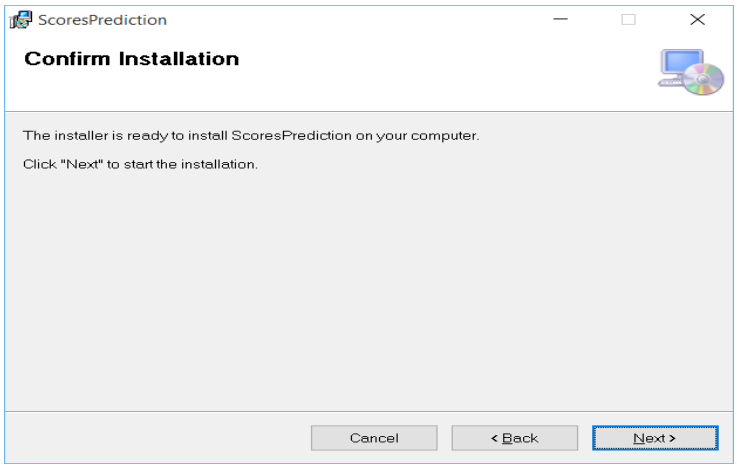
Click the **Yes** button. This opens the screen below:



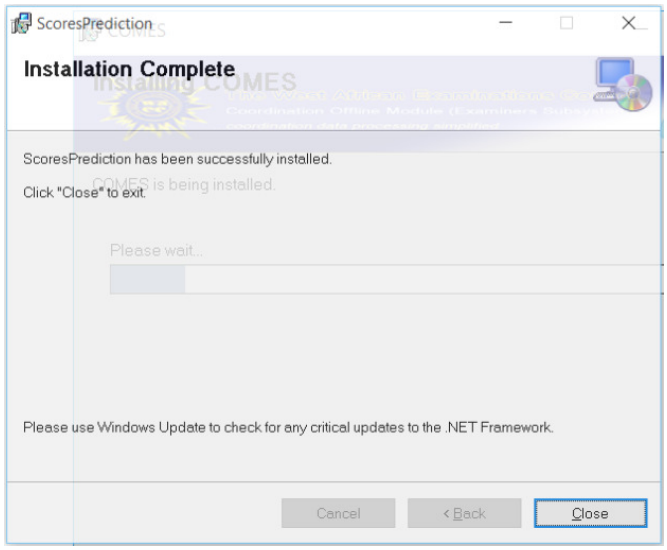
iii. Click the **Next** button to select the installation folder



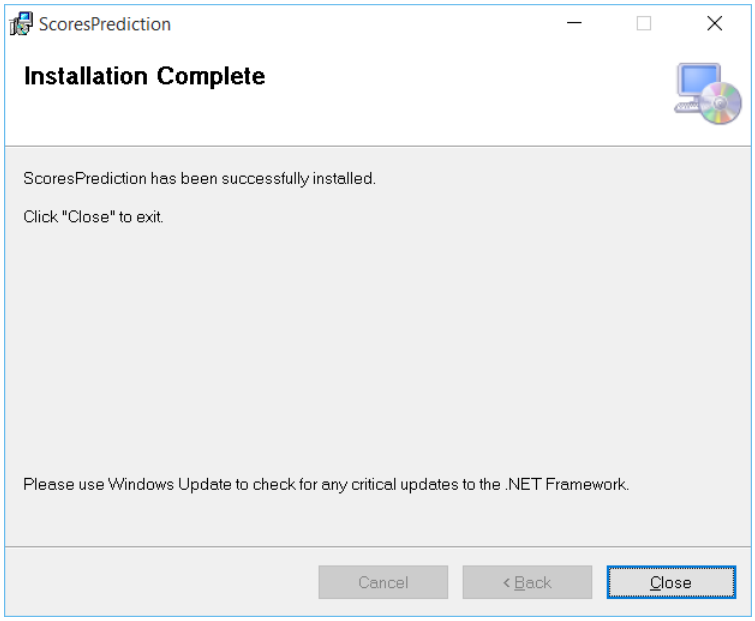
iv. Click the **Next** button



v. Click the **Next** button to start the installation. The process of the installation would display the screen below:



vi. Wait until the installation is completed and displays:



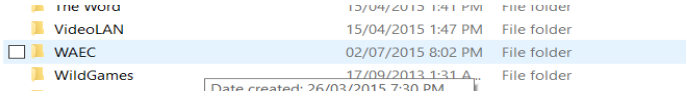
vii. Click the Close button

Setting up Installation folder rights

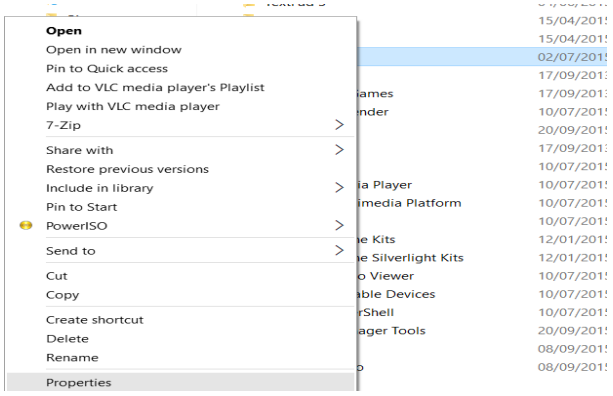
Access to read/write privileges for the current user will not be setup automatically. Hence the user needs to set the read/write access on the installation folder using the steps described below:

i. Click Computer or My Computer icon and open Local Disk (C:). Double click Program Files (x86) or Program Files.

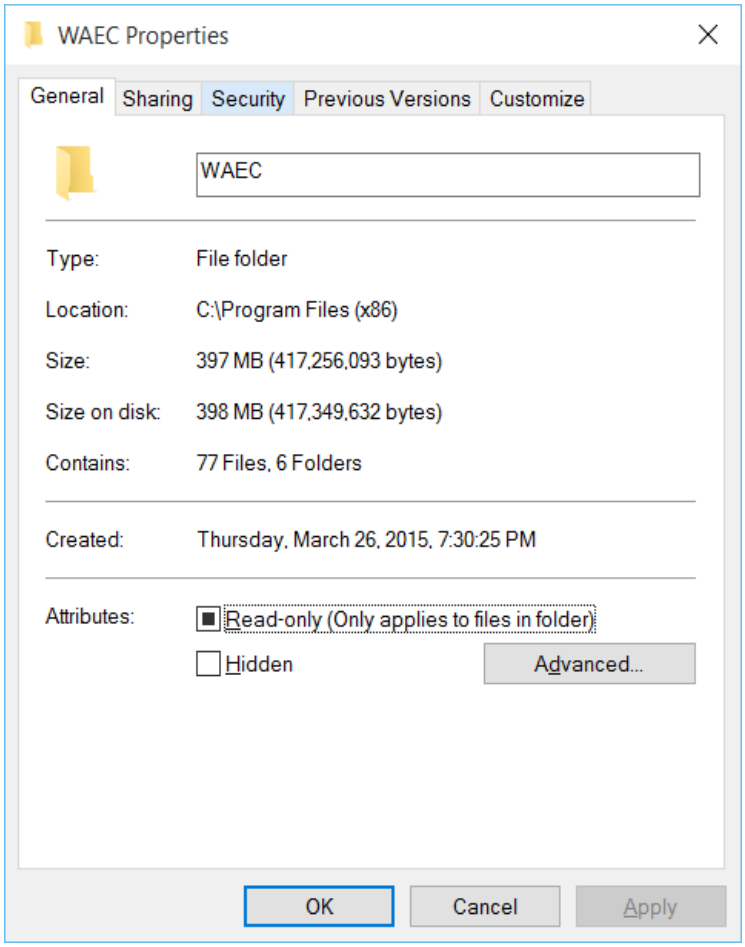
ii. Locate a folder names WAEC:



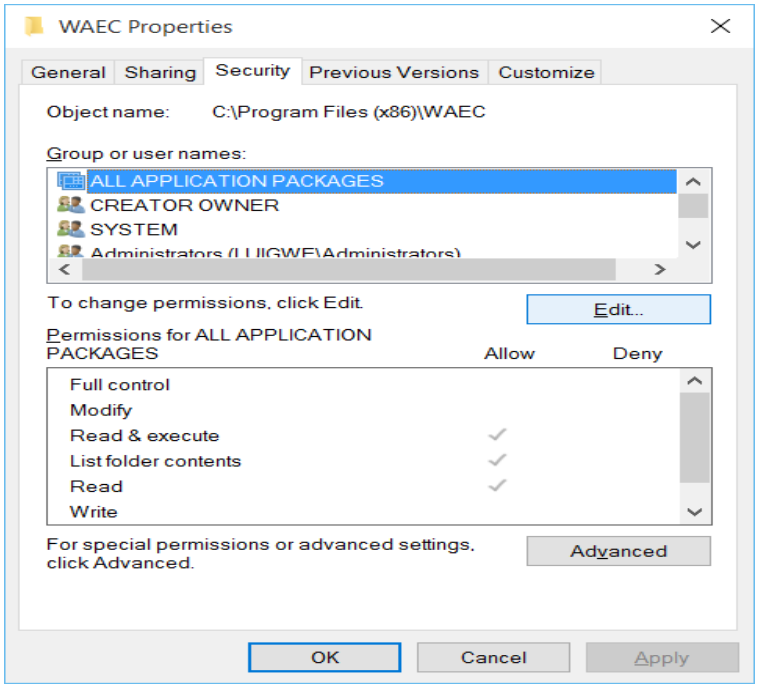
iii. Right click folder and select Properties



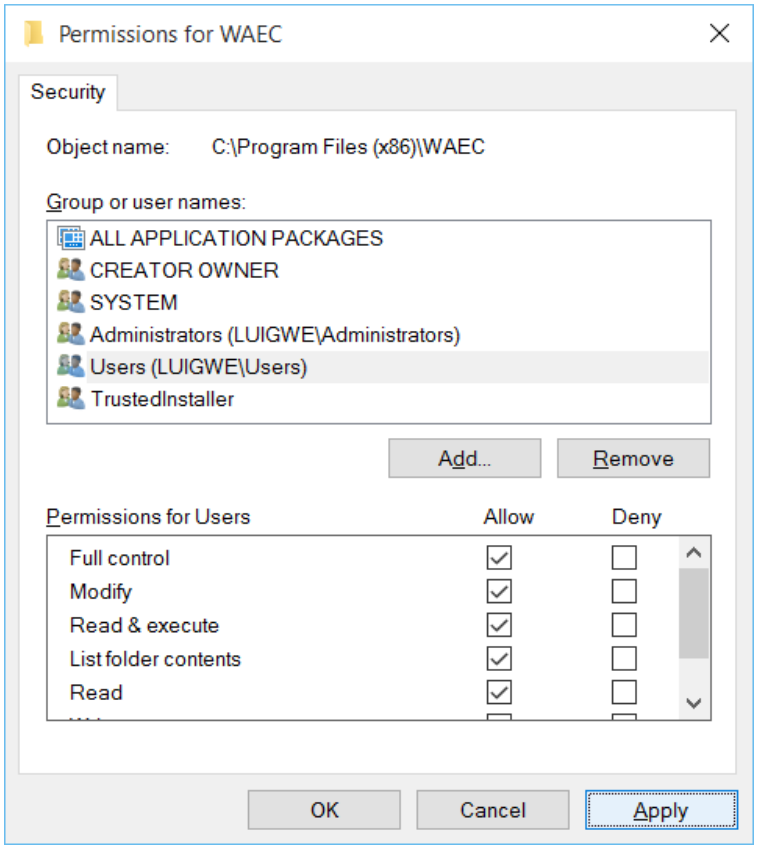
This open the screen below:

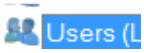


iv. Click the **Security** tab.



v. Click the Edit button



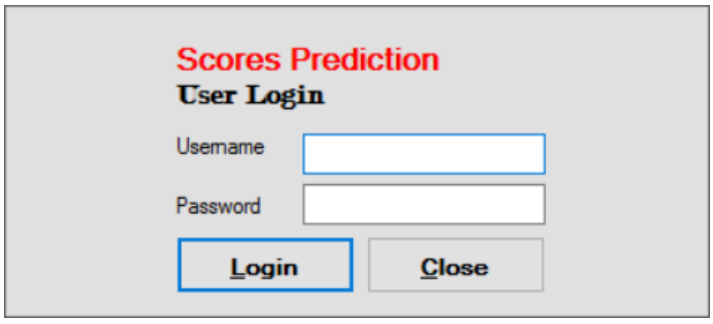
vi. Select the option with  and user ***Permissions for Users***, below **Allow**, select the box for **Full Control**

vii. Click the **Apply** button and click **OK** buttons until the screens are closed

USING SCORES PREDICTION APPLICATION

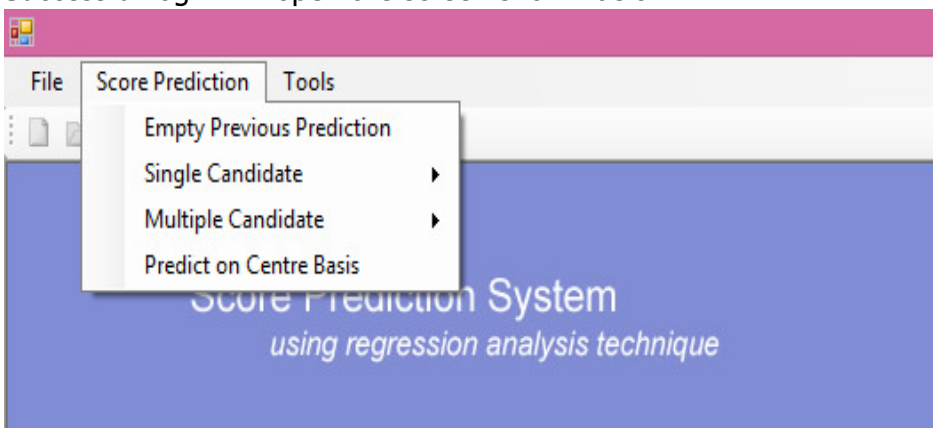
To run the application

i. Double click the Installation Icon. This opens the window below:



ii. Enter the Login details and click Login button

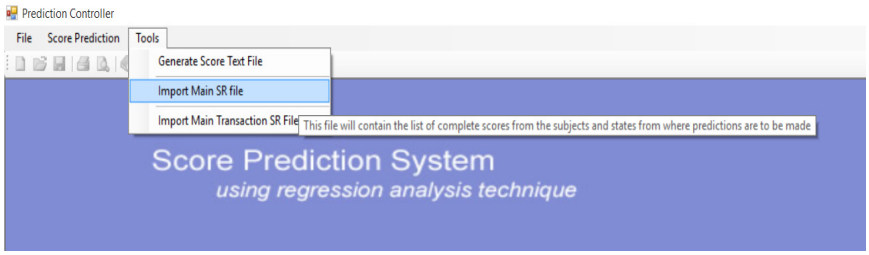
iii. Successful login will open the screen shown below



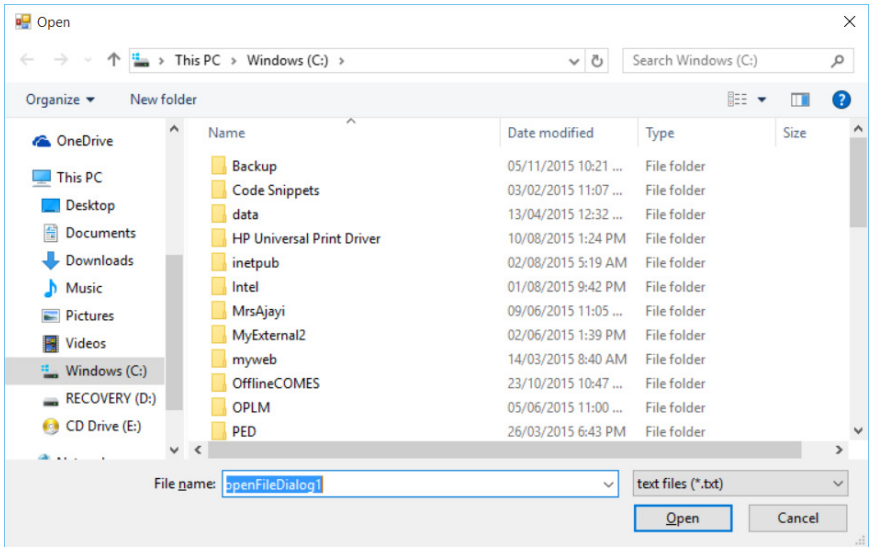
The menu items are provided for easy access to the application functions. Before new prediction can be carried out, all previous prediction log should be expunged using the ***Empty Previous Prediction*** *item on the Score Prediction menu*

To Start Prediction for a new exam diet

i. Click the Tools menu. This opens the screen below:



ii. Click Import Main SR File choice. This open the Import dialog as shown below:



iii. Browse to select the specified file and click Open button.

iv. The import process will start.

Ensure that you wait until the import of the Main SR file is completed. You would also import the Main Transaction SR file using the steps shown above by selecting Import Main Transaction SR file from the Tools menu

Prediction can be carried out using different menu choices:

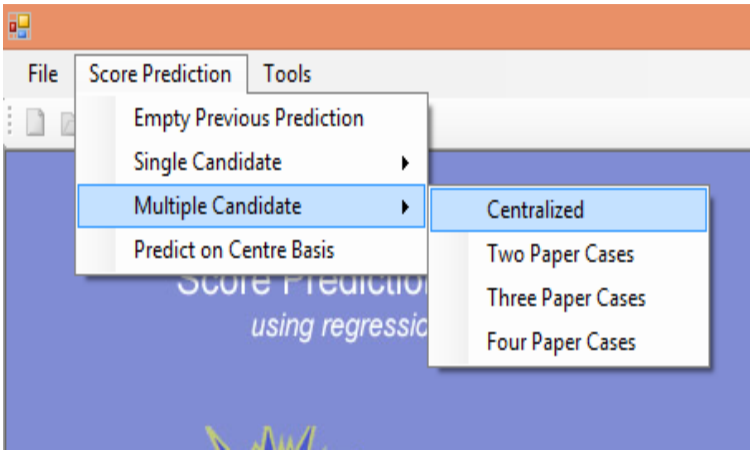
i. Single Candidate
ii. Multiple Candidates
iii. Prediction on Centre Basis

For either of (i) or (ii), the user can select from either Two Cases, Three Cases, Four Cases or Centralized Prediction.

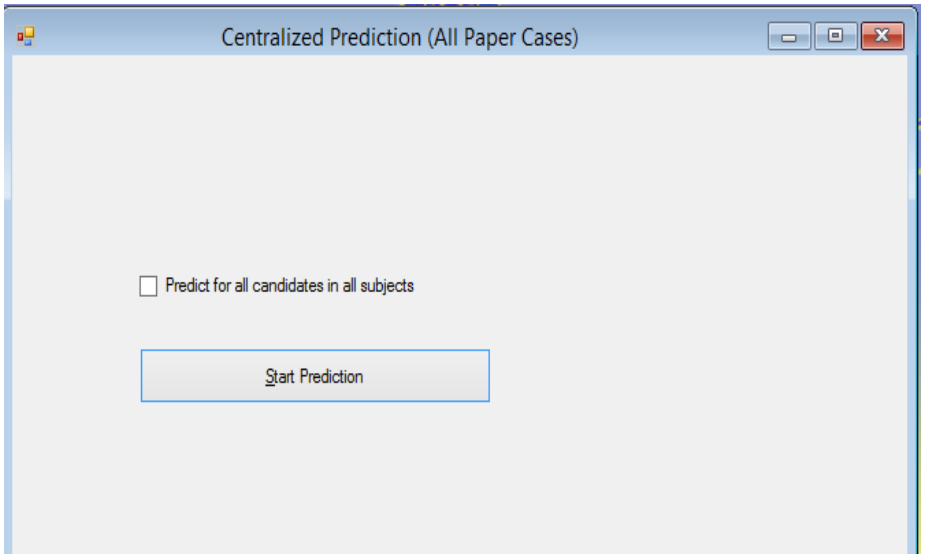
Centralized Prediction

The most recommended choice of prediction in the application is the Centralized Prediction. This provides a simplified user interface and also predicts for all missing papers in all states; as illustrated below:

i. From the *Multiple Candidates* menu choice, Click the *Centralized* choice as shown below:

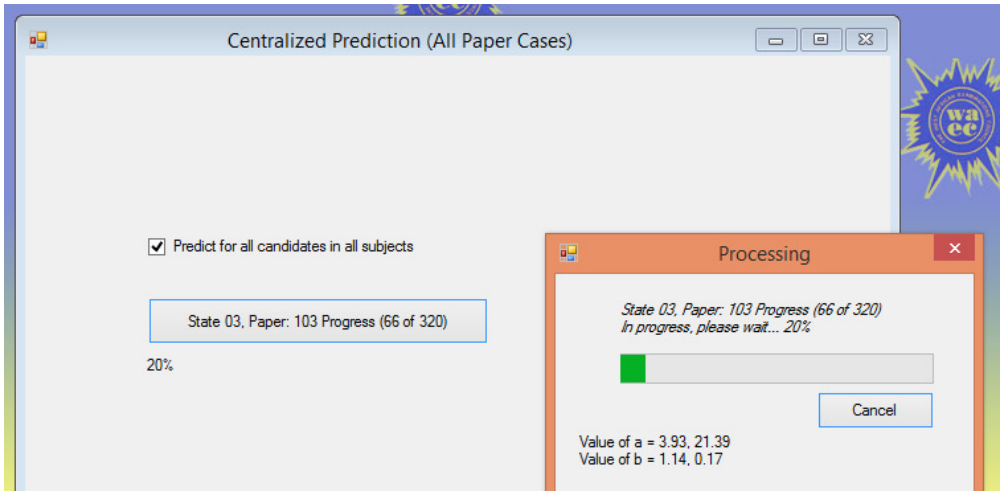


This opens the window below:



ii. To start, Check the *Predict for all Candidates in all subjects* option

iii. Click the *Start Prediction* button. This opens the screen below:

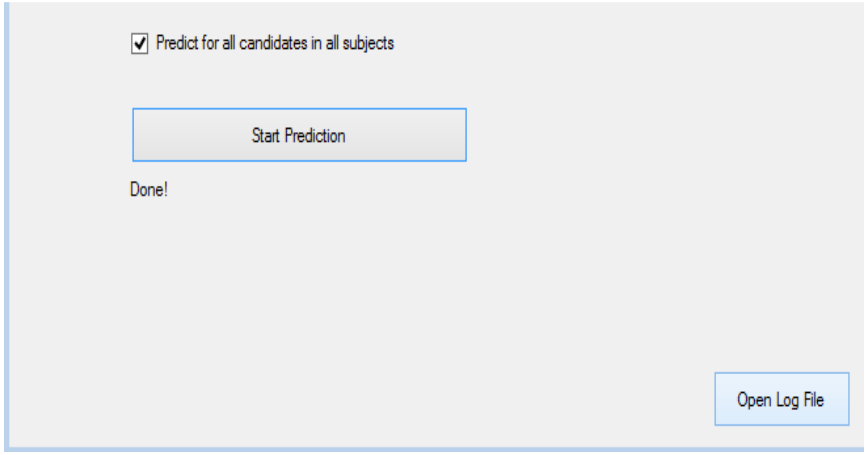


iv. The Constants for prediction are estimated for each prediction and the user waits until all required subjects in the list of states of candidates to be predicted are performed

v. The process generates a log file containing the statistics of the operation performed on State and Subjects basis. The Content of the Log file is as follows:

The Log File

To view the log File, the user can click the button, *Open Log File* once prediction is completed

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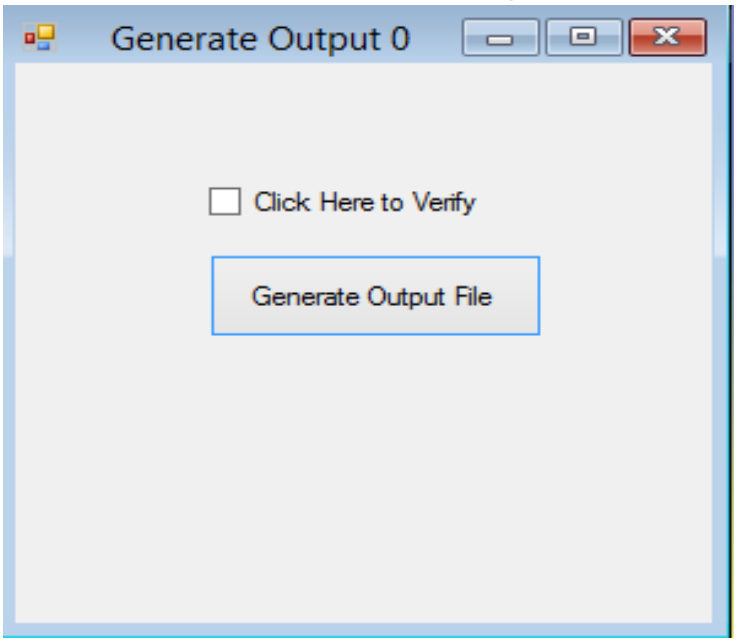
01/10/2013 10:40:54: Total Predicted for State Code: 03 for Paper Code 103 is 308 of 320
01/10/2013 10:54:43: Total Predicted for State Code: 03 for Paper Code 103 is 308 of 320
01/10/2013 12:14:43: Total Predicted for State Code: 03 for Paper Code 204 is 6933 of 7079
19/02/2014 08:39:30: State 03 of Paper 103 could not be predicted values of a and b could not be estimated
19/02/2014 08:40:57: Total Predicted for State Code: 03 for Paper Code 204 is 6931 of 7079
19/02/2014 08:44:00: Total Predicted for State Code: 03 for Paper Code 302 is 12003 of 12305
19/02/2014 08:44:28: Total Predicted for State Code: 03 for Paper Code 327 is 616 of 617
19/02/2014 08:45:02: Total Predicted for State Code: 03 for Paper Code 512 is 1172 of 1210
19/02/2014 08:45:57: Total Predicted for State Code: 09 for Paper Code 203 is 0 of 1397
19/02/2014 08:48:45: Total Predicted for State Code: 09 for Paper Code 205 is 1 of 4530
19/02/2014 08:49:46: Total Predicted for State Code: 09 for Paper Code 502 is 1406 of 1497
19/02/2014 08:50:19: Total Predicted for State Code: 09 for Paper Code 512 is 1123 of 1129
19/02/2014 08:50:33: Total Predicted for State Code: 09 for Paper Code 702 is 142 of 152
19/02/2014 08:50:33: State 35 of Paper 302 could not be predicted values of a and b could not be estimated
19/02/2014 23:06:39: Total Predicted for State Code: 03 for Paper Code 103 is 308 of 320
19/02/2014 23:09:48: Total Predicted for State Code: 03 for Paper Code 204 is 6931 of 7079
19/02/2014 23:14:38: Total Predicted for State Code: 03 for Paper Code 302 is 12003 of 12305
19/02/2014 23:14:51: Total Predicted for State Code: 03 for Paper Code 327 is 616 of 617
19/02/2014 23:15:26: Total Predicted for State Code: 03 for Paper Code 512 is 1172 of 1210
19/02/2014 23:16:23: Total Predicted for State Code: 09 for Paper Code 203 is 0 of 1397
19/02/2014 23:19:16: Total Predicted for State Code: 09 for Paper Code 205 is 1 of 4530
19/02/2014 23:20:16: Total Predicted for State Code: 09 for Paper Code 502 is 1406 of 1497
19/02/2014 23:20:46: Total Predicted for State Code: 09 for Paper Code 512 is 1123 of 1129
19/02/2014 23:20:59: Total Predicted for State Code: 09 for Paper Code 702 is 142 of 152
19/02/2014 23:21:00: State 35 of Paper 302 could not be predicted values of a and b could not be estimated
```

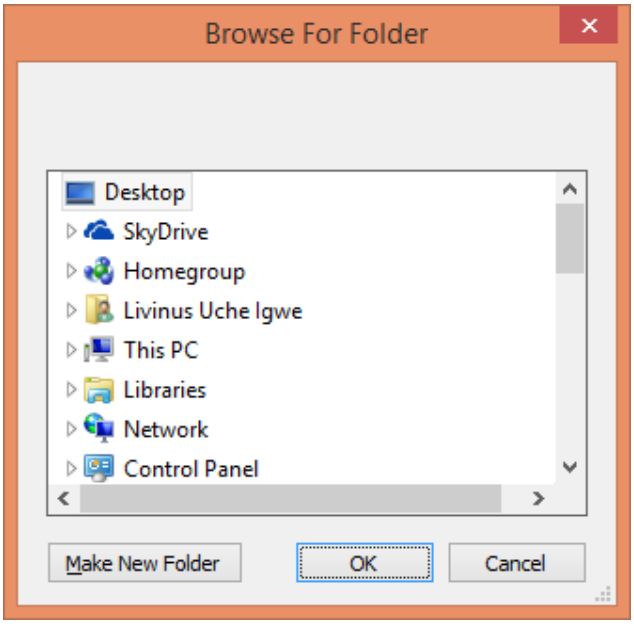
Exporting Predicted Scores

i. Click the Tools menu

ii. Click Generate Scores Text File. This open the screen below:



iii. Click the box *Click Here to Verify.* This open the dialog below:



iv. Locate where you want to save your file and Click *OK* button

v. The file will be exported and placed in the exact required format for processing.

Thank You

Prepared by

IGWE L. U.

AR (Programming)

CSD Yaba