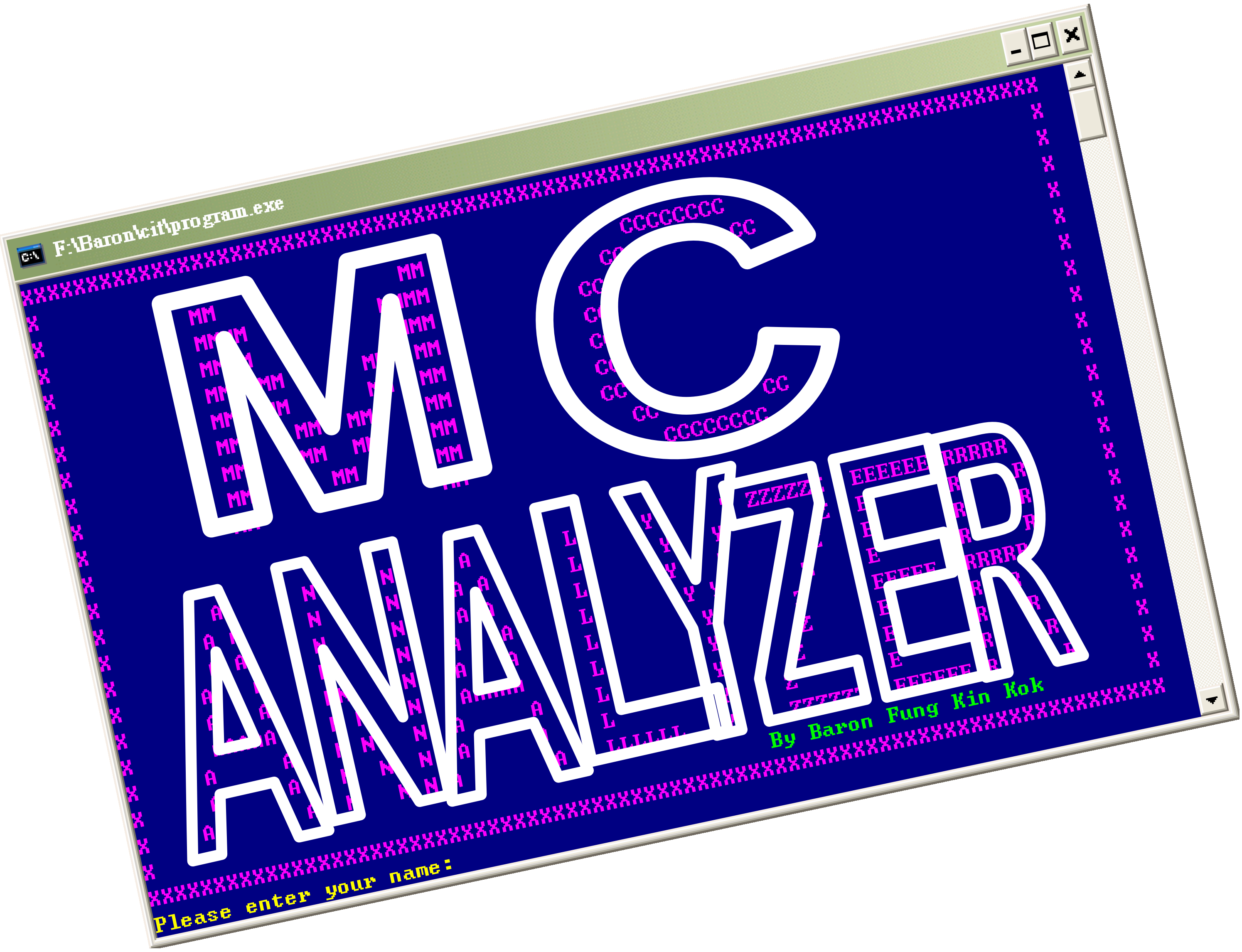
Hong Kong Certificate of Education Examination 2009
Computer and Information Technology Paper3
(Coursework)



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By Baron Fung Kin Kok
Please enter your name:
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Module A: Algorithm and Programming

Title: Multiple-Choice Analysis Report

Candidate ID No:

Content

Appendices :

Chapter 1 Introduction

1.1 Background

The situation:

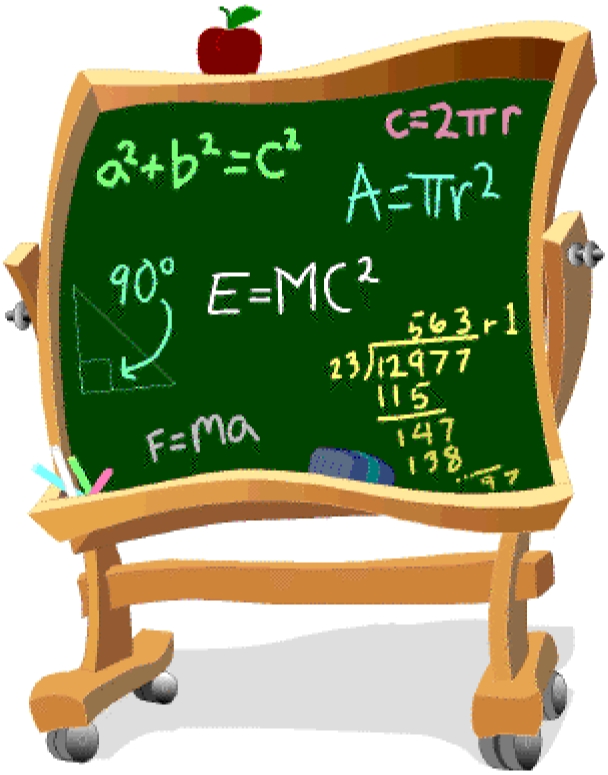
An inter-school mathematics multiple-choice competition has been currently organized. The answer sheet for participants are read and are converted into a text file for marking by an Optical Mark Recognition(OMR)system.

Students are now acting as a programmer and are going to develop a computer system to read all the answer, mark the answer and produce an analysis report on the competition.

The report should include:

- total number of participants,
- total number of participating schools
- total number of participant(s) from each participating school
- winners of individual awards
- winners of school awards
- Question analysis, e.g. the percentage of correct answers in each question, the percentage of each answer chooses from participants in each question, etc.

An mc answer sheet



What is the problem?

The problem is to develop a computer system to read all the students' answers, the answer key, marking of the answers, counting each student correct answers, sorting students results and school results.Finally, produce an analysis report on the Mathematics multiple-choice competition.

In an attempt to solve this problem, the best way is to write a computer program that allows markers to use. Marker can use the program to find out the result of the multiple-choice competition by just inputting the answer key text file name and the students' answer key text file name and they can save the report file using any names they want, any time they want.

As a result, markers can save time and vigor for checking answer of participants in the competition by their eyes, marking answers by their hands,counting answers by their hands, calculating students and schools' scores by the hands and finally sort the result by their mind.

It is a more efficient way to use a program to do the above procedures.The program can prevent human mistakes made carelessly; markers' job can be lessoned and markers' stress can be alleviated.

What are the sub problems?

There are several sub problems that can be separated out from the problem. The sub problems are the procedure that need to code in the program:

- Reading the answer key of the competition

- Reading the participants' information and answer

- Comparing participants' answer with the answer key

- Calculating correct marks of participants

-Calculating school results

- Store participants' result into two records (student record and school record)

- Sort the records

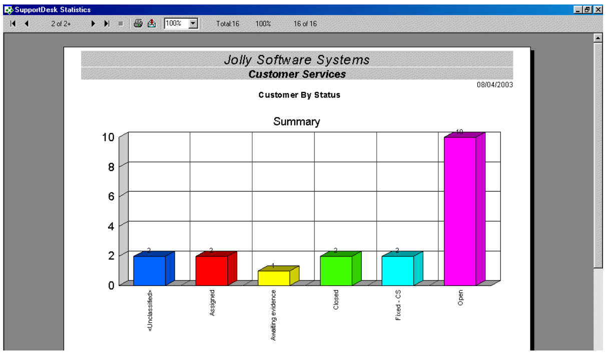
- Find the winners of the competition

- Do question analysis (answer distribution)

- Do statistics (graphs, standard deviation,mean, mode,median…)

- Release a report on screen

- Make a copy of report for the marker to save

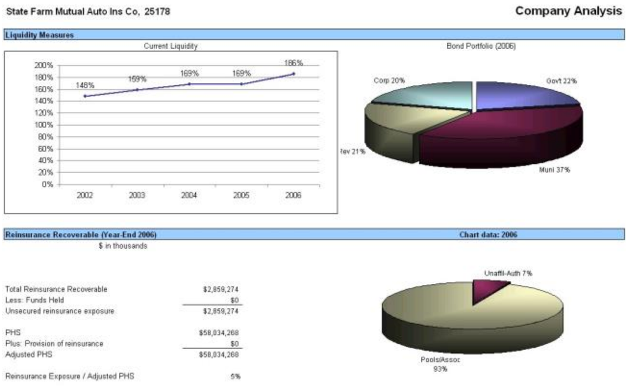


Jolly Software Systems

Customer Services

08/04/2003

Customer By Status


State Farm Mutual Auto Ins Co, 25178

Company Analysis

Liquidity Measures

Reinsurance Recoverable (Year-End 2006)

Chart data: 2006

$ in thousands

Total Reinsurance Recoverable	$2,859,274
Less: Funds Held	$0
Unsecured reinsurance exposure	$2,859,274
PHS	$58,034,268
Plus: Provision of reinsurance	$0
Adjusted PHS	$58,034,268
Reinsurance Exposure / Adjusted PHS	5%

Why do students study this problem?

Students studying this problem can learn and know more about the programming world. During program coding process, student can go deeper into the programming world, they can acquire more new things or knowledge that they have not seen and get along with in lessons. Students can jump out of the frame of learning, jump out of classrooms.

Moreover, students can go deeper into the programming syllabus in Computer and Information Technology this subject, much book knowledge can be handled easily without doing exercises or practice. Writing the coursework can help students in improving their programming skills and help improving their result in this subject.

In fact, the real world is not as small as school life; there are many things that students should learn at the moment and students will learn in the future.Beside programming, students can learn problem handling skills in studying this problem, learning how to separate a big problem into small slices. Students can know how a large program is made stepwisely. After studying this problem, students can solve similar problems easier in daily life too.

1.2 Objectives

In this project, I am going to develop a program to mark the answer of the inter-school mathematics multiple-choice competition and produce a detailed analysis report. I want to know more about the programming world and I want to learn how to handle problems better.

Who are the target users?

This program can be used in large-scale way. The target users of the program maybe the organizer of the mathematic competition, the marker of the competition or someone else who is responsible for the competition analysis report.I think this program can give them a lot of help and save them a lot of manpower. Moreover, if a teacher wants to correct answers of students in a multiple-choice exercise or test, he can use this program to achieve this. This program operating speed and cost is fast, it can help teachers a lot with the lowest cost.

Users' requirements

The overall requirements of intended users can be classified into three types,they are:

Accurate calculating results, fast opearting speed,a detailed and clear analysis report.

The following table is demonstrating the users' expectation:

Features	Users' expectation
Input answer key	Can input easily, only need to input the file address, the file name and the file format of the text file.
Input participants' information and answers	Can input easily, only need to input the file address, the file name and the file format of the text file.
Save report in a new file	Only by entering the file name that the user want to use
Displaying menu	Contains clear instruction, many options and sub-options, user-friendly displaying menu
Numbers of analysis result	Contain many different kinds of function, for example, ranking type, graph type
Types of analysis result	The program has a wide variety of results, for examplt, the mean, mode, median,SD. Graphs in the program can show the trend of students.
Reusability	The program can be used many times until the user stop the program
Bugs & errors	No bugs in the program

Functions should be provided in the analysis report

To produce a detailed analysis report on the mathematics competition, there are several things that the report should include:

- the total number of participants
- the total number of participating schools
- the total number of participant(s) from each participating school
- full mark of the competition
- mean
- median
- variance
- standard deviation
- quartile
- question distribution graph
- grading distribution graph
- question correct distribution graph
- highest mark(s) among participants
- lowest mark(s) among participants
- passing mark
- number of pass
- passing rate
- etc..

1.3 Project Plan

In a course work, a project plan should be included for planning working schedule, planning how to do the coursework stepwise, planning the working procedure.

I will solve the problem according to the following procedure:

1. Analysis:
    - Define the competition regulations, such as individual awards and school awards
    - Identify the input, processing, and output of the program
    - Based on the proposed functions, study alternative ways of solving the problem.
    - Justification of the choice of appropriate IT tools for solving the problem
    - Justification of the choice of programming language
    - Justification of the choice of OS platforms
2. Design
    - Design the overall structure of the program
    - Design the formats of the program
    - Design the formats of the input file
    - Design the formats of the output file
    - Design the layout of the analysis report
    - Design the format of distribution of the analysis result/result
    - Design the welcoming screen of the program
    - Design the results should be included in the analysis report/result
3. Implementation
    - Decide the data structures that will be used in the program.
    - Decide the data structures of the data files
    - Design the algorithms according to the proposed functions, the competition regulations, etc.
    - Construct the program
4. Testing and Evaluation
    - Design the test plan for the program.
    - Perform testing and evaluation on the program according to the proposed test plan.
    - Debug the program
5. Conclusion and Discussion
    - Summary of the project
    - Conclusion on what have been studied/learned
    - Discussion on the favorable features and shortcomings of the program
    - Suggestion on further development/improvements on the program
    - Self-reflection

Chapter2 Analysis

2.1 Competition Regulations

Here are some regulations which candidates should pay attention to:

1. Each participant must belong to a school

2. The maximum number of participating schools is 10

3. The maximum number of participants from each school is not limited and the minimum number of participants from each school is 5.

4. There is one group of people in this competition, using one set of questions in order to maintain fairness.

5. All the questions are in MC (multiple-choice) type.

6. There are 5 choices in one MC question.

7. The choices are A, B, C, D and E.

8. In each set of paper, there are 50 questions, 1mark each.

9. There is only 1 round of competition for each participant.

10. There are 15 awards provided.(10 individual awards and 3 school awards)

Individual award: 1st to 10th place

School awards: 1st to 3rd place

2.2 Data Collection

The way of data collection

Data collection can be access on several platforms, for example, from books, acquiry from teachers, experts of writing program, programmer, from the Internet, from newspapers, from daily life.

Refer to the question

An inter-school mathematics competition, in the form of multiple-choice questions, has been organized. The answer sheets for participants are read and converted into a text file using an Optical Mark Recognition (OMR) system.

Imagine you are a programmer. You are going to develop a computer program to read all raw plain text data and produce a detailed analysis report on the competition. The analysis report should include:

- Total number of participants, total number of participating schools and total number of participant(s) from each participating school Winners of individual awards and school awards
- Question analysis, such as the percentage correct for each question Candidates are required to write a program to generate the analysis report. The coursework should:
- Describe the raw plain text data files, including the keys of the multiple-choice questions and their format
- Define the competition regulations, such as individual awards and school awards
- Display a clear analysis report

How many text file will be collected?

There are two text file will be collected. The first one is the answer key text file, another one is the text file of candidates' information and answers.

How many text file will be outputted?

There will be only one text file will be outputted which is the analysis report of the Multiple-Choice competition, the name of the report is determined by the user

2.3 Input, Output and Process

Input: a text file with participants' information and answer, an answer key text file

Processing: checking of answers, sorting of students' marks and their corresponding schools' marks, find out students' ranking and their corresponding schools' ranking, producing a clear analysis report with detailed result.

Output: a clear analysis report (in text file and also on the screen)

Way of data input

Data can be inputted to the program by entering the file name of the data text file and the answer key file name by the user with a keyboard. A faster way is to drag the file from the desktop to the program screen.

The program can be used on different sets of data files with different file names. It can be reused for many many times until the user break the program.

The data files

Data in the data files:

One data file contains the participants' name, school names and their answers.

One data file contains a string of answer key.

Type of data files: in plain text file form

Number of data files will be inputted: 2

-One for participants' name, school names and answers

-One for answer key (From A to E),50answers

Output report

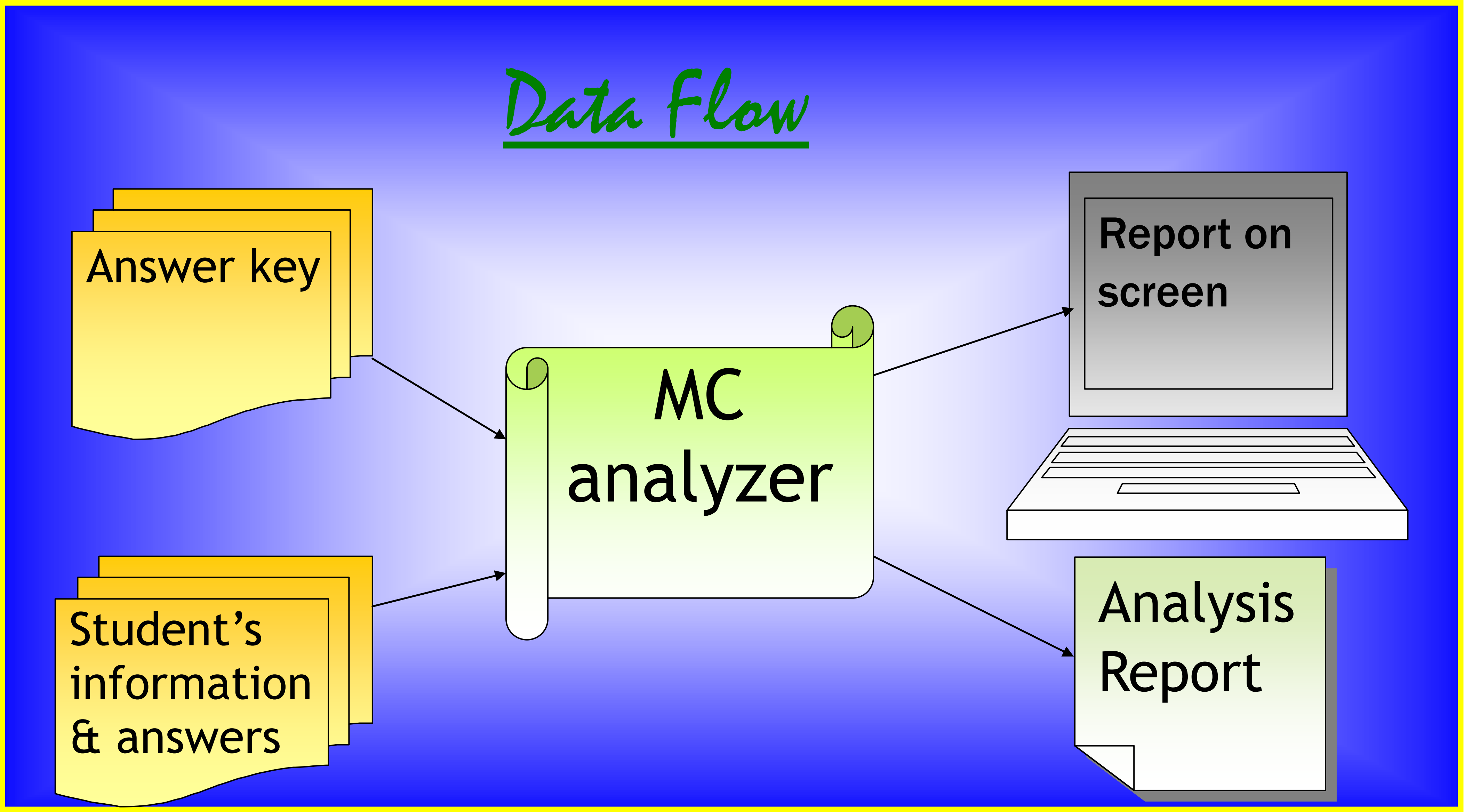
There are a list of results will be produced in the analysis report, for instance, total number of participants, total number of participating schools, total number of participant(s) from each participating school, question analysis(the percentage correct for each question), mean, mode, median, standard deviation, mark distribution graphs,etc.

The output would be both on screen and in a report file. The report file name is not fixed, it is deduced by the user as it is more flexible and the file can be easily handled after saving it. The file is in a plain text form.

Data processing

Some procedure are involved in the program, say the correction of answers, the calculation of the marks, the sorting of students and school result,the production of the analysis report, etc.

The following is the data flow of the program:



Data Flow

Answer key

Student's information & answers

MC analyzer

Report on screen

Analysis Report

2.4 Choice of IT Tools

Comparison of different mc-analyzer

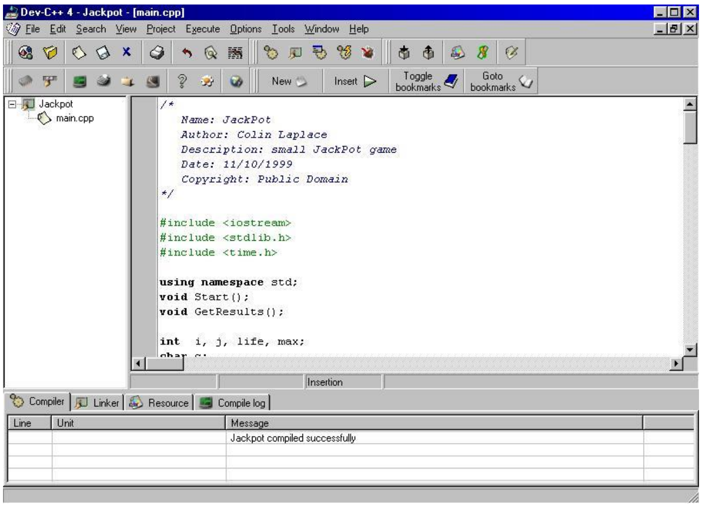
Ways Comparison	OMR System	My project	Markers
Correct answer speed	Fast	Fast	Slow
Calculation Speed	Normal	Fast	Slow
Calculation Efficiency	Accurate	Accurate	May have calculating error
Operating cost	Little	No	Salary
Cost	Need to buy a OMR	Only need a computer	Salary
Quality	High	High	May have marking errors
Human mistakes	Very little	Little(may be typing mistake)	Calculation mistakes
Preparation	Need to buy the machine	No need	Need to engage markers
Grade Standard	More subjective	More objective	More subjective
Health condition of markers	Best.Only need to input the answer key sample and put the set of answer inside it.	Best.Only need to input the answer key sample and put the set of answer inside it.	Worst. Markers need to mark every answer sheets. This would harm to their health.

Comparison of different programming language for solving the problem

Compare with	Pascal
C/C++	Advantages: 1. Pascal is more user-friendly; its code is easier to learn and is easier to read by programmers. C/C++ program code is shorter but they cannot be easily read by users 2.Pascal can often give programmers a meaningful error message which C/C++ do not give 3. Pascal has run time checking but C doesn't have. 4. Pascal has Boolean type but C doesn't have. Disadvantages: C/C++ have faster runner speed than Pascal
Java	Advantages: 1. Pascal has faster run-time speed (In Java, some of the codes are interpreted, so execution time is longer) 2. Although Java can run on many different operating systems, a JAVA platform is needed to 3. No interpreter is needed 4. install on the computers before using Disadvantages: 1. Java is more portable than Pascal. (Java can run on many operating systems)
Visual Basic	Advantages: 1. Pascal uses command-line user interface, Visual Basic uses graphical user interface (GUI), which does not support Windows 1.0, 2.0, 3.0, 3.1, 3.11. (which makes Visual Basic result in Lower capability) 2. Relatively strong type system Disadvantages: 1. Visual Basic has integration with other applicants (i.e. Microsoft Word, Microsoft Excel), but pascal does not. 2. Visual Basic is more user-friendly

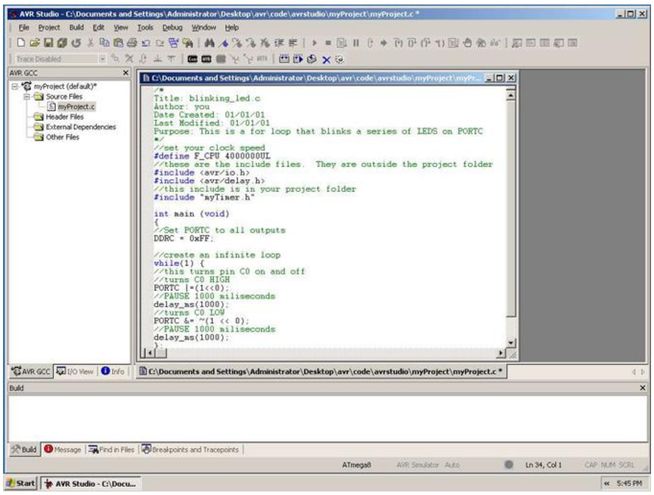
From the above comparison, it is clear seen that Pascal is the best programming language among all of the above. It is a common programming language nowadays; using command-line user interface so that it can be used in many window servers (Window XP, Window 2000). Pascal is user-friendly, it is easy to read, write, learn and understand. Pascal often give programmers a meaningful error message, it has run time checking and also Boolean type code. It has an acceptable running speed.

Different Programing language Interface



```
/*
   Name: JackPot
   Author: Colin Laplace
   Description: small JackPot game
   Date: 11/10/1999
   Copyright: Public Domain
*/

#include <iostream>
#include <stdlib.h>
#include <time.h>

using namespace std;
void Start();
void GetResults();

int  i, j, life, max;
char c;
```

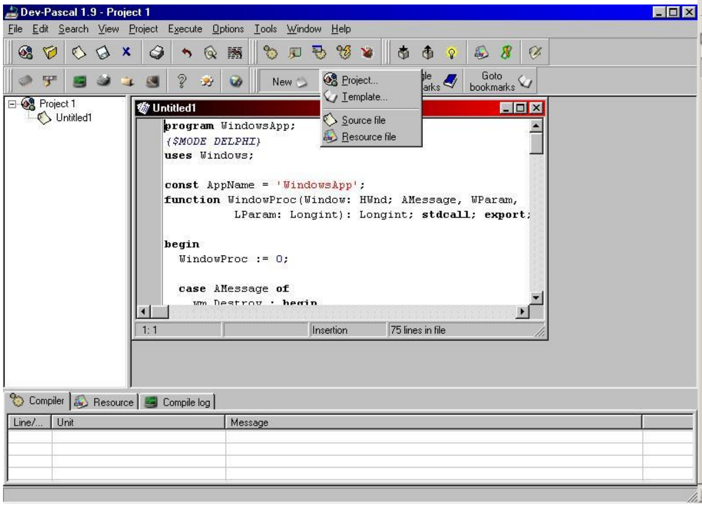
Line	Unit	Message
		Jackpot compiled successfully


AVR Studio - C:\Documents and Settings\Administrator\Desktop\avr\code\avrstudio\myProject\myProject.c *
File Project Build Edit View Tools Debug Window Help
AVR GCC
myProject (default)*
Source Files
myProject.c
Header Files
External Dependencies
Other Files
C:\Documents and Settings\Administrator\Desktop\avr\code\avrstudio\myProject\myPr...
AVR GCC
I/O View
Info
C:\Documents and Settings\Administrator\Desktop\avr\code\avrstudio\myProject\myProject.c *
Build
Message
Find in Files
Breakpoints and Tracepoints
ATmega8
AVR Simulator
Auto
Ln 34, Col 1
CAP NUM SCRL
Start
AVR Studio - C:\Docu...
5:45 PM

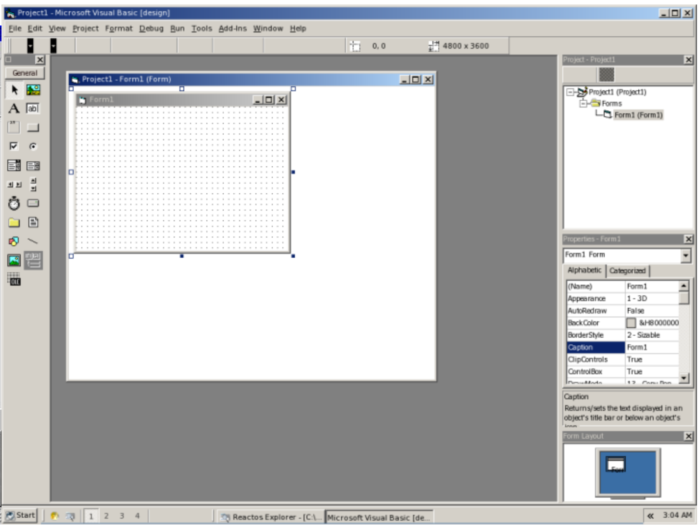
```
/*
Title: blinking_led.c
Author: you
Date Created: 01/01/01
Last Modified: 01/01/01
Purpose: This is a for loop that blinks a series of LEDS on PORTC
*/
//set your clock speed
#define F_CPU 4000000UL
//these are the include files.  They are outside the project folder
#include <avr/io.h>
#include <avr/delay.h>
//this include is in your project folder
#include "myTimer.h"

int main (void)
{
//Set PORTC to all outputs
DDRC = 0xFF;

//create an infinite loop
while(1) {
//this turns pin C0 on and off
//turns C0 HIGH
PORTC |=(1<<0);
//PAUSE 1000 miliseconds
delay_ms(1000);
//turns C0 LOW
PORTC &= ~(1 << 0);
//PAUSE 1000 miliseconds
delay_ms(1000);
};
```

C++ programming

C programming



```
program WindowsApp;
{$MODE DELPHI}
uses Windows;

const AppName = 'WindowsApp';
function WindowProc(Window: HWnd; AMessage, WParam,
         LParam: Longint): Longint; stdcall; export;

begin
  WindowProc := 0;

  case AMessage of
    wm_Destroy : begin
```



(Name)	Form1
Appearance	1 - 3D
AutoRedraw	False
BackColor	&H8000000
BorderStyle	2 - Sizable
Caption	Form1
ClipControls	True
ControlBox	True

Caption

Returns/sets the text displayed in an object's title bar or below an object's

Pascal programming

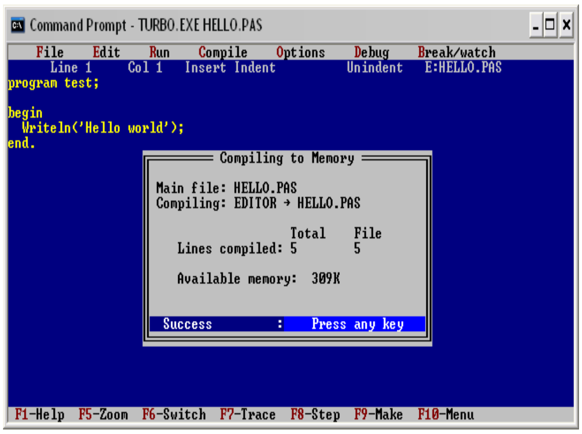
Visual Basic programming

Comparison of different Pascal program

Compare with	QPascal	Dev-Pascal	Free Pascal	Turbo Pascal
QPascal		QPascal does not need to type readln at the end for viewing results.	QPascal does not need to type readln at the end for viewing results.	QPascal is more suitable for professional programmers.
Dev-Pascal	Dev-Pascal is user-friendly, easier to use(can use mouse for using copy, paste, cut function).Dev-Pascal can be used in many windows platform.		Dev-Pascal is more user-friendly. Its screen looks like Microsoft office.	Dev-Pascal can run a larger capacity array.
Free Pascal	Free Pascal can use mouse (for using copy, paste and cut function). Free Pascal can run in window XP.	Free Pascal downloading speed is faster than Dev-Pascal.		Free Pascal can run a larger capacity array. Free Pascal is more suitable for professional programmers.
Turbo Pascal	Easier to use for learners.	Easier to use for learners.	Easier to use for learners.	

Among the four Pascal soft wares, I would choose Dev-Pascal. Although it need to type readln at the end of the program for viewing result, but it seems not a big problem to me. Dev-Pascal is user-friendly, it provides clear error message and it is also suitable for program learners.

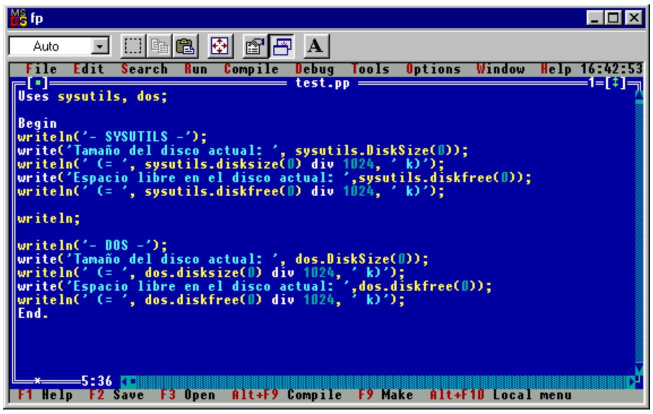
Different Pascal programming software interface


Command Prompt - TURBO.EXE HELLO.PAS
File Edit Run Compile Options Debug Break/watch
Line 1 Col 1 Insert Indent Unindent E:HELLO.PAS
F1-Help F5-Zoom F6-Switch F7-Trace F8-Step F9-Make F10-Menu

```
program test;

begin
  Writeln('Hello world');
end.
```

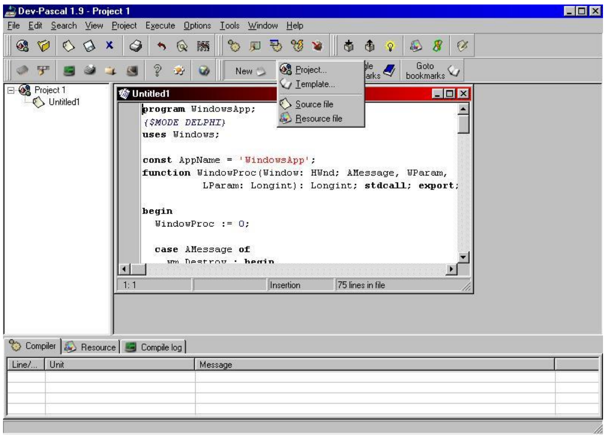
```
Compiling to Memory

Main file: HELLO.PAS
Compiling: EDITOR → HELLO.PAS

                    Total    File
   Lines compiled: 5        5

   Available memory:  309K

 Success          :     Press any key
```

Quick Pascal


fp
Auto
File Edit Search Run Compile Debug Tools Options Window Help 16:42:53
test.pp
5:36
F1 Help F2 Save F3 Open Alt+F9 Compile F9 Make Alt+F10 Local menu

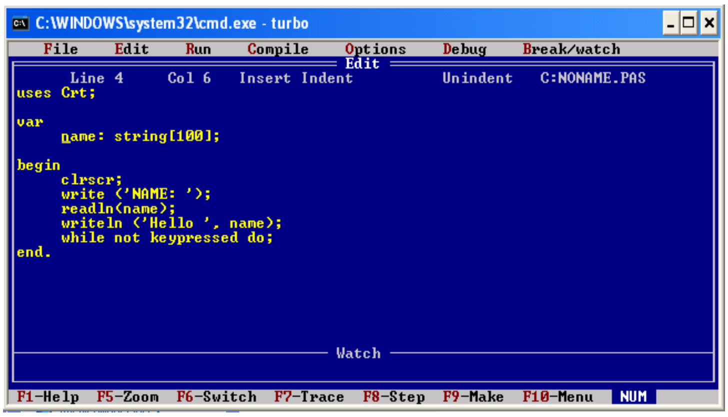
```
Uses sysutils, dos;

Begin
writeln('- SYSUTILS -');
write('Tamaño del disco actual: ', sysutils.DiskSize(0));
writeln(' (= ', sysutils.disksize(0) div 1024, ' k)');
write('Espacio libre en el disco actual: ',sysutils.diskfree(0));
writeln(' (= ', sysutils.diskfree(0) div 1024, ' k)');

writeln;

writeln('- DOS -');
write('Tamaño del disco actual: ', dos.DiskSize(0));
writeln(' (= ', dos.disksize(0) div 1024, ' k)');
write('Espacio libre en el disco actual: ',dos.diskfree(0));
writeln(' (= ', dos.diskfree(0) div 1024, ' k)');
End.
```

Free Pascal



```
program WindowsApp;
{$MODE DELPHI}
uses Windows;

const AppName = 'WindowsApp';
function WindowProc(Window: HWnd; AMessage, WParam,
            LParam: Longint): Longint; stdcall; export;

begin
  WindowProc := 0;

  case AMessage of
    wm_Destroy : begin
```

Dev-Pascal


C:\WINDOWS\system32\cmd.exe - turbo
File Edit Run Compile Options Debug Break/watch
Edit
Line 4 Col 6 Insert Indent Unindent C:NONAME.PAS
Watch
F1-Help F5-Zoom F6-Switch F7-Trace F8-Step F9-Make F10-Menu NUM

```
uses Crt;

var
      name: string[100];

begin
      clrscr;
      write ('NAME: ');
      readln(name);
      writeln ('Hello ', name);
      while not keypressed do;
end.
```

Turbo Pascal

Comparison of different OS platform

Compare with	Windows
Linux	Window is user-friendly, can be used easily by common users Linux is only for professional users. Linux is free and open source software.
UNIX	UNIX is a more powerful and flexible operating system. It runs on many types of computers, including supercomputers, PCs, mainframes and minicomputers UNIZ is not as easy to learn as Windows..
DOS	DOS could load only one application into the memory at a time. To work with a second program, the first one should be closed. Windows can load many applications in one time. Soft ware was difficult to install and configure under the DOS environment. Windows can install many soft wares easily. DOS is more suitable for professional programmers.
Macintosh Operating system(Mac OS)	Mac(OS) provides a truly graphical user interface. Both of them have built-in network support and hardware Plug and Play (PnP) support.

It is clearly seen that the pros of windows outweigh the cons of its. Windows is user-friendly and can be used easily by common users, for instance, students. It is easy to learn by students. It is common used in many computers. It can load many applications in one time. Soft ware can be easily installed in to it.

Linux

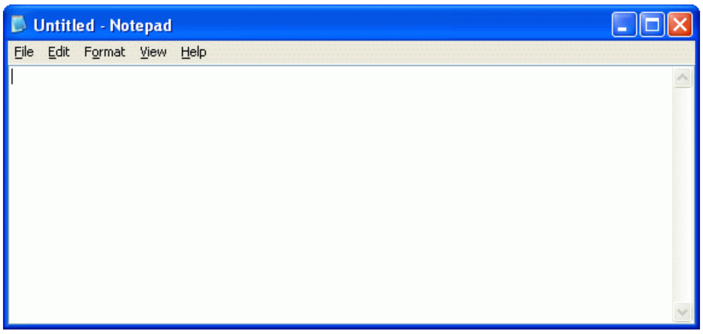
Unix

Window Xp

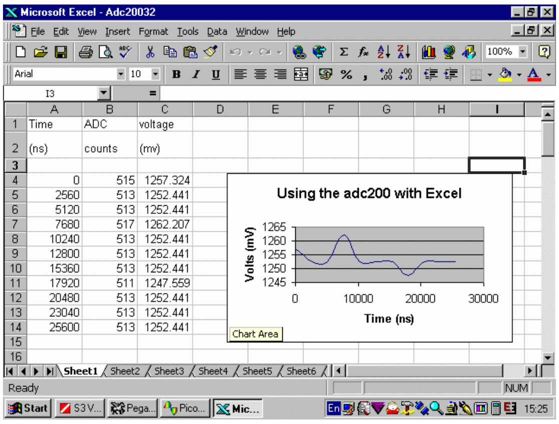
Mac OS

Choice of other IT tools for solving the problem

- Notepad—for preparing data file (answer keys, participants' information and answers)
- Excel—for porting graphs, making random answers
- Internet Explorer—for searching information to help analyzing the coursework
-

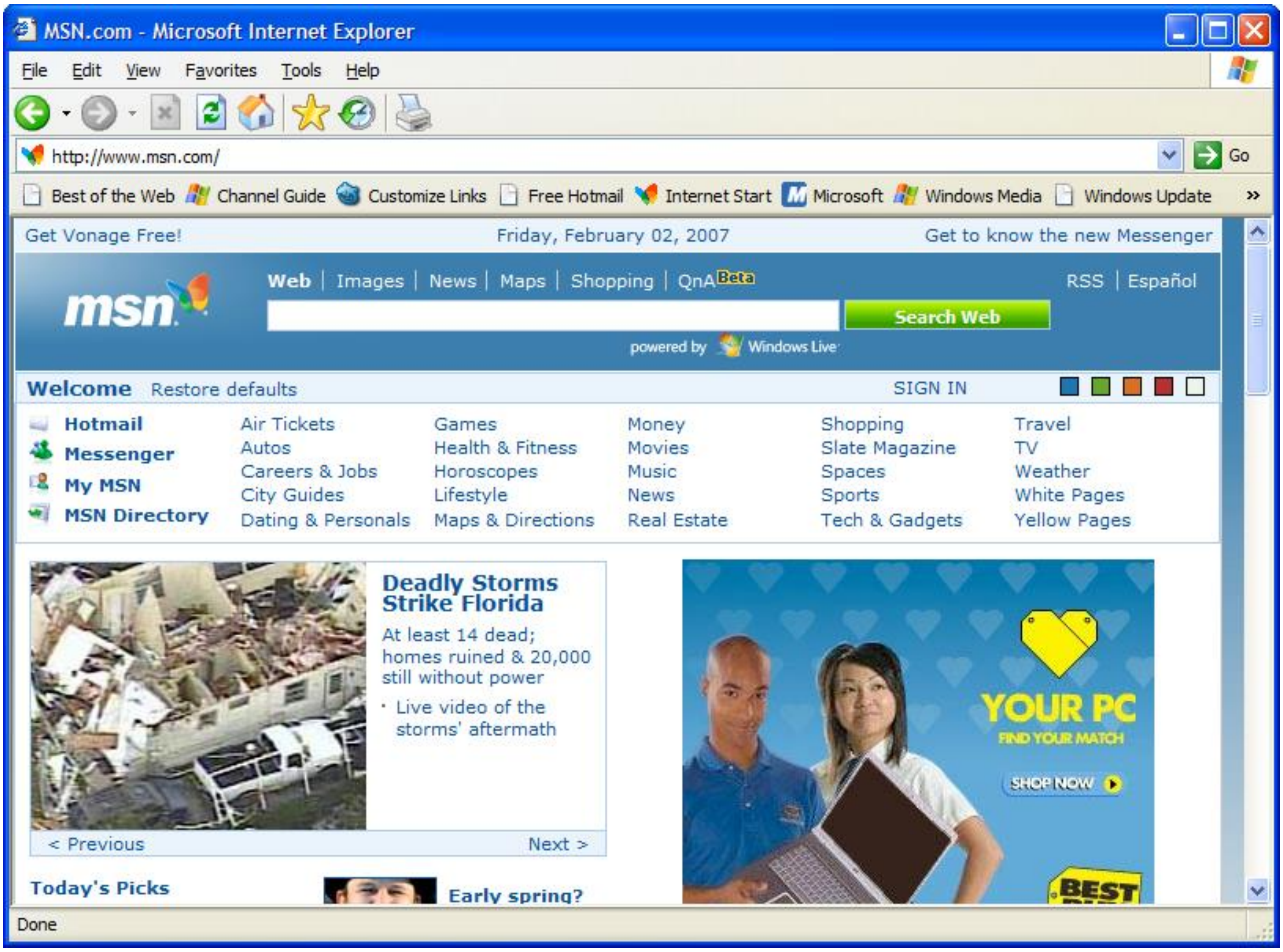


Notepad



	A	B	C
1	Time	ADC	voltage
2	(ns)	counts	(mv)
3			
4	0	515	1257.324
5	2560	513	1252.441
6	5120	513	1252.441
7	7680	517	1262.207
8	10240	513	1252.441
9	12800	513	1252.441
10	15360	513	1252.441
11	17920	511	1247.559
12	20480	513	1252.441
13	23040	513	1252.441
14	25600	513	1252.441
15			
16			

Excel



Get Vonage Free! Friday, February 02, 2007 Get to know the new Messenger

Welcome Restore defaults

Hotmail
Messenger
My MSN
MSN Directory

Air Tickets
Autos
Careers & Jobs
City Guides
Dating & Personals

Games
Health & Fitness
Horoscopes
Lifestyle
Maps & Directions

Money
Movies
Music
News
Real Estate

Shopping
Slate Magazine
Spaces
Sports
Tech & Gadgets

Travel
TV
Weather
White Pages
Yellow Pages

Deadly Storms Strike Florida

At least 14 dead; homes ruined & 20,000 still without power

- Live video of the storms' aftermath

< Previous Next >

Today's Picks

Early spring?

Internet Explorer

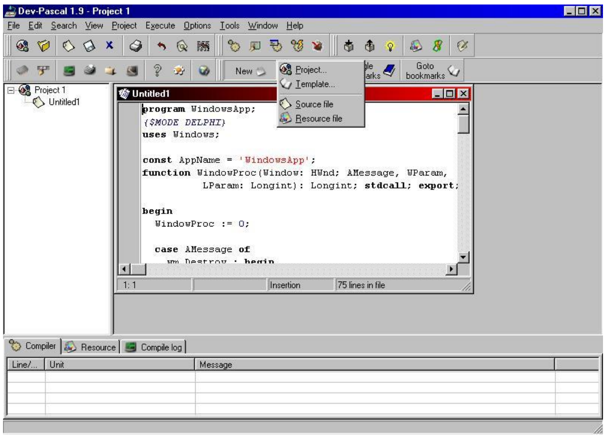
2.5 Conclusion of Study

From the above comparison tables, it can find the most suitable software and tools that I need to use in this coursework.

For programming language, I would use Pascal. It is a common programming language nowadays; using command-line user interface so that it can be used in many window servers (Window XP, Window 2000). Pascal is user-friendly, it is easy to read, write, learn and understand. Pascal often give programmers a meaningful error message, it has run time checking and also Boolean type code. It has an acceptable running speed.

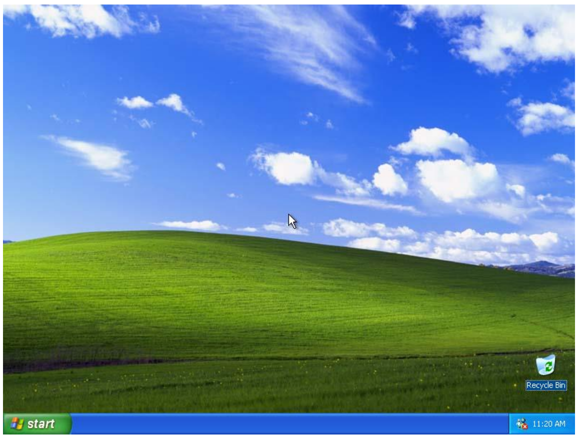
For Pascal program, I would use Dev-Pascal. Although it need to type readln at the end of the program for viewing result, but it seems not a big problem to me. Dev-Pascal is user-friendly, it provides clear error message and it is also suitable for program learners.

And finally, the OS platform, I would use window XP. The pros of windows outweigh the cons of its. Windows is user-friendly and can be used easily by common users, for instance, students. It is easy to learn by students. It can load many applications in one time. Soft ware can be easily installed in to it. It does not provide graphical user interface which helps reducing the consumption of ram.



```
program WindowsApp;
{$MODE DELPHI}
uses Windows;

const AppName = 'WindowsApp';
function WindowProc(Window: HWnd; AMessage, WParam,
         LParam: Longint): Longint; stdcall; export;

begin
  WindowProc := 0;

  case AMessage of
    wm_Destroy : begin
```

Dev-Pascal



Window XP

Chapter 3 Design of Solution

3.1 Brief Description

In this Chapter, I will design the program based on the functions I proposed in Chapter1, and the input, process and output I studied in Chapter2.

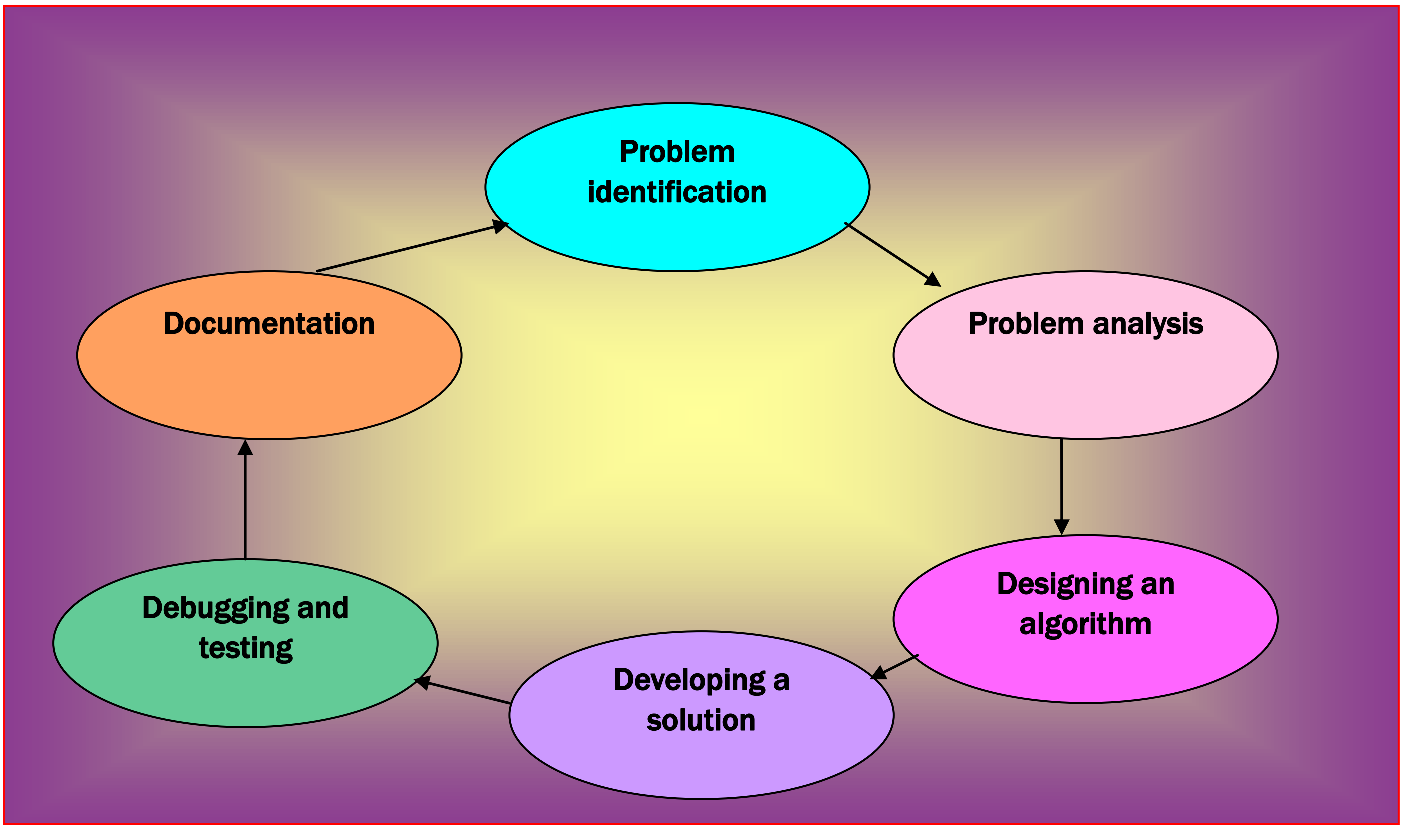
I will design:

1. the overall structure of the program by refining the problem
2. the formats of the data files for storing the answers of the participants and the answer keys
3. the formats of displaying analysis result
4. the format of the report file for storing the analysis report
5. the outline of the content of the analysis report
6. the user-interface main menu
7. the welcoming screen
8. the user-interface analysis report interface

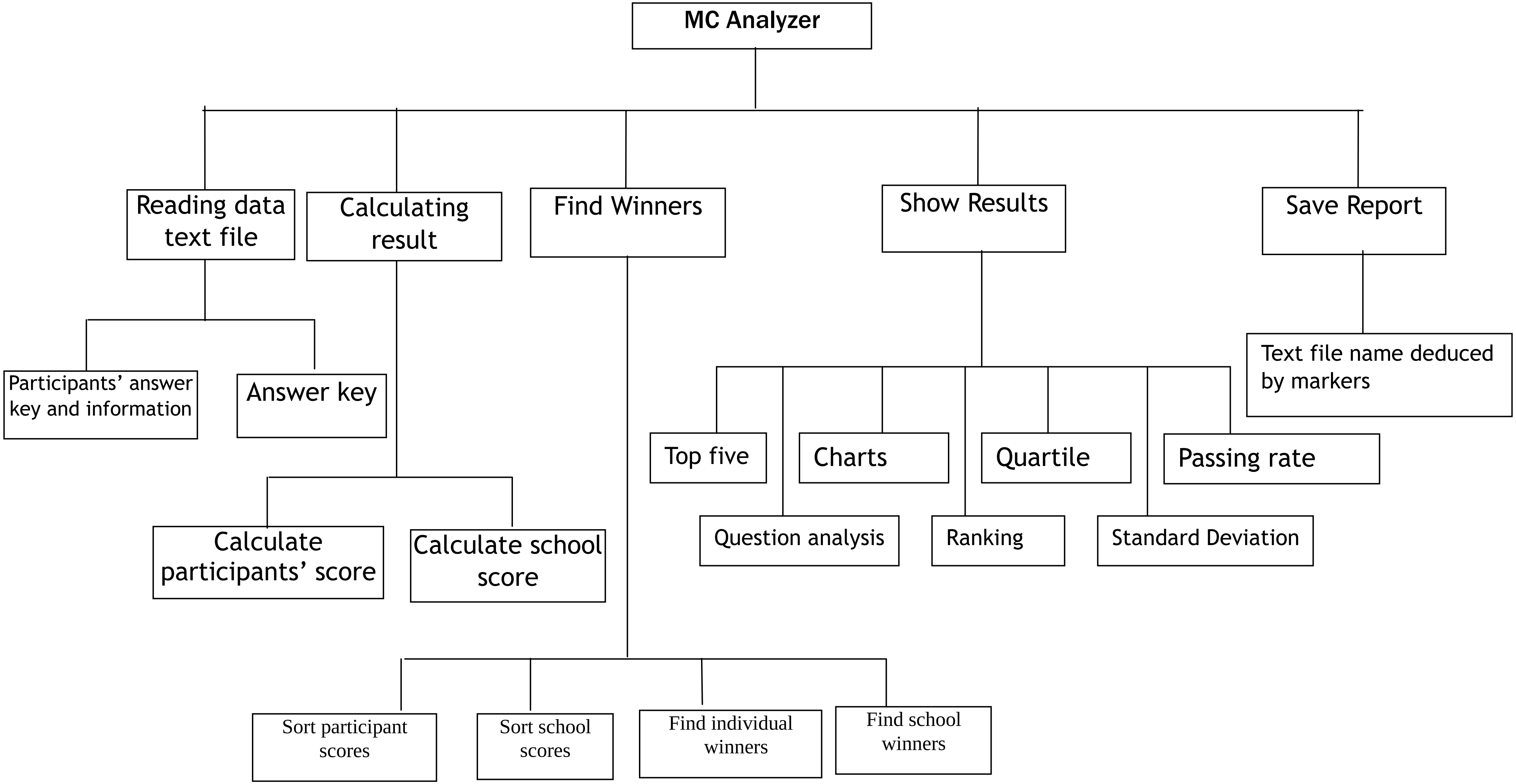
3.2 Refinement of Problem

Computers are data processing machines. Thus, writing computer programs is important for solving information problems. However, programming is very time-consuming because a lot of effort is required. Before wring a program to solve the problem, we need to refine the problem. We cannot solve the problem by guessing or using trial-and-error methods, we might end up spending a lot of time and might not obtain any solution at all. Therefore we need a systematic way of finding the solution.

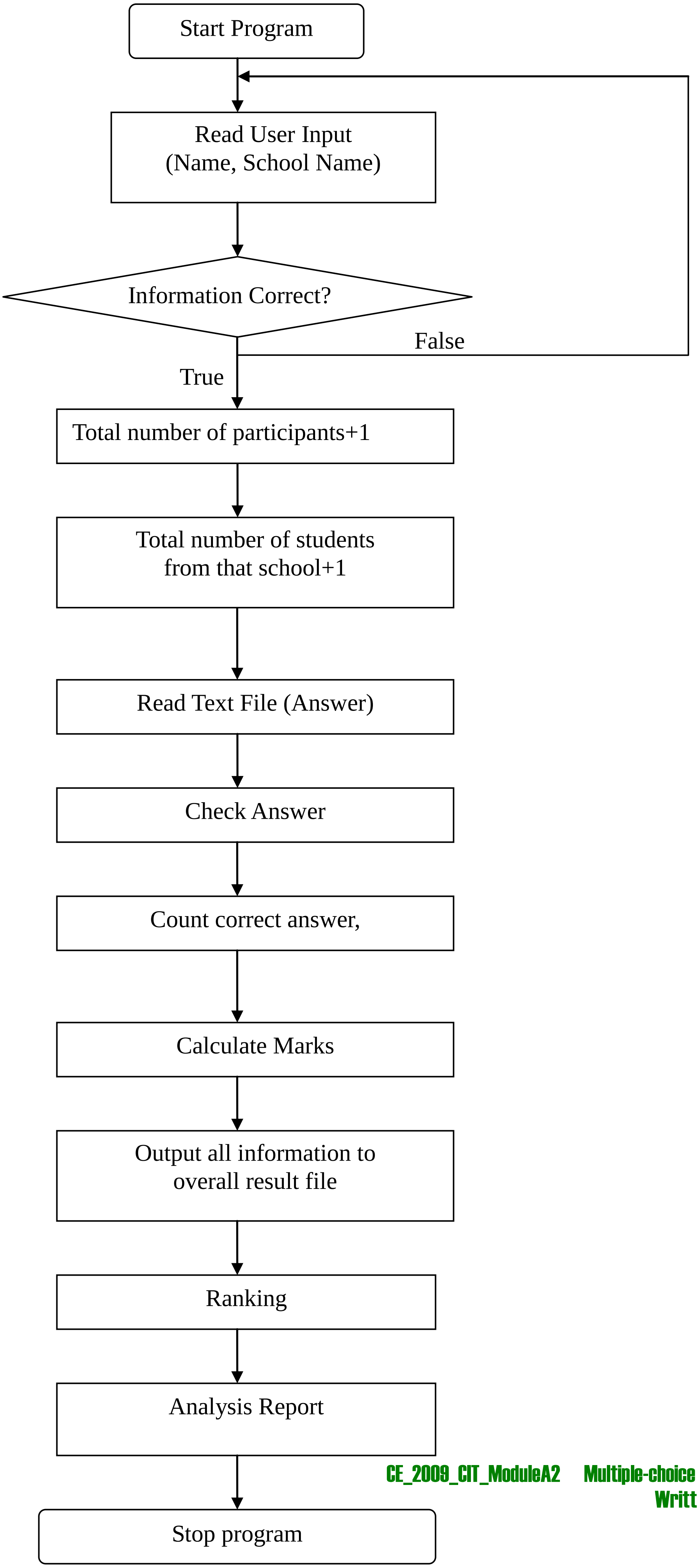
There are six step problem solving procedure that we need to take: problem identification, problem analysis, designing algorithm, developing a solution, debugging and testing, documentation.



The structure of the whole system



Flow chart of the whole program


Start Program
Read User Input (Name, School Name)
Information Correct?
False
True
Total number of participants+1
Total number of students from that school+1
Read Text File (Answer)
Check Answer
Count correct answer,
Calculate Marks
Output all information to overall result file
Ranking
Analysis Report
Stop program

Analysis to the structure of the program

For a multiple-choice analyzer, several steps should be taken.

Firstly, data file should be read. We may ask the user to enter the participants' answer and their information then read the corresponding answer keys by entering the file names and their address

.

The second step is correcting the participant's answer by comparing with the answer keys, if the participants' answer is same as the answer key, then one mark would be added to that participant.

.

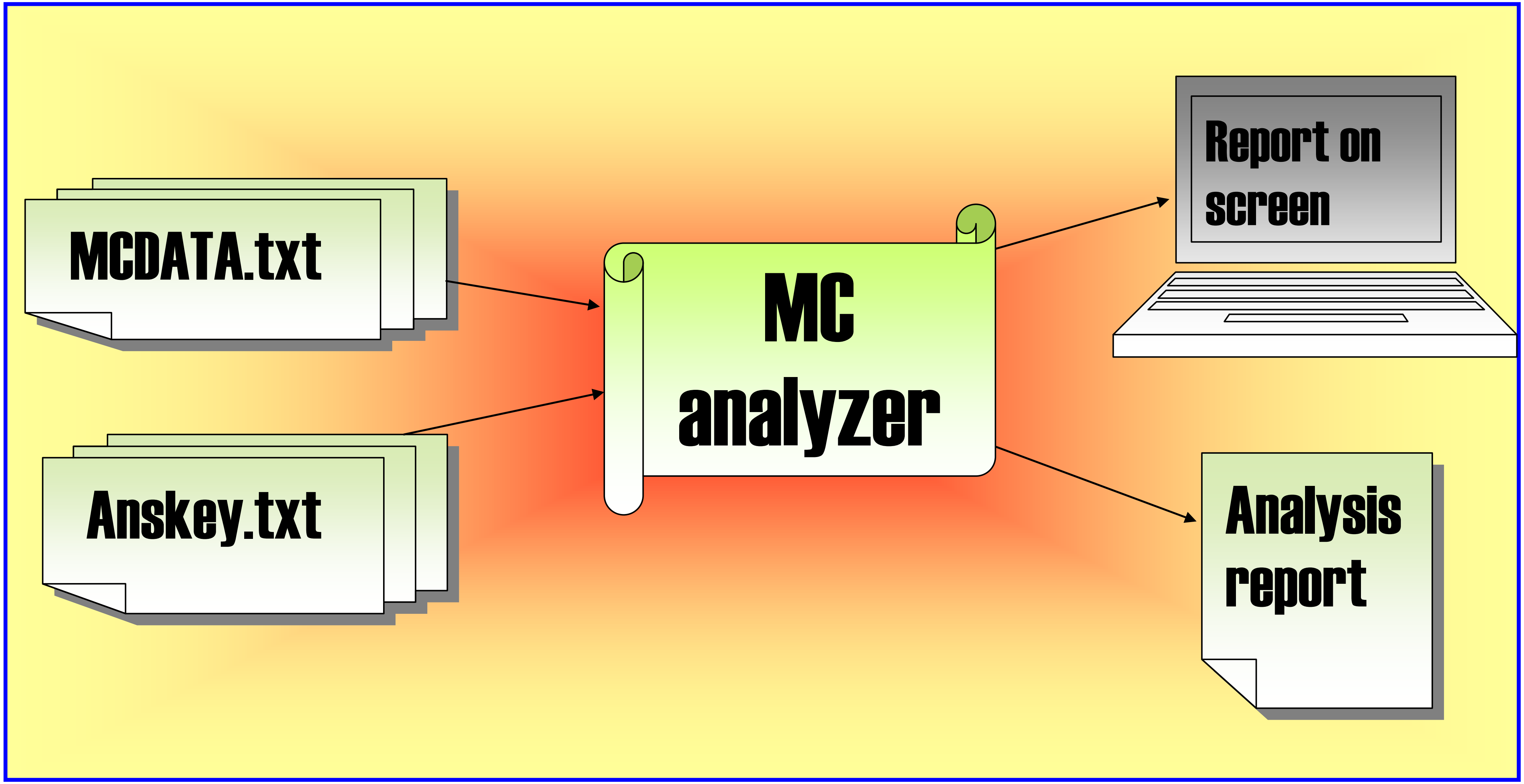
Then, count the participants' correct mark and then calculate their corresponding school score.

The next step is to find the winners; we should sort both the participants' scores and the school scores, and then find the winners for individual and school, the top five, the top ten, etc.

After finding out the winners, we can produce a clear and detail report. We can show the result on screen. We can show the top ten winners of individual section, top three winners of the school section, the standard deviation, the quartile range, the ranking or even show a graph of the result.

Finally, we need to ask the user if he want to save it as a text file or not, the user can further handle the result by excel or other word processing tools easily.

Data Flow



MCDATA.txt
Anskey.txt
MC analyzer
Report on screen
Analysis report

Input Data File Formats

File storing the Participants' Answers:

- One single file only
- File name: inputted by user (e.g. MCDATA.TXT) (As discussed in Section 2.3.)
- File type: plain text file
- Data stored:

  The data file stores the record of each participant, which includes the following information:

  - School name of the participant (45 characters)
  - Participant name (15 characters)
  - Answers of the 50 questions (altogether 50 characters)
    - Valid answers: ‘A’, ‘B’, C’, ‘D’, ‘E’
- File structure:

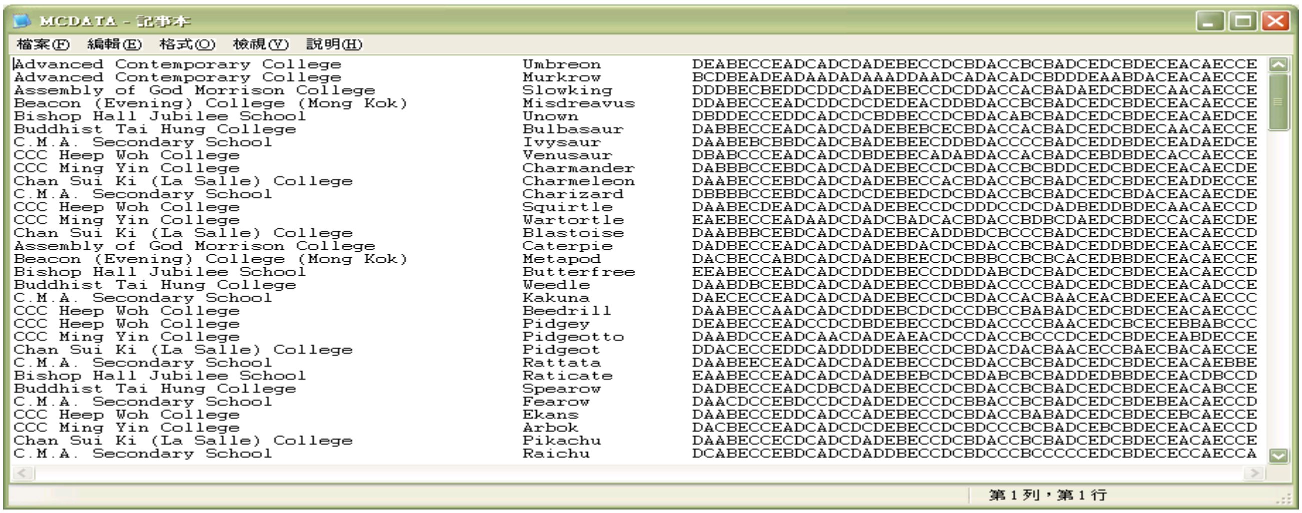
  Each line of the data file stores the record of one participant with the following format:

	School Name 80characters	Participant Name 30characters	Answers of 50 MC questions 50 characters in ‘A’, ‘B’, C’,										
e.g.	Cheung Sha Wan Catholic Secondary School	Fung Kin Kok	D	C	C	B	A	E	D	A	A	E	…

The input data format should all be in plain text file form.

The text file containing MC answer and the participants' information is said to be MCDATA.txt/MCDATA2.txt, the answer key for the competition is said to be ANSKEY.txt/ANSKEY2.txt/ANSKEY3.txt

The following is the sample file of the Participants' Answers data file
Sample file:



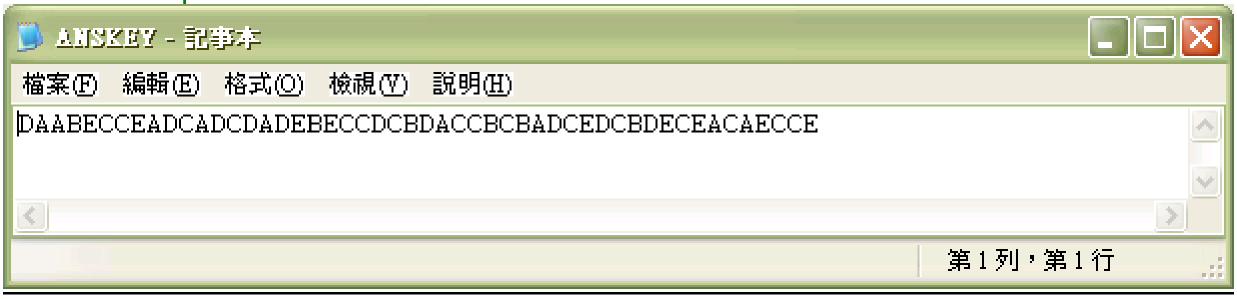
```
Advanced Contemporary College                 Umbreon        DEABECCEADCADCDADEBECCDCBDACCBCBADCEDCBDECEACAECCE
Advanced Contemporary College                 Murkrow        BCDBEADEADAADADAAADDAADCADACADCBDDDEAABDACEACAECCE
Assembly of God Morrison College              Slowking       DDDBECBEDDCDDCDADEBECCDCDDACCACBADAEDCBDECAACAECCE
Beacon (Evening) College (Mong Kok)           Misdreavus     DDABECCEADCDDCDCDEDEACDDBDACCBCBADCEDCBDECEACAECCE
Bishop Hall Jubilee School                    Unown          DBDDECCEDDCADCDCBDBECCDCBDACABCBADCEDCBDECEACAEDCE
Buddhist Tai Hung College                     Bulbasaur      DABBECCEADCADCDADEBEBCECBDACCACBADCEDCBDECAACAECCE
C.M.A. Secondary School                       Ivysaur        DAABEBCBBDCADCBADEBEECDDBDACCCCBADCEDDBDECEADAEDCE
CCC Heep Woh College                          Venusaur       DBABCCCEADCADCDBDEBECADABDACCACBADCEBDBDECACCAECCE
CCC Ming Yin College                          Charmander     DABBBCCEBDCADCDADEBECCDCBDACCBCBDDCEDCBDECEACAECDE
Chan Sui Ki (La Salle) College                Charmeleon     DAABECCEBDCADCDADEBECCACBDACCBCBADCEDCBDECEADDECCE
C.M.A. Secondary School                       Charizard      DBBBBCCEBDCADCDCDEBEDCDCBDACCBCBADCEDCBDACEACAECDE
CCC Heep Woh College                          Squirtle       DAABECDEADCADCDADEBECCDCDDDCCDCDADBEDDBDECAACAECCD
CCC Ming Yin College                          Wartortle      EAEBECCEADAADCDADCBADCACBDACCBDBCDAEDCBDECCACAECDE
Chan Sui Ki (La Salle) College                Blastoise      DAABBBCEBDCADCDADEBECADDBDCBCCCBADCEDCBDECEACAECCD
Assembly of God Morrison College              Caterpie       DADBECCEADCADCDADEBDACDCBDACCBCBADCEDDBDECEACAECCE
Beacon (Evening) College (Mong Kok)           Metapod        DACBECCABDCADCDADEBEECDCBBBCCBCBCACEDBBDECEACAECCE
Bishop Hall Jubilee School                    Butterfree     EEABECCEADCADCDDDEBECCDDDDABCDCBADCEDCBDECEACAECCD
Buddhist Tai Hung College                     Weedle         DAABDBCEBDCADCDADEBECCDBBDACCCCBADCEDCBDECEACADCCE
C.M.A. Secondary School                       Kakuna         DAECECCEADCADCDADEBECCDCBDACCACBAACEACBDEEEACAECCC
CCC Heep Woh College                          Beedrill       DAABECCAADCADCDDDEBCDCDCCDBCCBABADCEDCBDECEACAECCC
CCC Heep Woh College                          Pidgey         DEABECCEADCCDCDBDEBECCDCBDACCCCBAACEDCBCECEBBABCCC
CCC Ming Yin College                          Pidgeotto      DAABDCCEADCAACDADEAEACDCCDACCBCCCDCEDCBDECEABDECCE
Chan Sui Ki (La Salle) College                Pidgeot        DDACECCEDDCADDDDDEBECCDCBDACDACBAACECCBAECBACAECCE
C.M.A. Secondary School                       Rattata        DAABEECEADCADCDADEBECCDCBDACCBCBADCEDCBDECEACAEBBE
Bishop Hall Jubilee School                    Raticate       EAABECCEADCADCDADEBEBCDCBDABCBCBADDEDBBDECEACDBCCD
Buddhist Tai Hung College                     Spearow        DADBECCEADCDBCDADEBECCDCBDACCBCBADCEDCBDECEACABCCE
C.M.A. Secondary School                       Fearow         DAACDCCEBDCCDCDADEDECCDCBBACCBCBADCEDCBDEBEACAECCD
CCC Heep Woh College                          Ekans          DAABECCEDDCADCCADEBECCDCBDACCBABADCEDCBDECEBCAECCE
CCC Ming Yin College                          Arbok          DACBECCEADCADCDCDEBECCDCBDCCCBCBADCEBCBDECEACAECCD
Chan Sui Ki (La Salle) College                Pikachu        DAABECCECDCADCDADEBECCDCBDACCBCBADCEDCBDECEACAECCE
C.M.A. Secondary School                       Raichu         DCABECCEBDCADCDADDBECCDCBDCCCBCCCCCEDCBDECECCAECCA
```

File storing Answer Key :

One single file only

- File name: inputted by user (e.g. ANSKEY.TXT) (As discussed in Section 2.3.)
- File type: plain text file
- Data stored (for one question set only):
  The data file stores one set of answer key for the 50 MC questions.
  The answer keys consist of 50 characters in ‘A’, ‘B’, C’, ‘D’ or ‘E’.
- File structure:
  A single line of 50 characters in ‘A’, ‘B’, C’, ‘D’ or ‘E’

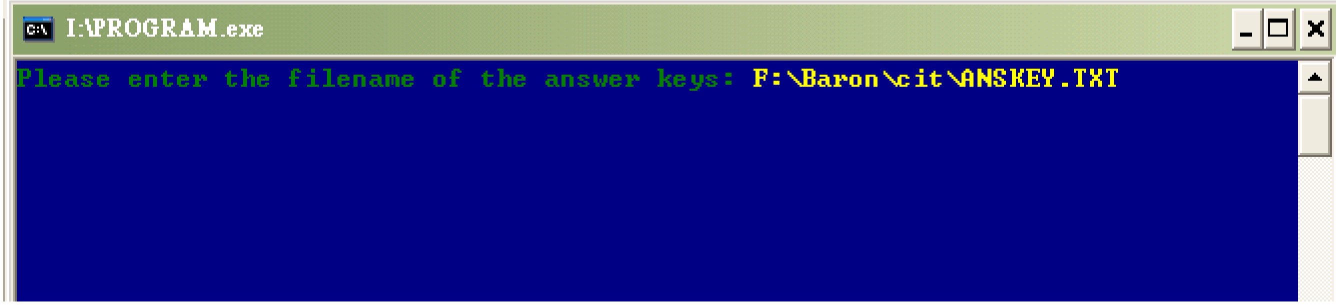
- Sample file:



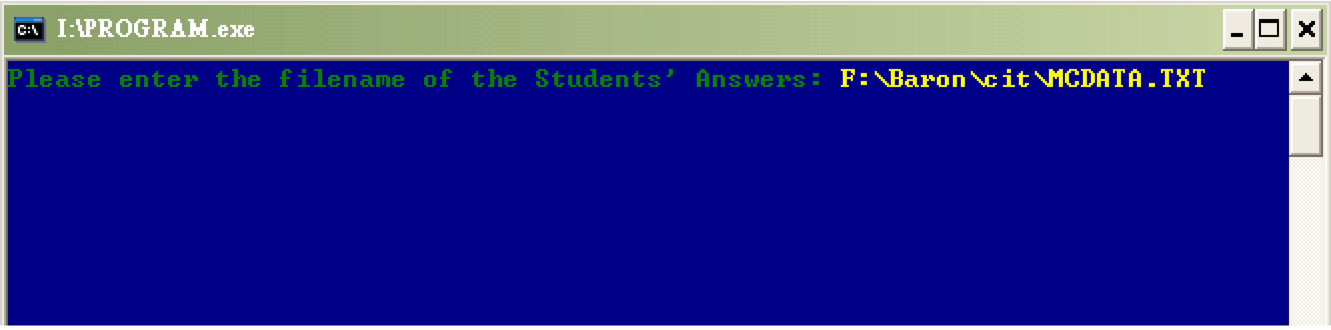
```
DAABECCEADCADCDADEBECCDCBDACCBCBADCEDCBDECEACAECCE
```

Sample input screen on running the program

- E.g.



```
Please enter the filename of the answer keys: F:\Baron\cit\ANSKEY.TXT
```



```
Please enter the filename of the Students’ Answers: F:\Baron\cit\MCDATA.TXT
```

3.4 Output Report Format

1. Sample output results on screen

- Results displayed:
-
  - ○ Ranking
    - Top five students
    - Bottom five students
    - School average scores
    - Scores of students in descending order
    - Average score of schools is descending order

  - ○ Analysis result
    - Total number of participants
    - Total number of participating schools
    - Overall School Results:
      - school name
      - no. of participants from each school,
      - school's average score
    - Passing mark
    - Number of pass
    - Passing rate
    - Percentage correct for each question
    - Standard deviation
    - Variance
    - Quartile Range

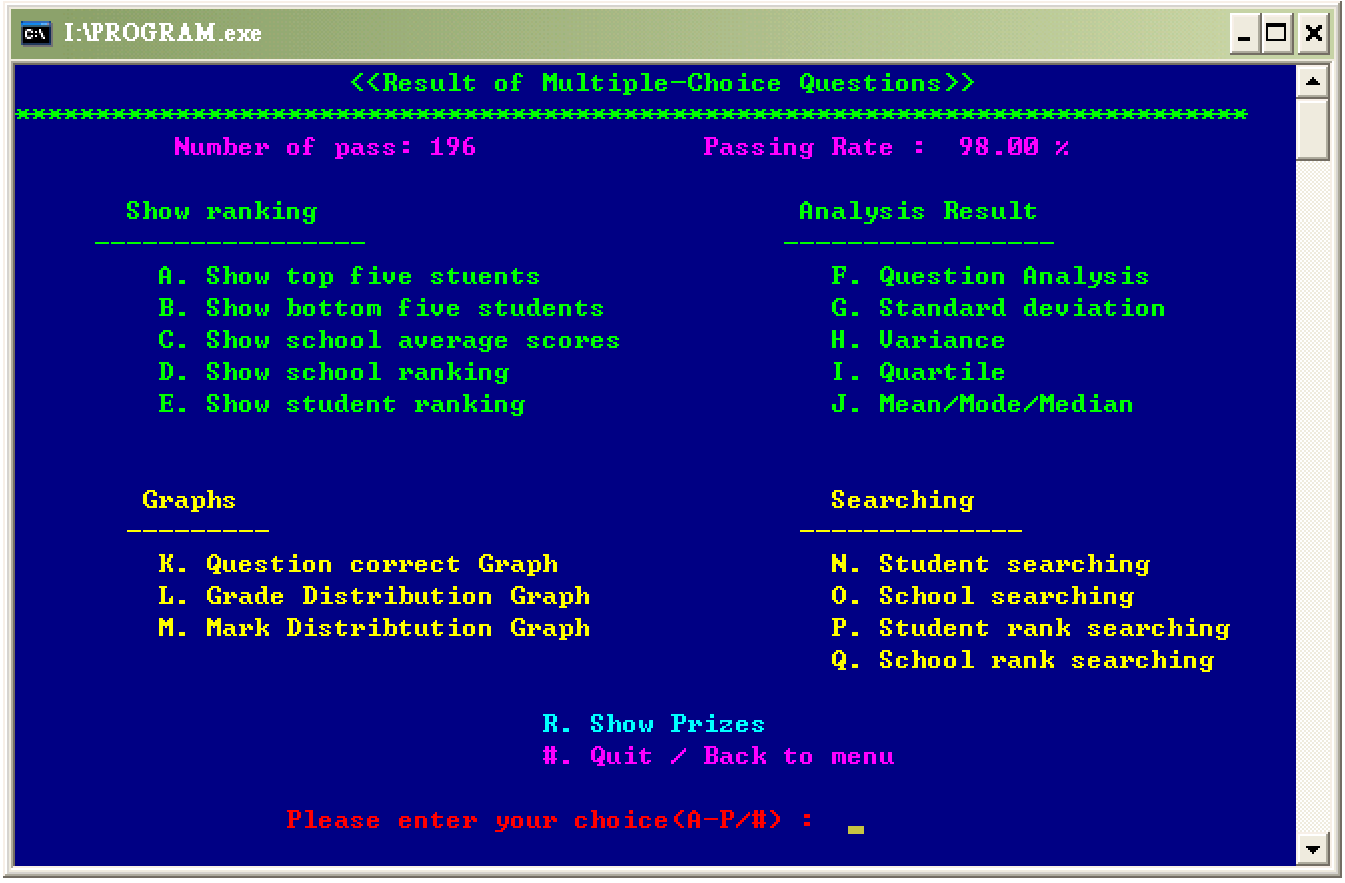
  - ○ Graphs
    - Grade distribution Graph
    - Question Correct Graph
    - Mark Distribution Graph

  - ○ Individual awards (with scores):
    - Champion (participant name with school name)
    - 1st Runner-up (participant name with school name)
    - 2nd Runner-up (participant name with school name)
    - 4th place(participant name with school name)
    - 5th place(participant name with school name)
    - 6th place(participant name with school name)
    - 7th place(participant name with school name)
    - 8th place(participant name with school name)
    - 9th place(participant name with school name)
    - 10th place(participant name with school name)

  - ○ School awards (with school average scores):
    - Champion (school name)
    - 1st Runner-up (school name)
    - 2nd Runner-up (school name)

Etc…

Sample layout:



```
                     <<Result of Multiple-Choice Questions>>
******************************************************************************
          Number of pass: 196                 Passing Rate :  98.00 %

       Show ranking                              Analysis Result
     -----------------                          -----------------
         A. Show top five stuents                  F. Question Analysis
         B. Show bottom five students              G. Standard deviation
         C. Show school average scores             H. Variance
         D. Show school ranking                    I. Quartile
         E. Show student ranking                   J. Mean/Mode/Median


        Graphs                                     Searching
       ---------                                 --------------
         K. Question correct Graph                 N. Student searching
         L. Grade Distribution Graph               O. School searching
         M. Mark Distribtution Graph               P. Student rank searching
                                                   Q. School rank searching

                                 R. Show Prizes
                                 #. Quit / Back to menu

                 Please enter your choice(A-P/#) :  _
```

2. Sample output results in Analysis Report file

- One single report file only
- File name: inputted by user (e.g. REPORT.TXT) (As discussed in Section 2.3.)
- File type: plain text file
- Results stored:

○ Ranking
- Top five students
- Bottom five students
- School average scores
- Scores of students in descending order
- Average score of schools is descending order

○ Analysis result
- Total number of participants
- Total number of participating schools
- Overall School Results:
  - school name
  - no. of participants from each school,
  - school's average score
- Passing mark
- Number of pass
- Passing rate
- Percentage correct for each question
- Standard deviation
- Variance
- Quartile Range

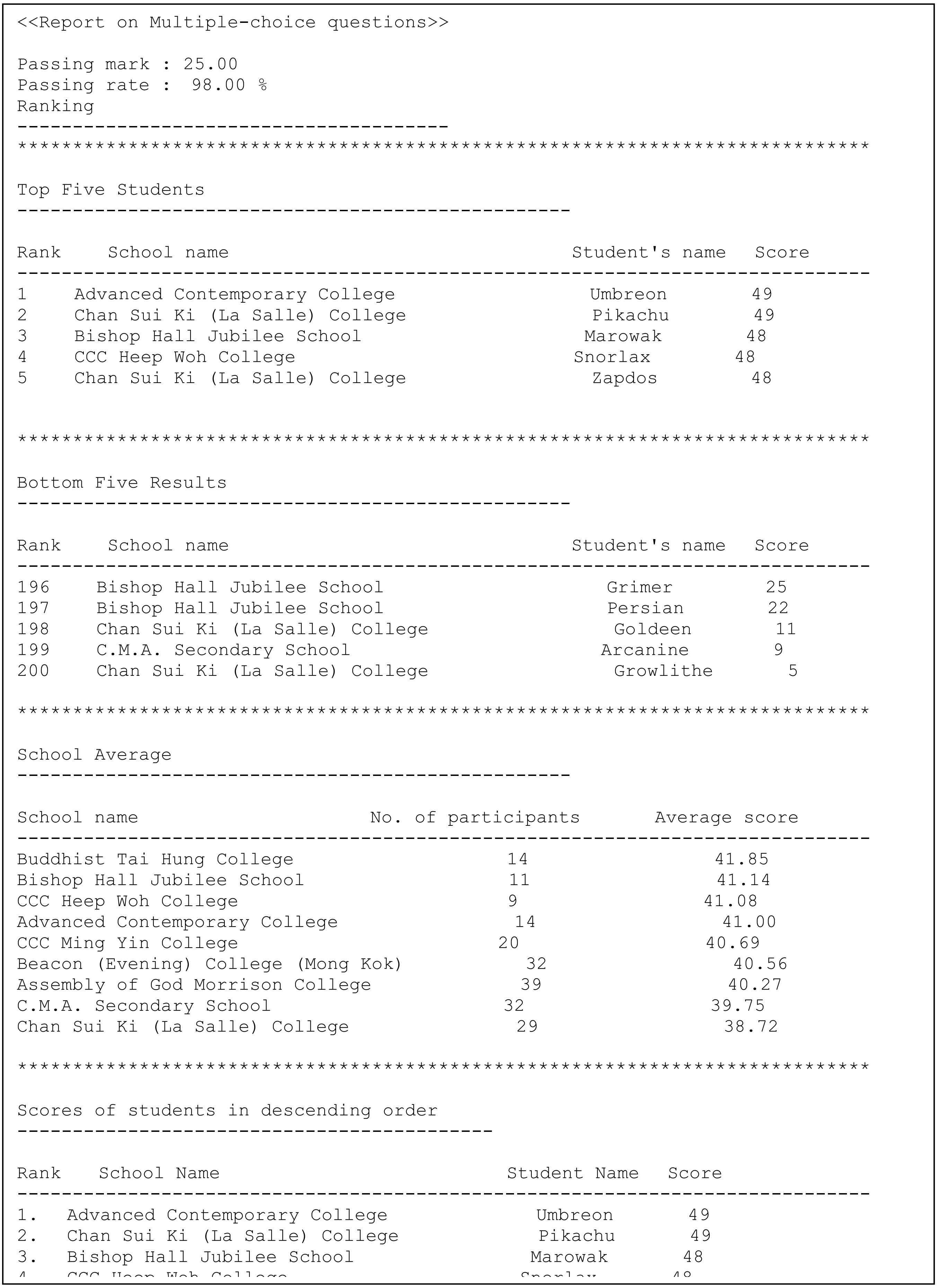
○ Graphs
- Grade distribution Graph
- Question Correct Graph
- Mark Distribution Graph

○ Individual awards (with scores):
  - Champion (participant name with school name)
  - 1st Runner-up (participant name with school name)
  - 2nd Runner-up (participant name with school name)
  - 4th place(participant name with school name)
  - 5th place(participant name with school name)
  - 6th place(participant name with school name)
  - 7th place(participant name with school name)
  - 8th place(participant name with school name)
  - 9th place(participant name with school name)
  - 10th place(participant name with school name)

○ School awards (with school average scores):
  - Champion (school name)
  - 1st Runner-up (school name)
  - 2nd Runner-up (school name)

Etc…

- Sample layout:



```
<<Report on Multiple-choice questions>>

Passing mark : 25.00
Passing rate :  98.00 %
Ranking
---------------------------------------
*****************************************************************************

Top Five Students
--------------------------------------------------

Rank    School name                               Student's name   Score
-----------------------------------------------------------------------------
1    Advanced Contemporary College                  Umbreon       49
2    Chan Sui Ki (La Salle) College                 Pikachu        49
3    Bishop Hall Jubilee School                    Marowak        48
4    CCC Heep Woh College                         Snorlax        48
5    Chan Sui Ki (La Salle) College                 Zapdos         48


*****************************************************************************

Bottom Five Results
--------------------------------------------------

Rank    School name                               Student's name   Score
-----------------------------------------------------------------------------
196    Bishop Hall Jubilee School                    Grimer         25
197    Bishop Hall Jubilee School                    Persian        22
198    Chan Sui Ki (La Salle) College                 Goldeen        11
199    C.M.A. Secondary School                       Arcanine        9
200    Chan Sui Ki (La Salle) College                 Growlithe       5

*****************************************************************************

School Average
--------------------------------------------------

School name                     No. of participants       Average score
-----------------------------------------------------------------------------
Buddhist Tai Hung College                   14                 41.85
Bishop Hall Jubilee School                  11                 41.14
CCC Heep Woh College                        9                 41.08
Advanced Contemporary College                14                 41.00
CCC Ming Yin College                       20                 40.69
Beacon (Evening) College (Mong Kok)           32                 40.56
Assembly of God Morrison College             39                 40.27
C.M.A. Secondary School                     32                 39.75
Chan Sui Ki (La Salle) College               29                 38.72

*****************************************************************************

Scores of students in descending order
-------------------------------------------

Rank   School Name                          Student Name   Score
-----------------------------------------------------------------------------
1.  Advanced Contemporary College              Umbreon       49
2.  Chan Sui Ki (La Salle) College             Pikachu       49
3.  Bishop Hall Jubilee School                Marowak       48
4.  CCC Heep Woh College                     Snorlax       48
```

```
 9.   Assembly of God Morrison College            Exeggutor     47
10.   CCC Ming Yin College                       Weezing       47
11.   Buddhist Tai Hung College                   Kabuto        47
12.   Chan Sui Ki (La Salle) College               Charmeleon     46
13.   Assembly of God Morrison College             Caterpie       46
14.   Buddhist Tai Hung College                   Spearow       46
15.   CCC Heep Woh College                       Ekans        46
16.   CCC Heep Woh College                       Sandshrew     46
17.   Assembly of God Morrison College             Bellsprout     46
18.   C.M.A. Secondary School                     Onix          46
19.   CCC Ming Yin College                       Hypno        46
20.   CCC Heep Woh College                       Starmie       46
21.   CCC Heep Woh College                       Magikarp      46
22.   Advanced Contemporary College               Eevee          46
23.   Chan Sui Ki (La Salle) College               Mewtwo         46
24.   Bishop Hall Jubilee School                  Chikorita      46
25.   Buddhist Tai Hung College                   Bulbasaur      45
26.   CCC Ming Yin College                       Charmander     45
27.   CCC Ming Yin College                       Arbok        45
28.   Chan Sui Ki (La Salle) College               Nidoqueen      45
29.   Beacon (Evening) College (Mong Kok)          Cubone         45
30.   C.M.A. Secondary School                     Hitmonchan     45
31.   CCC Heep Woh College                       Koffing       45
32.   C.M.A. Secondary School                     Seaking        45
33.   Bishop Hall Jubilee School                  Magmar         45
34.   Buddhist Tai Hung College                   Pinsir         45
35.   CCC Heep Woh College                       Gyarados      45
36.   Advanced Contemporary College               Jolteon        45
37.   Bishop Hall Jubilee School                  Omastar        45
38.   CCC Heep Woh College                       Aerodactyl     45
39.   C.M.A. Secondary School                     Totodile       45
40.   Buddhist Tai Hung College                   Quagsire       45
41.   Beacon (Evening) College (Mong Kok)          Misdreavus     44
42.   Buddhist Tai Hung College                   Weedle         44
43.   Bishop Hall Jubilee School                  Nidoking       44
44.   CCC Heep Woh College                       Vulpix        44
45.   CCC Ming Yin College                       Ninetales      44
46.   CCC Heep Woh College                       Geodude       44
47.   Buddhist Tai Hung College                   Hitmonlee      44
48.   CCC Heep Woh College                       Lickitung      44
49.   Buddhist Tai Hung College                   Tangela        44
50.   C.M.A. Secondary School                     Staryu         44
51.   Beacon (Evening) College (Mong Kok)          Electabuzz     44
52.   CCC Ming Yin College                       Lapras        44
53.   C.M.A. Secondary School                     Kabutops       44
54.   CCC Ming Yin College                       Articuno      44
55.   CCC Ming Yin College                       Quilava       44
56.   Chan Sui Ki (La Salle) College               Typhlosion     44
57.   Chan Sui Ki (La Salle) College               Pichu          44
58.   C.M.A. Secondary School                     Kakuna         43
59.   Buddhist Tai Hung College                   Ponyta         43
```

```
74.   Bishop Hall Jubilee School                Raticate      42
 75.   C.M.A. Secondary School                   Fearow        42
 76.   CCC Ming Yin College                      Sandslash     42
 77.   Chan Sui Ki (La Salle) College              Jigglypuff    42
 78.   Beacon (Evening) College (Mong Kok)          Weepinbell    42
 79.   Buddhist Tai Hung College                  Tentacool     42
 80.   CCC Heep Woh College                      Farfetch'd    42
 81.   CCC Heep Woh College                      Cloyster      42
 82.   CCC Heep Woh College                      Gastly       42
 83.   CCC Ming Yin College                      Haunter      42
 84.   C.M.A. Secondary School                   Kingler       42
 85.   CCC Heep Woh College                      Voltorb      42
 86.   Chan Sui Ki (La Salle) College              Rhyhorn       42
 87.   C.M.A. Secondary School                   Kangaskhan    42
 88.   CCC Heep Woh College                      Horsea       42
 89.   CCC Ming Yin College                      Seadra       42
 90.   Chan Sui Ki (La Salle) College              Ditto         42
 91.   Advanced Contemporary College              Omanyte       42
 92.   Advanced Contemporary College              Dratini       42
 93.   Buddhist Tai Hung College                  Bayleef      42
 94.   Buddhist Tai Hung College                  Noctowl      42
 95.   Assembly of God Morrison College            Slowking      41
 96.   Bishop Hall Jubilee School                 Unown        41
 97.   CCC Heep Woh College                      Squirtle      41
 98.   Chan Sui Ki (La Salle) College              Blastoise     41
 99.   Beacon (Evening) College (Mong Kok)          Metapod       41
100.   CCC Ming Yin College                      Pidgeotto     41
101.   C.M.A. Secondary School                   Raichu        41
102.   CCC Heep Woh College                      Vileplume     41
103.   Buddhist Tai Hung College                  Clefairy      41
104.   C.M.A. Secondary School                   Clefable      41
105.   Chan Sui Ki (La Salle) College              Diglett       41
106.   CCC Ming Yin College                      Alakazam      41
107.   CCC Ming Yin College                      Doduo        41
108.   Assembly of God Morrison College             Seel          41
109.   Chan Sui Ki (La Salle) College              Gengar        41
110.   Assembly of God Morrison College             Jynx          41
111.   C.M.A. Secondary School                   Tauros        41
112.   Advanced Contemporary College              Vaporeon      41
113.   Advanced Contemporary College              Porygon       41
114.   C.M.A. Secondary School                   Croconaw      41
115.   CCC Heep Woh College                      Chinchou      41
116.   CCC Ming Yin College                      Lanturn      41
117.   Assembly of God Morrison College             Cleffa        41
118.   Buddhist Tai Hung College                  Togetic       41
119.   Buddhist Tai Hung College                  Espeon        41
120.   C.M.A. Secondary School                   Ivysaur       40
121.   CCC Heep Woh College                      Venusaur      40
122.   CCC Heep Woh College                      Pidgey       40
123.   Assembly of God Morrison College             Nidoran       40
124.   Beacon (Evening) College (Mong Kok)          Nidorino      40
```

```
124.   Beacon (Evening) College (Mong Kok)          Nidorino      40
125.   CCC Heep Woh College                       Mankey       40
126.   CCC Ming Yin College                       Primeape      40
127.   C.M.A. Secondary School                     Abra         40
128.   C.M.A. Secondary School                     Tentacruel    40
129.   CCC Ming Yin College                       Slowbro      40
130.   Chan Sui Ki (La Salle) College               Magnemite     40
131.   C.M.A. Secondary School                     Magneton      40
132.   Beacon (Evening) College (Mong Kok)          Dewgong       40
133.   C.M.A. Secondary School                     Shellder      40
134.   CCC Heep Woh College                       Drowzee      40
135.   Chan Sui Ki (La Salle) College               Krabby        40
136.   C.M.A. Secondary School                     Rhydon       40
137.   Chan Sui Ki (La Salle) College               Ariados       40
138.   Bishop Hall Jubilee School                   Togepi        40
139.   CCC Heep Woh College                       Xatu         40
140.   Chan Sui Ki (La Salle) College               Ampharos      40
141.   Advanced Contemporary College               Bellossom     40
142.   CCC Heep Woh College                       Jumpluff      40
143.   Chan Sui Ki (La Salle) College               Pidgeot       39
144.   C.M.A. Secondary School                     Wigglytuff    39
145.   Chan Sui Ki (La Salle) College               Oddish        39
146.   Chan Sui Ki (La Salle) College               Exeggcute     39
147.   Advanced Contemporary College               Moltres       39
148.   CCC Ming Yin College                       Dragonite     39
149.   C.M.A. Secondary School                     Mew          39
150.   CCC Ming Yin College                       Sentret      39
151.   Chan Sui Ki (La Salle) College               Furret        39
152.   Assembly of God Morrison College             Hoothoot      39
153.   CCC Heep Woh College                       Mareep       39
154.   Advanced Contemporary College               Marill        39
155.   Advanced Contemporary College               Azumarill     39
156.   Advanced Contemporary College               Sudowoodo     39
157.   Buddhist Tai Hung College                   Yanma        39
158.   CCC Ming Yin College                       Wartortle     38
159.   CCC Ming Yin College                       Golbat       38
160.   Chan Sui Ki (La Salle) College               Machamp       38
161.   CCC Ming Yin College                       Graveler      38
162.   C.M.A. Secondary School                     Rapidash      38
163.   C.M.A. Secondary School                     Ledyba       38
164.   Beacon (Evening) College (Mong Kok)          Igglybuff     38
165.   CCC Ming Yin College                       Flaaffy      38
166.   CCC Heep Woh College                       Aipom        38
167.   Buddhist Tai Hung College                   Wooper       38
168.   CCC Heep Woh College                       Paras        37
169.   CCC Ming Yin College                       Parasect      37
170.   Assembly of God Morrison College             Dugtrio       37
171.   CCC Heep Woh College                       Poliwag      37
172.   CCC Ming Yin College                       Machoke      37
173.   CCC Heep Woh College                       Cyndaquil     37124.
Beacon (Evening) College (Mong Kok)          Nidorino      40
```

```
174.   Assembly of God Morrison College              Gloom         36
175.   CCC Ming Yin College                         Venomoth      36
176.   CCC Heep Woh College                         Kadabra       36
177.   CCC Heep Woh College                         Ledian        36
178.   CCC Ming Yin College                         Spinarak      36
179.   C.M.A. Secondary School                       Crobat        36
180.   CCC Ming Yin College                         Sunkern       36
181.   Chan Sui Ki (La Salle) College                 Sunflora      36
182.   CCC Heep Woh College                         Zubat        35
183.   Chan Sui Ki (La Salle) College                 Poliwrath     35
184.   Chan Sui Ki (La Salle) College                 Dodrio        35
185.   Buddhist Tai Hung College                      Muk           35
186.   Beacon (Evening) College (Mong Kok)              Meowth        34
187.   Buddhist Tai Hung College                      Psyduck       34
188.   Chan Sui Ki (La Salle) College                 Golem         34
189.   CCC Ming Yin College                         Poliwhirl     33
190.   CCC Heep Woh College                         Venonat       32
191.   C.M.A. Secondary School                       Golduck       32
192.   CCC Heep Woh College                         Machop        32
193.   C.M.A. Secondary School                       Natu          32
194.   C.M.A. Secondary School                       Hoppip        30
195.   Advanced Contemporary College                  Murkrow       29
196.   Bishop Hall Jubilee School                    Grimer        25
197.   Bishop Hall Jubilee School                    Persian       22
198.   Chan Sui Ki (La Salle) College                 Goldeen       11
199.   C.M.A. Secondary School                       Arcanine      9
200.   Chan Sui Ki (La Salle) College                 Growlithe     5

**********************************************************************
******** School Results:

Total number of Schools: 9

          Average score of schools in descending order
         --------------------------------------------------

Rank   School Name                                 Size       Average
Score
----------------------------------------------------------------------
--------
  1.   Buddhist Tai Hung College                     14              41.85
  2.   Bishop Hall Jubilee School                    11              41.14
  3.   CCC Heep Woh College                           9              41.08
  4.   Advanced Contemporary College                   14
41.00
  5.   CCC Ming Yin College                          20              40.69
  6.   Beacon (Evening) College (Mong Kok)              32
40.56
  7.   Assembly of God Morrison College                 39
40.27
  8.   C.M.A. Secondary School                       32
```

```
**********************************************************************
********
                    Analysis Result
         ------------------------------------------
**********************************************************************
********
                      Question Analysis
         -------------------------------------------------

Percentage correct for each question

----------------------------------------------------------------------
--------
  Q  1. 62.00 %  Q  2. 63.50 %  Q  3. 70.00 %  Q  4. 87.50 %  Q  5. 80.50
%
  Q  6. 80.50 %  Q  7. 87.00 %  Q  8. 77.50 %  Q  9. 71.50 %  Q 10. 87.00
%
  Q 11. 88.50 %  Q 12. 71.00 %  Q 13. 89.00 %  Q 14. 87.00 %  Q 15. 88.00
%
  Q 16. 65.50 %  Q 17. 82.50 %  Q 18. 80.00 %  Q 19. 79.00 %  Q 20. 78.00
%
  Q 21. 79.00 %  Q 22. 84.50 %  Q 23. 79.00 %  Q 24. 89.00 %  Q 25. 77.00
%
  Q 26. 84.00 %  Q 27. 70.00 %  Q 28. 90.00 %  Q 29. 90.50 %  Q 30. 68.50
%
  Q 31. 87.00 %  Q 32. 83.00 %  Q 33. 76.50 %  Q 34. 83.50 %  Q 35. 87.50
%
  Q 36. 81.00 %  Q 37. 82.50 %  Q 38. 88.00 %  Q 39. 91.00 %  Q 40. 91.50
%
  Q 41. 87.50 %  Q 42. 91.00 %  Q 43. 74.50 %  Q 44. 75.50 %  Q 45. 90.00
%
  Q 46. 82.00 %  Q 47. 77.00 %  Q 48. 84.50 %  Q 49. 83.50 %  Q 50. 71.50
%

**********************************************************************
********
Standard deviation :  5.71

Variance    : 32.56

1st Quartile : 39

2nd Quartile : 41

3rd Quartile : 44

Mean  :  40.55

Mode        :  41

Median            : 41.00
```

```
**********************************************************************
********

                         Question Correct Graph
                   -----------------------------------
Q  1  XX  *******************************(124)
Q  2  XX  *******************************(127)
Q  3  XX  ***********************************(140)
Q  4  XX  *******************************************(175)
Q  5  XX  ****************************************(161)
Q  6  XX  ****************************************(161)
Q  7  XX  *******************************************(174)
Q  8  XX  **************************************(155)
Q  9  XX  ***********************************(143)
Q 10  XX  *******************************************(174)
Q 11  XX  ********************************************(177)
Q 12  XX  ***********************************(142)
Q 13  XX  ********************************************(178)
Q 14  XX  *******************************************(174)
Q 15  XX  ********************************************(176)
Q 16  XX  ********************************(131)
Q 17  XX  *****************************************(165)
Q 18  XX  ****************************************(160)
Q 19  XX  ***************************************(158)
Q 20  XX  ***************************************(156)
Q 21  XX  ***************************************(158)
Q 22  XX  ******************************************(169)
Q 23  XX  ***************************************(158)
Q 24  XX  ********************************************(178)
Q 25  XX  **************************************(154)
Q 26  XX  ******************************************(168)
Q 27  XX  ***********************************(140)
Q 28  XX  *********************************************(180)
Q 29  XX  *********************************************(181)
Q 30  XX  **********************************(137)
Q 31  XX  *******************************************(174)
Q 32  XX  *****************************************(166)
Q 33  XX  **************************************(153)
Q 34  XX  *****************************************(167)
Q 35  XX  *******************************************(175)
Q 36  XX  ****************************************(162)
Q 37  XX  *****************************************(165)
Q 38  XX  ********************************************(176)
Q 39  XX  *********************************************(182)
Q 40  XX  *********************************************(183)
Q 41  XX  *******************************************(175)
Q 42  XX  *********************************************(182)
Q 43  XX  *************************************(149)
Q 44  XX  *************************************(151)
Q 45  XX  *********************************************(180)
Q 46  XX  *****************************************(164)
Q 47  XX  **************************************(154)
Q 48  XX  ******************************************(169)
Q 49  XX  *****************************************(167)
Q 50  XX  ***********************************(143)
----------------------------------------------------------------------
--------
              No. of students  get the answer correct
```

```
                Mark Distribution Graph
          -------------------------------------------
Mark
 0  XX  (0)
 1  XX  (0)
 2  XX  (0)
 3  XX  (0)
 4  XX  (0)
 5  XX  *(1)
 6  XX  (0)
 7  XX  (0)
 8  XX  (0)
 9  XX  *(1)
10  XX  (0)
11  XX  *(1)
12  XX  (0)
13  XX  (0)
14  XX  (0)
15  XX  (0)
16  XX  (0)
17  XX  (0)
18  XX  (0)
19  XX  (0)
20  XX  (0)
21  XX  (0)
22  XX  *(1)
23  XX  (0)
24  XX  (0)
25  XX  *(1)
26  XX  (0)
27  XX  (0)
28  XX  (0)
29  XX  *(1)
30  XX  *(1)
31  XX  (0)
32  XX  ****(4)
33  XX  *(1)
34  XX  ***(3)
35  XX  ****(4)
36  XX  ********(8)
37  XX  ******(6)
38  XX  **********(10)
39  XX  ***************(15)
40  XX  ***********************(23)
41  XX  *************************(25)
42  XX  ************************(24)
43  XX  *************(13)
44  XX  *****************(17)
45  XX  ****************(16)
46  XX  *************(13)
47  XX  ******(6)
48  XX  ***(3)
49  XX  **(2)
50  XX  (0)
----------------------------------------------------------------------
--------
              No. of students  get this mark

**********************************************************************
********
```

Chapter 4 Implementation

4.1 Brief Description

- In this Chapter, I will discuss the implementation of the MC Analysis Program.
- I will:
  1. determine the data structures that will be used in the program.
  2. determine the reusability of the program
  3. determine the ease of using the program
  4. describe the functions that will be performed by each procedure in the program.
  5. explain the main algorithms used in the program
  6. display some of the program codes
  7. display the user interface and analysis report.
  8. display some sample output of my program

4.2 Data Structures

In this program, I would use 2-dimensional array in my program.

I will use the following parallel arrays to store the school name, student name and student score of each participant:

```
sch_name :      array[1..maxsch] of string[80];
sch_size :      array[1..maxsch] of integer;
sch_score:      array[1..maxsch] of real;

stud_sch :      array[1..maxstudno] of string[80];
stud_name :     array[1..maxstudno] of string[30];
stud_ans: array[1..questno] of   string[50];
```

where maxsch is the constant of maximum school numbers ;
maxstudno is the constant of maximum student numbers ;
questno is the constant of the numbers of questions.

e.g. stud_sch[1], stu_name[1] and stu_ans[1] will store the corresponding data of the first participant in sting type.

Questions to think:

1.Is it necessary to use an array to store the MC answers of each participant that are read from the data file (e.g. MCDATA.TXT)? Why?

Yes, it is necessary to use an array to store the MC answers of each participant that are read from the data file(e.g. MCDATA.TXT) and it is a must. Array can store the MC answers of each participant, the name of each participant and the school name of each participant that are read from data file(eg.MCDATA.TXT). Array are used to implement tables of data, it can help the program to read a table of data easier,array also help the programmer to handle the program easier.

Using parallel array can help in this program, let's see the following table showing the use of parallel array.

i(number of lines)	Stud_sch	Stud_name	Stud_answer
1	Advanced Contemporary College	Umbreon	AABBEDADBCECDBAEBBECDCBABDBDDACCDEADEAACECCDDDDCEA
2	Assembly of God Morrison College	Slowking	CCEDACAECBECACCCBBDBEEBBDADDACABDABDCDCBEAEABBDCAA

Moreover, using an array to store the MC answers of each participant can help to check the answer of participant by comparing the participant's MC answers with the answer key. If array is not used, it is very hard to compare student's answer with the answer key.

2.What is/are the data structures for storing the answer keys read from the answer key file (ANSKEY.TXT)

How to store the total number of participant(s) from each participating school?

Use a counter variable to store it (stud_count). Add 1 student to stud_count variable when reading the participants' datafile, the number of lines at the end of file is the total numbers of participants.(Each row only consist of one participant record).

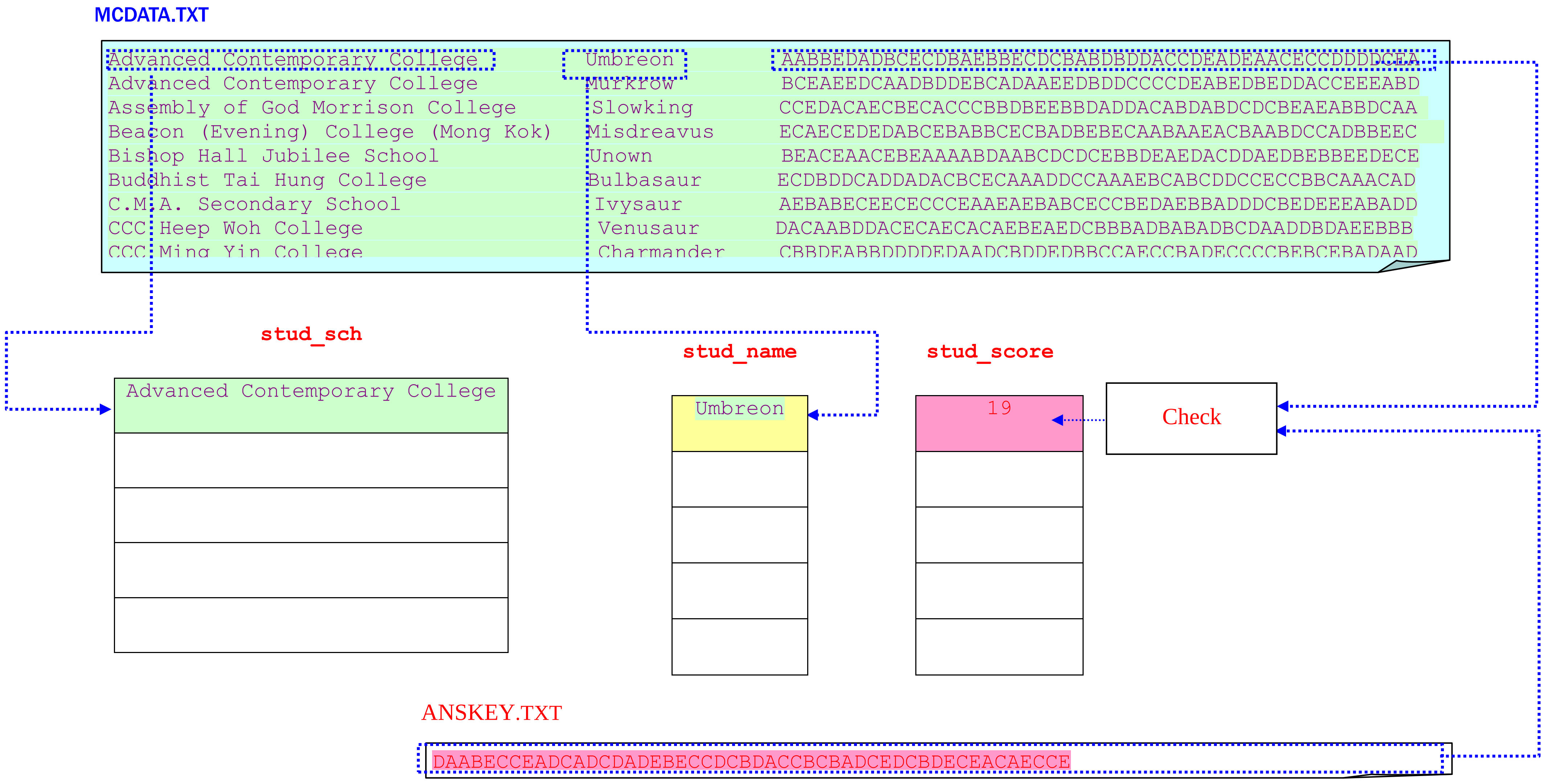
How to store the average score of each school?

Count the score for each school by a array(sch_score[i])

Then, divide sch_score[i] with sch_size[i](the number of students in ith school)

How to store the percentage correct for each question?

Count the number of students that get correct answer in a question. Then, divide them by the number of students (stud_count)



MCDATA.TXT

```
Advanced Contemporary College          Umbreon        AABBEDADBCECDBAEBBECDCBABDBDDACCDEADEAACECCDDDDCEA
Advanced Contemporary College          Murkrow        BCEAEEDCAADBDDEBCADAAEEDBDDCCCCDEABEDBEDDACCEEEABD
Assembly of God Morrison College       Slowking       CCEDACAECBECACCCBBDBEEBBDADDACABDABDCDCBEAEABBDCAA
Beacon (Evening) College (Mong Kok)    Misdreavus     ECAECEDEDABCEBABBCECBADBEBECAABAAEACBAABDCCADBBEEC
Bishop Hall Jubilee School             Unown          BEACEAACEBEAAAABDAABCDCDCEBBDEAEDACDDAEDBEBBEEDECE
Buddhist Tai Hung College              Bulbasaur      ECDBDDCADDADACBCECAAADDCCAAAEBCABCDDCCECCBBCAAACAD
C.M.A. Secondary School                Ivysaur        AEBABECEECECCCEAAEAEBABCECCBEDAEBBADDDCBEDEEEABADD
CCC Heep Woh College                   Venusaur       DACAABDDACECAECACAEBEAEDCBBBADBABADBCDAADDBDAEEBBB
CCC Ming Yin College                   Charmander     CBBDEABBDDDDEDAADCBDDEDBBCCAECCBADECCCCBEBCEBADAAD
```

ANSKEY.TXT

```
DAABECCEADCADCDADEBECCDCBDACCBCBADCEDCBDECEACAECCE
```

4.3 Procedures in the Program

According to the sub-problems in Section 3.2 of Chapter 3, the following procedures will be constructed in the program:

1. Welcome Screen

Before asking the user to enter the data file names, there should be a welcome screen for welcoming and thanking user to use this multiple choice analyzer.

In this procedure, a colourful welcome screen is required and a few welcome messages should be added, for instance, ‘Welcome XXX to use this multiple-choice analyzer’. The designer of this program is also necessary to add to the welcome screen, for example,’ By Baron Fung Kin Kok’.

Program code of

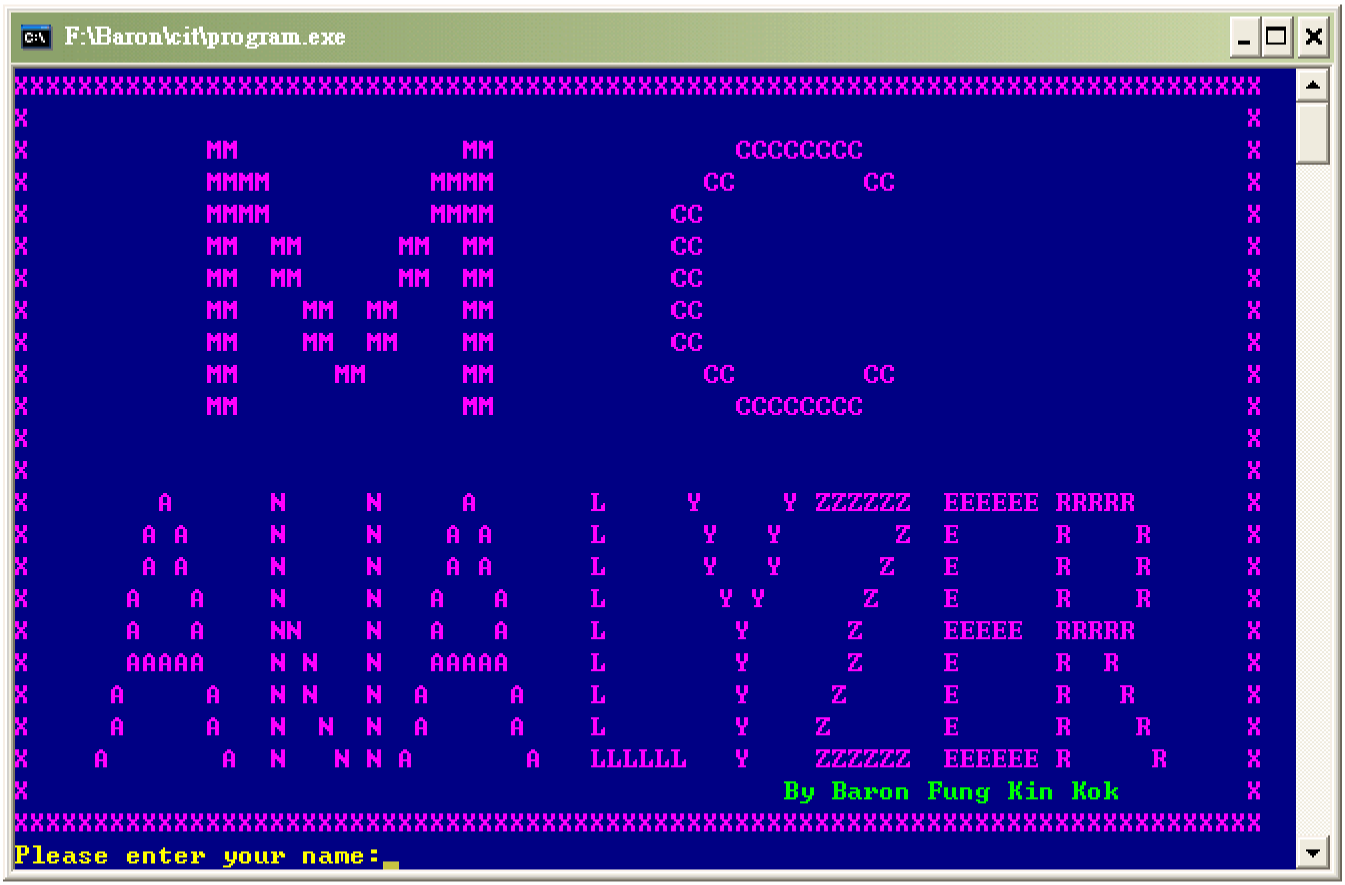
welcome screen:

```
TextBackGround(1);
clrscr;
TextBackGround(1);
textcolor(13);
delay(100);                         {welcoming screen}
writeln('XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXX');
delay(100);
writeln('X                                                                      X');
delay(100);
writeln('X          MM             MM              CCCCCCCC
X');
delay(100);
writeln('X          MMMM         MMMM            CC       CC
X');
delay(100);
writeln('X          MMMM         MMMM          CC
X');
delay(100);
writeln('X          MM  MM     MM  MM          CC
X');
delay(100);
writeln('X          MM  MM     MM  MM          CC
X');
delay(100);
writeln('X          MM    MM  MM    MM          CC
X');
delay(100);
writeln('X          MM    MM  MM    MM          CC
X');
delay(100);
writeln('X              MM        MM        MM                CC          CC
X');
delay(100);
writeln('X              MM                  MM                  CCCCCCCC
X');
delay(100);
writeln('X                                                                                               X');
delay(100);
writeln('X                                                                                               X');
delay(100);
writeln('X          A        N       N       A         L       Y       Y ZZZZZZ   EEEEEE RRRRR
X');
delay(100);
writeln('X         A A       N       N      A A        L        Y    Y         Z   E        R      R
X');
delay(100);
writeln('X         A A       N       N      A A        L        Y    Y        Z    E        R      R
X');
delay(100);
writeln('X        A    A      N       N     A    A      L          Y Y        Z     E        R      R
X');
delay(100);
writeln('X        A    A      NN      N     A    A      L           Y        Z       EEEEE   RRRRR
X');
delay(100);
writeln('X        AAAAA      N N     N     AAAAA       L           Y        Z       E        R   R
X');
delay(100);
writeln('X       A       A    N N     N   A       A     L          Y      Z        E        R    R
X');
delay(100);
writeln('X       A       A    N   N   N   A       A     L          Y     Z         E        R      R
X');
delay(100);
writeln('X      A         A   N     N N A          A    LLLLLL    Y     ZZZZZZ   EEEEEE R       R
X');
write('X                                          ');
textcolor(26);
write('              By Baron Fung Kin Kok       ');
textcolor(13);
writeln('    X');
delay(100);
```

```
writeln('XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXX');
textcolor(14);
writeln('Please enter your name:');
readln(username);
textcolor(12);
write('Welcome ');            {welcome the user}
textcolor(14);
write(username);
textcolor(12);
writeln(' to use this Multiple-Choice Analyzer!');
textcolor(18);
writeln('Please press <Enter> to continue');
readln;
```

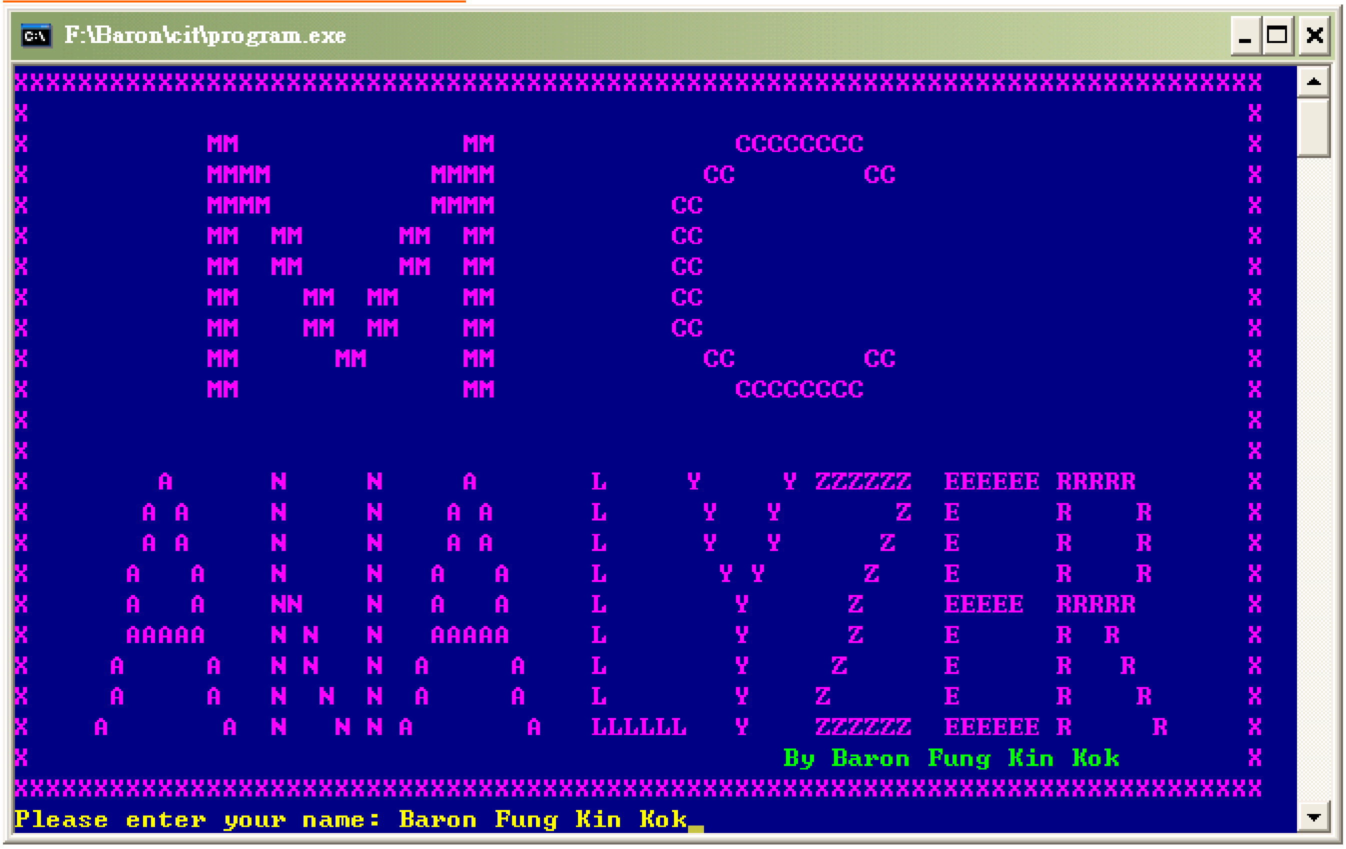
The code ‘delay’ is used for displaying the word string one by one to make the effect of lowering the blind, waterfall.

The execution of the program welcoming screen is shown as follows:



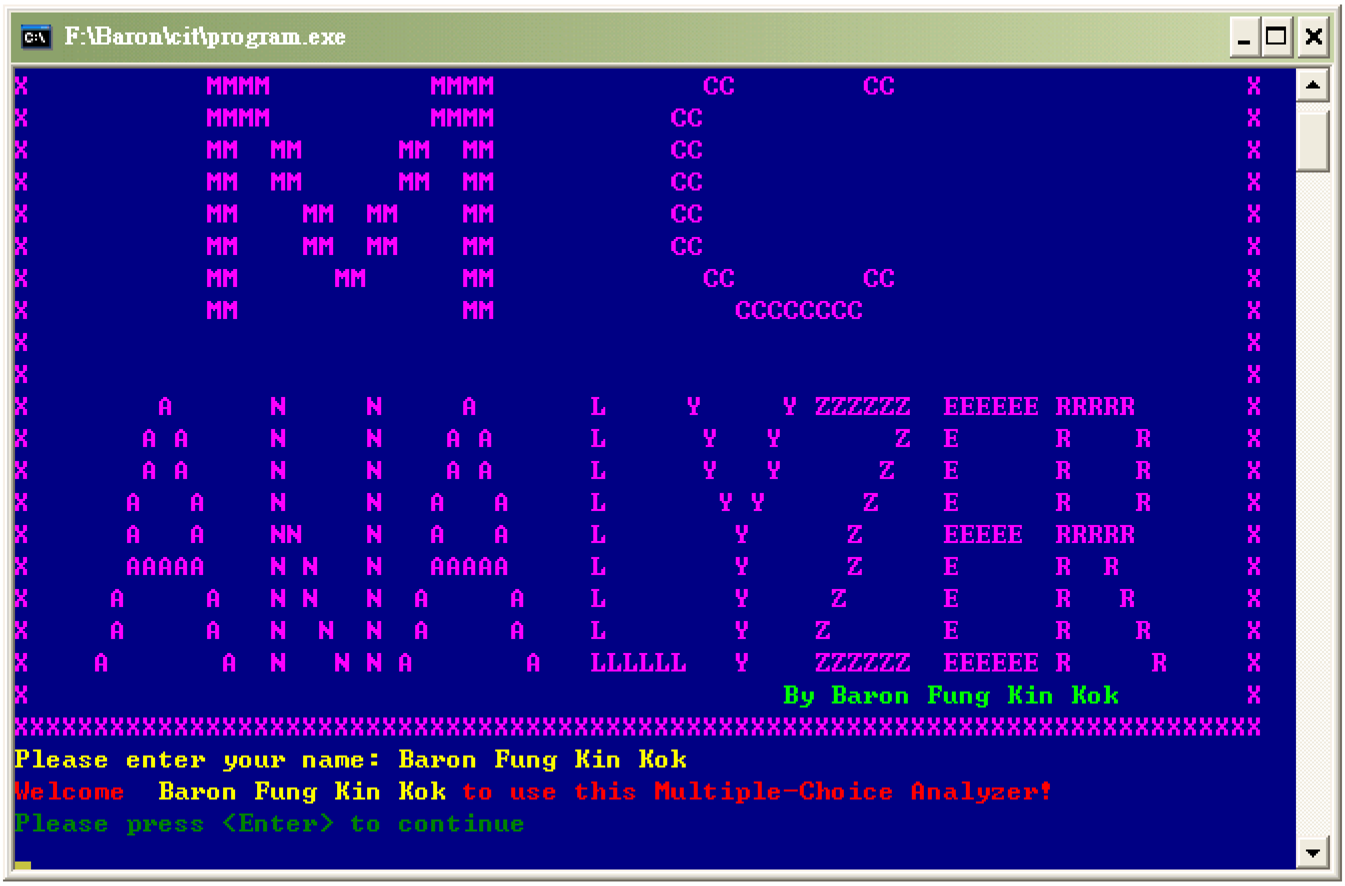
```
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X                                                                            X
X           MM              MM               CCCCCCCC                        X
X           MMMM          MMMM             CC        CC                      X
X           MMMM          MMMM           CC                                  X
X           MM  MM      MM  MM           CC                                  X
X           MM  MM      MM  MM           CC                                  X
X           MM    MM  MM    MM           CC                                  X
X           MM    MM  MM    MM           CC                                  X
X           MM      MM      MM             CC        CC                      X
X           MM              MM               CCCCCCCC                        X
X                                                                            X
X                                                                            X
X        A      N     N     A       L     Y     Y ZZZZZZ  EEEEEE RRRRR       X
X       A A     N     N    A A      L      Y   Y       Z  E      R    R      X
X       A A     N     N    A A      L      Y   Y      Z   E      R    R      X
X      A   A    N     N   A   A     L       Y Y      Z    E      R    R      X
X      A   A    NN    N   A   A     L        Y      Z     EEEEE  RRRRR       X
X      AAAAA    N N   N   AAAAA     L        Y      Z     E      R  R        X
X     A     A   N N   N  A     A    L        Y     Z      E      R   R       X
X     A     A   N  N  N  A     A    L        Y    Z       E      R    R      X
X    A       A  N   N N A       A   LLLLLL   Y    ZZZZZZ  EEEEEE R     R     X
X                                               By Baron Fung Kin Kok        X
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Please enter your name:_
```

Ask the user to answer his name



```
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X                                                                            X
X           MM              MM               CCCCCCCC                        X
X           MMMM          MMMM             CC        CC                      X
X           MMMM          MMMM           CC                                  X
X           MM  MM      MM  MM           CC                                  X
X           MM  MM      MM  MM           CC                                  X
X           MM    MM  MM    MM           CC                                  X
X           MM    MM  MM    MM           CC                                  X
X           MM      MM      MM             CC        CC                      X
X           MM              MM               CCCCCCCC                        X
X                                                                            X
X                                                                            X
X        A      N     N     A       L     Y     Y ZZZZZZ  EEEEEE RRRRR       X
X       A A     N     N    A A      L      Y   Y       Z  E      R    R      X
X       A A     N     N    A A      L      Y   Y      Z   E      R    R      X
X      A   A    N     N   A   A     L       Y Y      Z    E      R    R      X
X      A   A    NN    N   A   A     L        Y      Z     EEEEE  RRRRR       X
X      AAAAA    N N   N   AAAAA     L        Y      Z     E      R  R        X
X     A     A   N N   N  A     A    L        Y     Z      E      R   R       X
X     A     A   N  N  N  A     A    L        Y    Z       E      R    R      X
X    A       A  N   N N A       A   LLLLLL   Y    ZZZZZZ  EEEEEE R     R     X
X                                               By Baron Fung Kin Kok        X
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Please enter your name: Baron Fung Kin Kok_
```

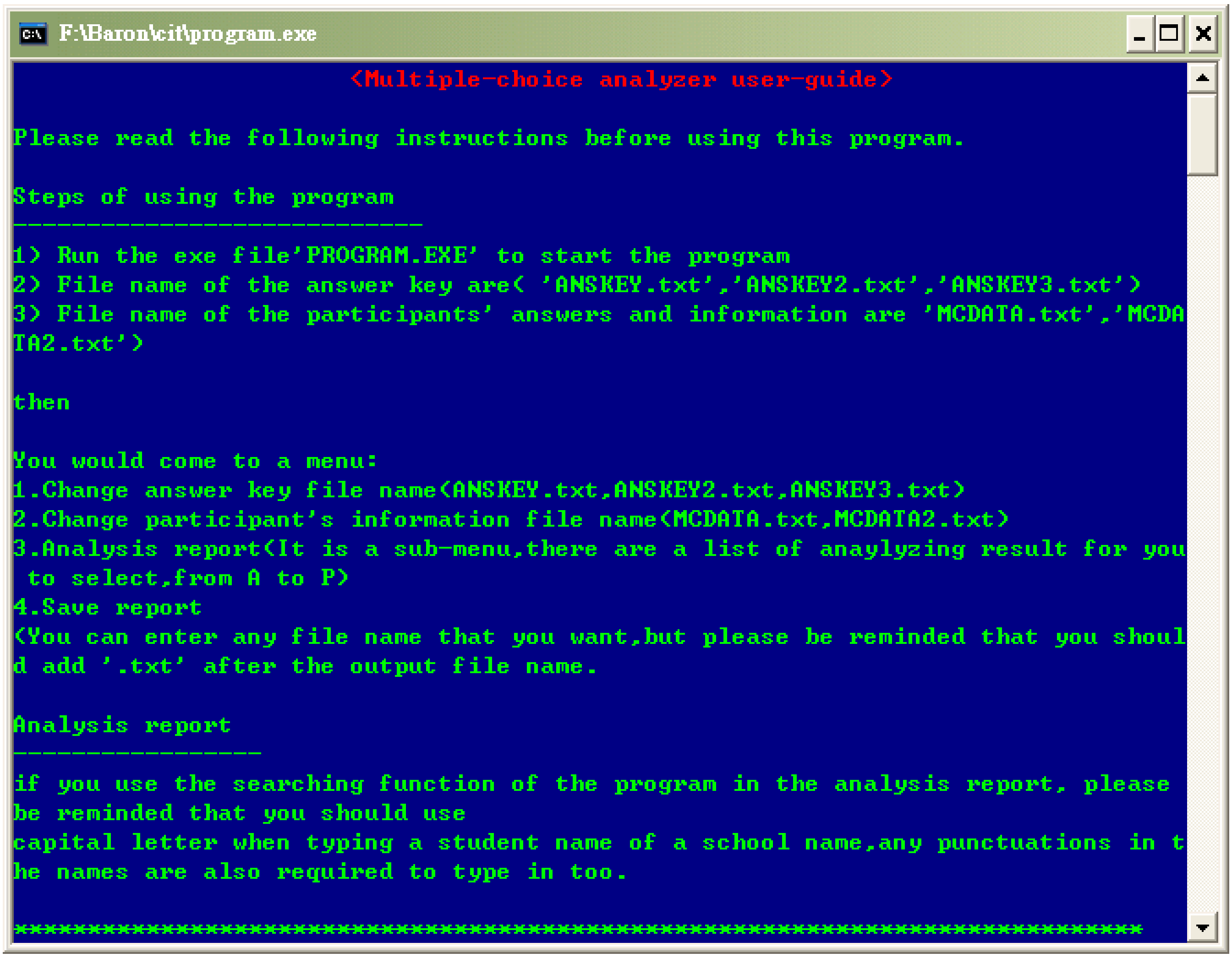
Welcome the user to use this multiple choice analyzer



```
X           MMMM          MMMM             CC        CC                      X
X           MMMM          MMMM           CC                                  X
X           MM  MM      MM  MM           CC                                  X
X           MM  MM      MM  MM           CC                                  X
X           MM    MM  MM    MM           CC                                  X
X           MM    MM  MM    MM           CC                                  X
X           MM      MM      MM             CC        CC                      X
X           MM              MM               CCCCCCCC                        X
X                                                                            X
X                                                                            X
X        A      N     N     A       L     Y     Y ZZZZZZ  EEEEEE RRRRR       X
X       A A     N     N    A A      L      Y   Y       Z  E      R    R      X
X       A A     N     N    A A      L      Y   Y      Z   E      R    R      X
X      A   A    N     N   A   A     L       Y Y      Z    E      R    R      X
X      A   A    NN    N   A   A     L        Y      Z     EEEEE  RRRRR       X
X      AAAAA    N N   N   AAAAA     L        Y      Z     E      R  R        X
X     A     A   N N   N  A     A    L        Y     Z      E      R   R       X
X     A     A   N  N  N  A     A    L        Y    Z       E      R    R      X
X    A       A  N   N N A       A   LLLLLL   Y    ZZZZZZ  EEEEEE R     R     X
X                                               By Baron Fung Kin Kok        X
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Please enter your name: Baron Fung Kin Kok
Welcome  Baron Fung Kin Kok to use this Multiple-Choice Analyzer!
Please press <Enter> to continue
```

2. Showing User Guide

This part only uses writeln to show the user guide on the program screen to tell the user how to use the program. If I use read file to show this user-guide, and if the user place the user-guide text file into another address, the program may not read the user-guide text file, and the users may not be able to run the program successfully. So, it is better to use writeln to show the user guide.



```
                        <Multiple-choice analyzer user-guide>

Please read the following instructions before using this program.

Steps of using the program
----------------------------
1) Run the exe file'PROGRAM.EXE' to start the program
2) File name of the answer key are( 'ANSKEY.txt','ANSKEY2.txt','ANSKEY3.txt')
3) File name of the participants' answers and information are 'MCDATA.txt','MCDA
TA2.txt')

then

You would come to a menu:
1.Change answer key file name(ANSKEY.txt,ANSKEY2.txt,ANSKEY3.txt)
2.Change participant's information file name(MCDATA.txt,MCDATA2.txt)
3.Analysis report(It is a sub-menu,there are a list of anaylyzing result for you
 to select,from A to P)
4.Save report
(You can enter any file name that you want,but please be reminded that you shoul
d add '.txt' after the output file name.

Analysis report
-----------------
if you use the searching function of the program in the analysis report, please
be reminded that you should use
capital letter when typing a student name of a school name,any punctuations in t
he names are also required to type in too.

******************************************************************************
```

3. Reading data files

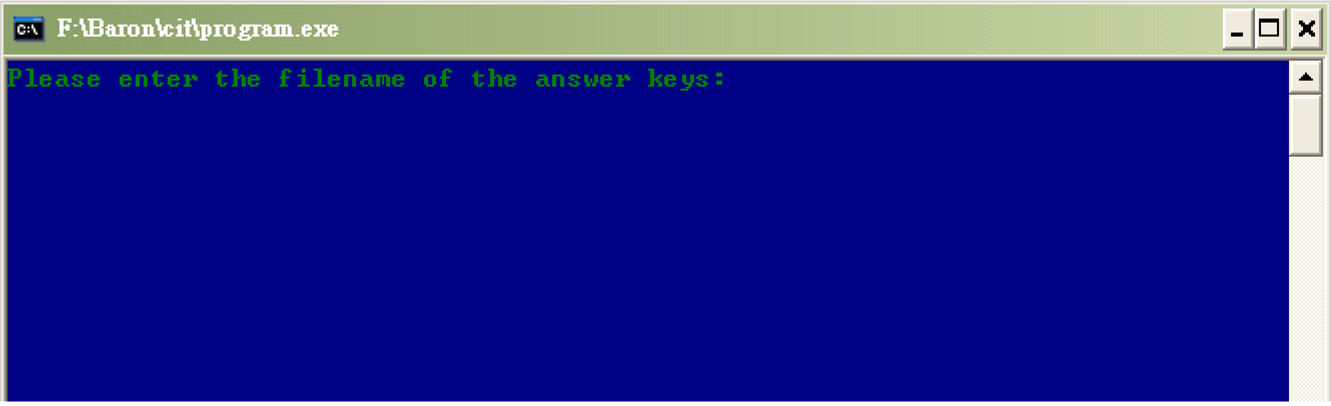
The step of reading data file is a must in this program. In this procedure, the program need to read two data files,we have to ask users to enter two data file names:

1. The participants' information and answers
2. answer key

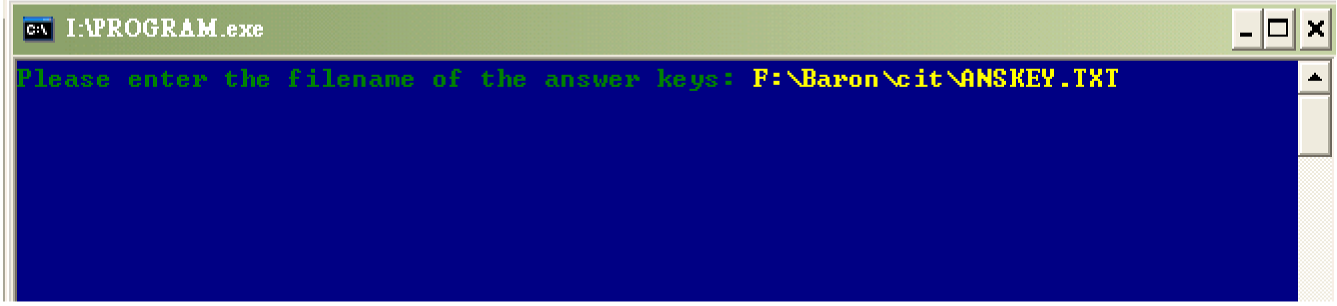
Sample
Please enter the participants' answer and information text file name: ____________
Please enter the answer key text file name: ____________

The user can drag the file to the program execution window instead of typing the whole name of the file. This method is faster, more convenient and can reduce the possibility of happening human typing mistakes.

3.1.Reading answer key



```
Please enter the filename of the answer keys:
```



```
Please enter the filename of the answer keys: F:\Baron\cit\ANSKEY.TXT
```

Program code:

```
procedure reading_ans_keys;
                                                              {the procedure for reading the answer key}
    var
        ans_file_name: string;          {the file name variable of answer key inputted by the user}
        infile:text;                                                    {the answer key file varible}
            begin
            clrscr;
            write('Please enter the filename of the answer keys: ');
            textcolor(14);                                                    {the colour of the text}
            readln(ans_file_name);
                                                                   {Read answer key from the user}
            assign(infile,ans_file_name);
                                            {Assign the file name which the user type as the answer key}
            reset(infile);
            read(infile,answer);
                                                 {Read the answer from the answer key to the program}
            close(infile)

            end;
```

3.2.Reading participants' information and answers

When the user is asked to enter the data file name for the participants' information and answers, they are also recommended to drag the data file to the program screen directly, as I mentioned above, this method is faster, more convenient and can reduce the possibility of typing mistakes.

After asking user to enter the data file name, we should read the data(the participants' name, school name and their answers) in the data file.

We can use 'while loop' or 'for do loop' to tell the program to read data.For a 'while loop', number of data/records is deduced by the file size,the number of rows in the data text file. The data will be read until the end of file.

For 'for do loop', numbers of data/record read will be deduce by the programmer.

For example

```
for a := 1 to 100do
readln(infile,stud_record)
```

In this for-do loop, the program would loop and read the data from the first line(1) to the last line(100).

In this program, we do not know there are how many participants' records in one data file, so we have to use while loop(while not eof(infile)do) to read all the participants' record in this case.

Then, we can use the function: copy .This function is to copy a short string from a long string. The first 45 characters is the student's school name, the next 15 characters is the student's name, and the last 50 characters is the student's answer. We can store each student's record into several arrays: stud_name[ ],stud_sch[ ] and stud_ans[ ].

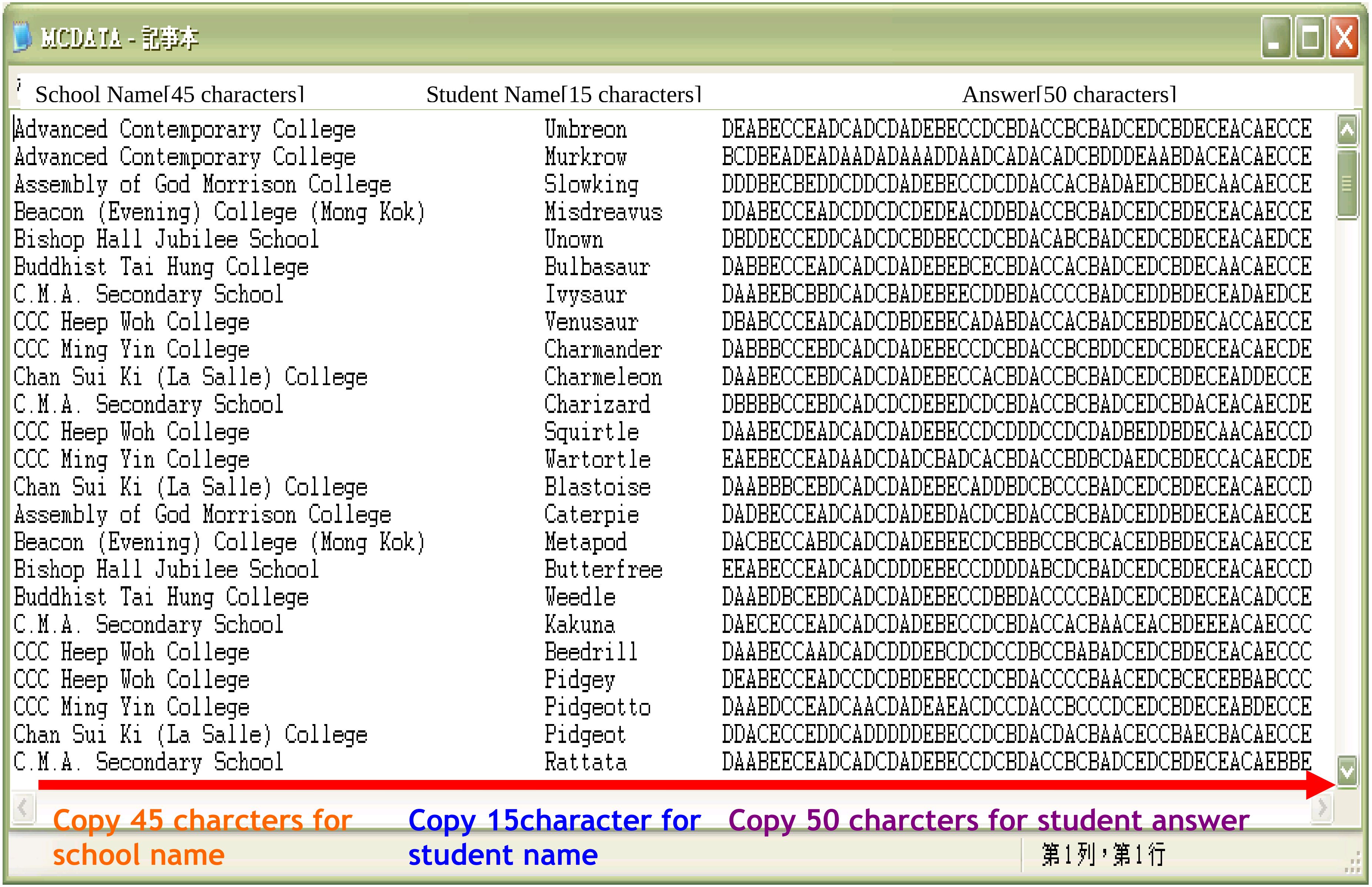
There is also another method to read a string from a long string, we can simply read string from another string.

For example,stud_ans[ ] is an array string, stuans is a string we want to copy from stud_record(a string)

```
We can read stud_ans[] by
While no eof (infile) do
Stud_ans[i]:=(stud_record,Stuans);
```

Program code of my program, using copy function:

```
   procedure reading_stud_record;
     var
        stud_file_name:string;                                         {the file name of the
participants varible}
        infile:text;
        stud_record: string[110];                                     {this record contains the
participant's name, school name
                                                                            and the corresponding
answers}
        i: integer;                                                    {Counter variable}

      begin
      clrscr;
      textcolor(18);
                                                                          {asking the user to input
the participants' file name}
      write('Please enter the filename of the Students'' Answers: ');
      textcolor(14);
      readln(stud_file_name);
      assign(infile,stud_file_name);
      reset(infile);

      i:=0;
     while not eof(infile) do                                        {while the condition is not the
end of file do}
       begin
       i := i+1;
       readln(infile,stud_record);                                   {read students' record}
       stud_sch[i] := copy(stud_record,1,45);                       {copy i th student's school
name}
       stud_name[i]:=copy(stud_record,46,15);                         {copy i th student's name}
       stud_ans[i]:=copy(stud_record,61,50);                         {copy i th student's answers}
       end;
       close(infile);
       stud_count :=i;                                                  {count the number of
students}
       {writeln(stud_ans[i]); }                                     {Test if the answer key are
inputted successfully}
       {writeln('Data input successfully!'); }
     end;
```



MCDATA - 記事本

School Name「45 characters」 Student Name「15 characters」 Answer「50 characters」

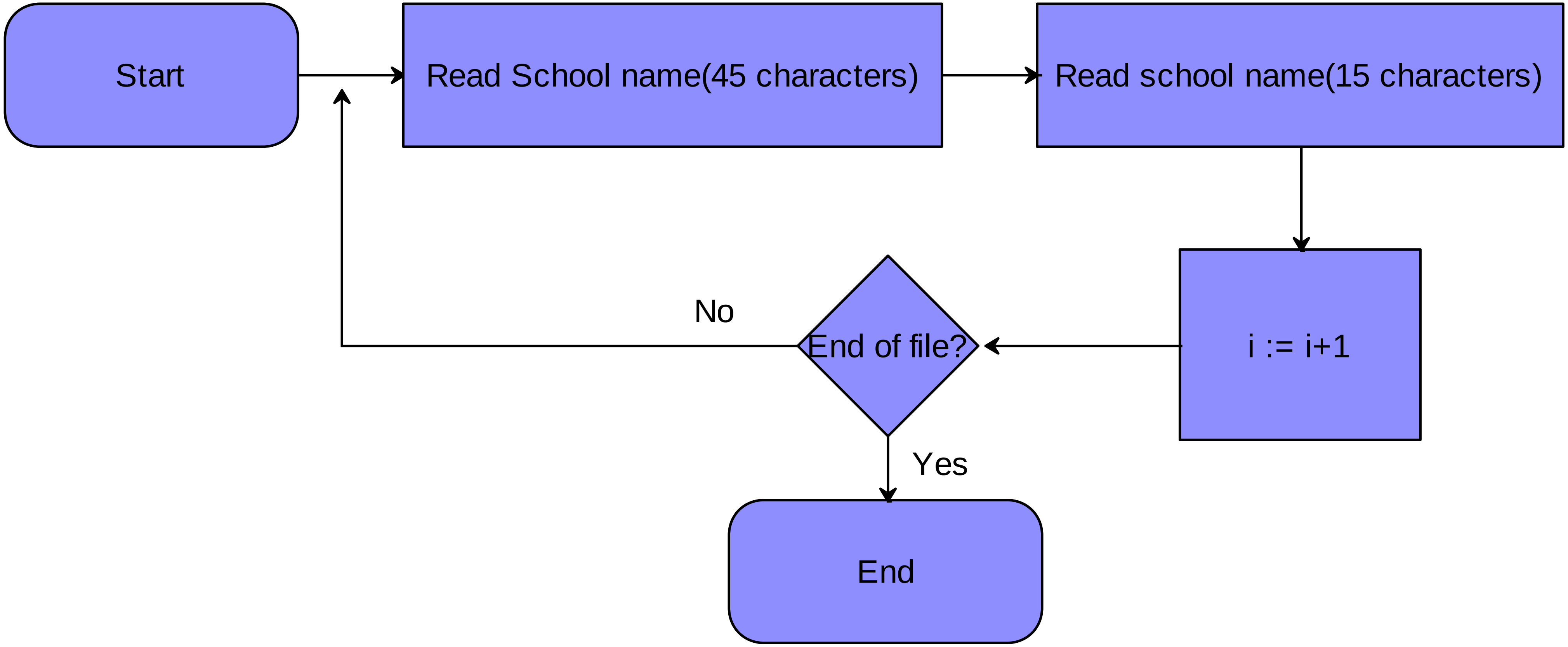
```
Advanced Contemporary College                Umbreon        DEABECCEADCADCDADEBECCDCBDACCBCBADCEDCBDECEACAECCE
Advanced Contemporary College                Murkrow        BCDBEADEADAADADAAADDAADCADACADCBDDDEAABDACEACAECCE
Assembly of God Morrison College             Slowking       DDDBECBEDDCDDCDADEBECCDCDDACCACBADAEDCBDECAACAECCE
Beacon (Evening) College (Mong Kok)          Misdreavus     DDABECCEADCDDCDCDEDEACDDBDACCBCBADCEDCBDECEACAECCE
Bishop Hall Jubilee School                   Unown          DBDDECCEDDCADCDCBDBECCDCBDACABCBADCEDCBDECEACAEDCE
Buddhist Tai Hung College                    Bulbasaur      DABBECCEADCADCDADEBEBCECBDACCACBADCEDCBDECAACAECCE
C.M.A. Secondary School                      Ivysaur        DAABEBCBBDCADCBADEBEECDDBDACCCCBADCEDDBDECEADAEDCE
CCC Heep Woh College                         Venusaur       DBABCCCEADCADCDBDEBECADABDACCACBADCEBDBDECACCAECCE
CCC Ming Yin College                         Charmander     DABBBCCEBDCADCDADEBECCDCBDACCBCBDDCEDCBDECEACAECDE
Chan Sui Ki (La Salle) College               Charmeleon     DAABECCEBDCADCDADEBECCACBDACCBCBADCEDCBDECEADDECCE
C.M.A. Secondary School                      Charizard      DBBBBCCEBDCADCDCDEBEDCDCBDACCBCBADCEDCBDACEACAECDE
CCC Heep Woh College                         Squirtle       DAABECDEADCADCDADEBECCDCDDDCCDCDADBEDDBDECAACAECCD
CCC Ming Yin College                         Wartortle      EAEBECCEADAADCDADCBADCACBDACCBDBCDAEDCBDECCACAECDE
Chan Sui Ki (La Salle) College               Blastoise      DAABBBCEBDCADCDADEBECADDBDCBCCCBADCEDCBDECEACAECCD
Assembly of God Morrison College             Caterpie       DADBECCEADCADCDADEBDACDCBDACCBCBADCEDDBDECEACAECCE
Beacon (Evening) College (Mong Kok)          Metapod        DACBECCABDCADCDADEBEECDCBBBCCBCBCACEDBBDECEACAECCE
Bishop Hall Jubilee School                   Butterfree     EEABECCEADCADCDDDEBECCDDDDABCDCBADCEDCBDECEACAECCD
Buddhist Tai Hung College                    Weedle         DAABDBCEBDCADCDADEBECCDBBDACCCCBADCEDCBDECEACADCCE
C.M.A. Secondary School                      Kakuna         DAECECCEADCADCDADEBECCDCBDACCACBAACEACBDEEEACAECCC
CCC Heep Woh College                         Beedrill       DAABECCAADCADCDDDEBCDCDCCDBCCBABADCEDCBDECEACAECCC
CCC Heep Woh College                         Pidgey         DEABECCEADCCDCDBDEBECCDCBDACCCCBAACEDCBCECEBBABCCC
CCC Ming Yin College                         Pidgeotto      DAABDCCEADCAACDADEAEACDCCDACCBCCCDCEDCBDECEABDECCE
Chan Sui Ki (La Salle) College               Pidgeot        DDACECCEDDCADDDDDEBECCDCBDACDACBAACECCBAECBACAECCE
C.M.A. Secondary School                      Rattata        DAABEECEADCADCDADEBECCDCBDACCBCBADCEDCBDECEACAEBBE
```

Read until end of file

Copy 45 charcters for school name

Copy 15character for student name

Copy 50 charcters for student answer

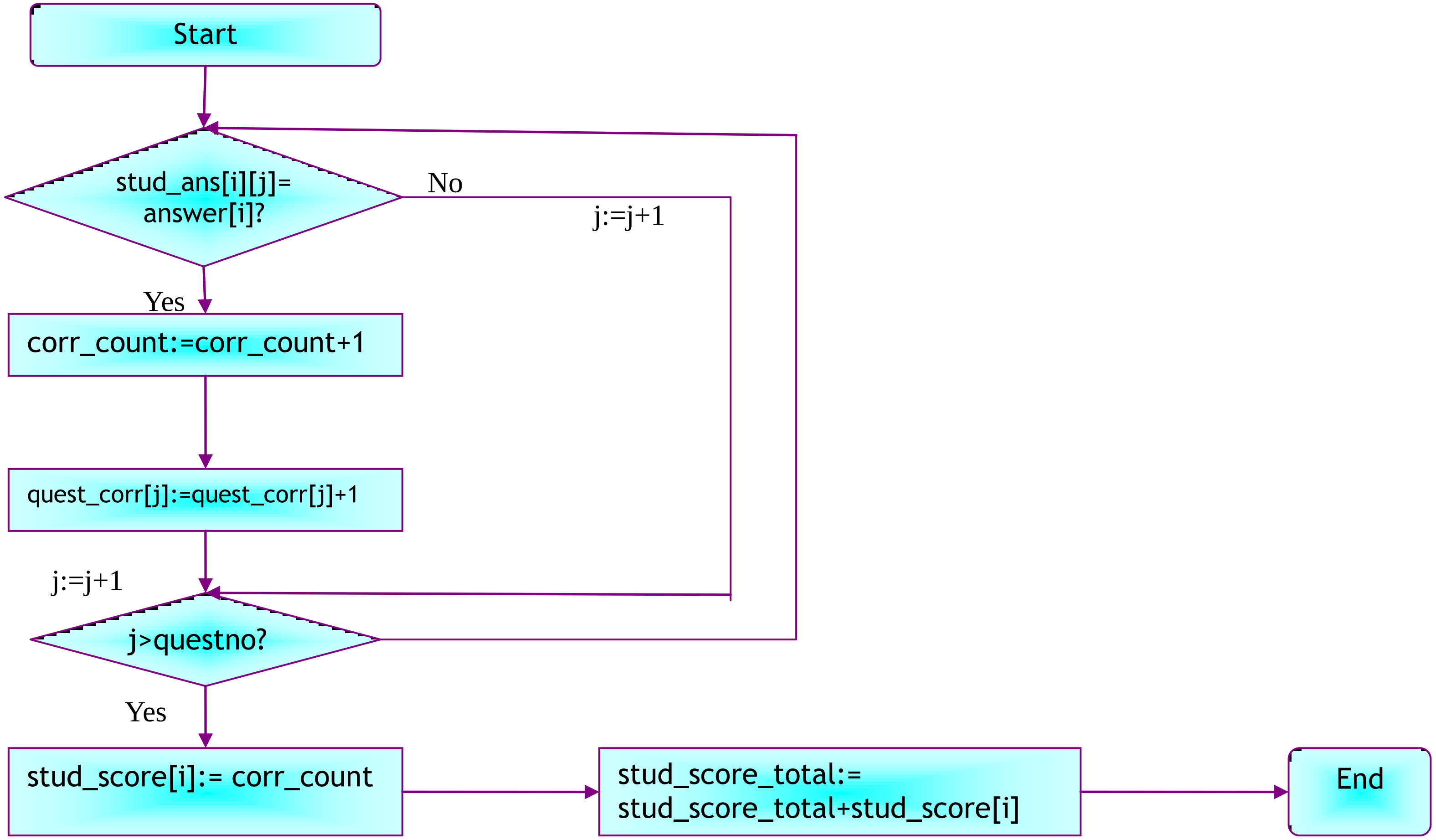

Start
Read School name(45 characters)
Read school name(15 characters)
i := i+1
End of file?
No
Yes
End

4. Calculating participants' score and number of participants

To calculate the participants' score, we should compare the participants' answer with the answer key. If a participant's nth answer is equal to that of the answer key, the participant get 1 mark.
After comparing all of the answers of one participant's to the answer key, the score of the participant is found..We can repeat the step of checking answer simply by a for do loop.
After calculating all the participants' score, the program run to the last line which is the ith line.The number of line is equal to the number of participants in the competition.

Program code:

```
procedure calculate_stud_scores;                                   {procedure for calculating students' scores}
    var
        i,j,k,corr_count: integer;                                 {Counter variable}
   begin
      stud_score_total:=0;                                         {initialize total score of all students}
          for k :=1 to questno do                                       {from the 1st question to the (questno)th question}
              quest_corr[k] := 0;                            {initialize total number of students get the k th question correct}

          for i := 1 to stud_count do                      {from the 1st student to the total number of students)th student}
             begin
                corr_count:=0;                                      {initialize number of correct answers for one student}

                   for j :=1 to questno do                          {from the 1st question to the (questno) th question}
                      begin
                          if stud_ans[i][j] = answer[j] then          {compare i th student j th answer with j th answer key}
                              begin
                                  corr_count := corr_count +1;
                                                              {if they are equal,one mark will be added to the i th student}

                                                           quest_corr[j] := quest_corr[j]+1 ;
                        {one student would be added to the total number of students get the j th question correct}
                              end;
                      end;
         stud_score[i] := corr_count;                   {sum up the score of the i th student}
         stud_score_total := stud_score_total+ stud_score[i];        {sum up the total score of all students}

          end;

             {for a:= 1 to stud_count do                                {Test if the students' score can be corrected and
               writeln(stud_score[a]);                                          the total number of students can be count}
               writeln('Number of students:',stud_count);
               readln }
         end;
```


Start
stud_ans[i][j]= answer[i]?
No
j:=j+1
Yes
corr_count:=corr_count+1
quest_corr[j]:=quest_corr[j]+1
j:=j+1
j>questno?
Yes
stud_score[i]:= corr_count
stud_score_total:= stud_score_total+stud_score[i]
End

5 Calculating school scores ,number of schools and number of students from schools

```
  procedure calculate_sch_score;
var
      i, j : integer;
      found : boolean;
```

It is a easy task to calculate school scores and count the number of students from schools.
Several array are involved:
sch_name[ ] : The school name of that school
sch_size[ ]   : The number of students from that school
sch_score[ ] : The score of that school
stud_sch[ ]   : The school name of that student
stud_score[] : The score of that student
stud_count[]:   The number of students count in the competition

```
begin
```

The first step of this procedure is to assign the school name to the student school name.

```
sch_name[1] := stud_sch[1];
```

Then, the next step is to initialize the number of students from the i^{th} school (sch_size[i])and the numbers of school joined in the competition(sch_count).

```
sch_size[1] := 1;
sch_score[1]:=stud_score[1];
sch_count := 1;
```

To calculate the number of students from a school, we should first check if the i^{th} student school name(stud_sch[i]) have appear before. If stud_sch[i] has appeared before, then no need to add 1 to the number of schools(sch_count) else we need to add 1 to the sch_count. We can use a for do loop to check all the student records.

```
for i :=2 to stud_count do
      begin
         j:=1;
         found := false;
```

To calculate school scores, we can use the repeat until function. If the school name of the ith student is equal to the name of ith school, the score the ith student is added to the school score of the ith school.

```
          repeat
            if sch_name[j] = stud_sch[i] then
     begin
         sch_size[j] := sch_size[j]+1;
         sch_score[j] := sch_score[j] + stud_score[j];
         found := true
         end
             else
             j := j+1
          until found or (j> sch_count);
          if not found then
   begin
   sch_count:=j;
   sch_name[sch_count] :=stud_sch[i];
   sch_size[sch_count] := 1;
   sch_score[sch_count] := sch_score[sch_count] + stud_score[sch_count]
   end
          end;
```

The final step is to calculate the average school score of each score. It is because the numbers of participants from each school is different, if we find the ranking of school according to the total school score, the result would be unfair, so, using the average score for finding out ranking of school is more suitable.

```
       for i:=1 to sch_count do
         sch_score[i] := sch_score[i]/sch_size[i]
       end;
```

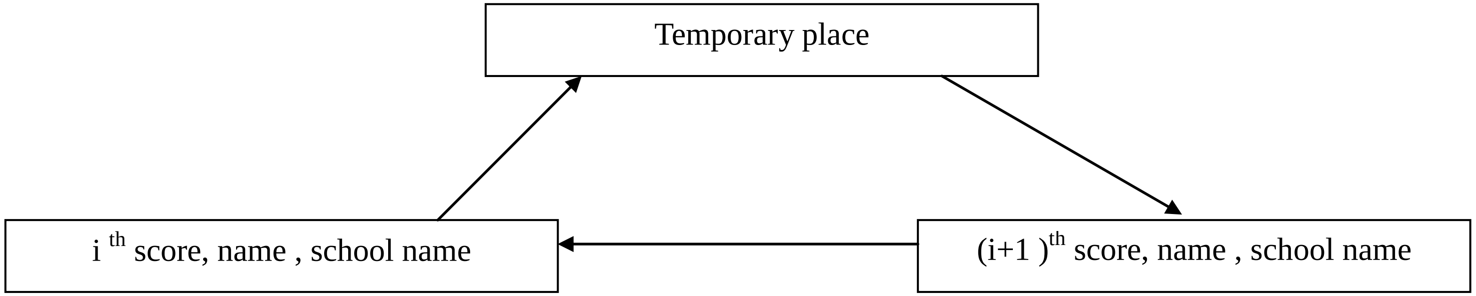
6.Find_Winners

To produce a clear and detailed analysis report, we need to find out the winners of the multiple choice competition first. We have to sort the list of participants’ scores and schools scores to achieve this.

6.1. Sorting participants’ score

```
procedure sort_stud_score;                        {the procedure for sorting students' scores}
var
   k,j :integer;
   tmp_sch : string[45];                          {temporary school}
   tmp_studname      : string[15];                  {temporary student name}
   tmp_score : integer;                            {temporary score }
```

Bubble sort can be used here, it is a fast sorting method, n-1 turns should be done in this sorting. N equals to the numbers of students. In this method, we should compare the score of the j^{th} student with the $(j+1)^{th}$ student, swap if the j^{th} student’s score is larger than the$(j+1)^{th}$ score. In the swaping process, a temporary place is needed, let’s see how the swapping process work.


Temporary place
i th score, name , school name
(i+1)th score, name , school name

This swapping process looks like we swap things in two drawers, if we want to put the 2nd drawer's thing into the 1st drawer. We need to put the things in 1st drawer to a temporary place. Then, we can put the 2nd drawer's thing into the 1st drawer. Finally, the 2nd drawer is empty and we can put the 1st drawer's thing placed in the temporary place back to the 2nd drawer.

Program coding of sorting student's score:

```
begin
  {Bubble Sort}
  for k := 1 to stud_count-1 do
   for j := 1 to stud_count-k do
     if stud_score[j] < stud_score[j+1] then    {compare the j th score with the score behind it}
   begin
       tmp_sch := stud_sch[j];                      {Swaping students' school name}
       stud_sch[j]:= stud_sch[j+1];
       stud_sch[j+1] := tmp_sch;

       tmp_studname := stud_name[j];                {Swaping students' name}
       stud_name[j]:= stud_name[j+1];
       stud_name[j+1] := tmp_studname;

        tmp_score := stud_score[j];                 {Swaping students' score}
        stud_score[j]:=stud_score[j+1];
        stud_score[j+1]:=tmp_score;
       end;
       end;
```

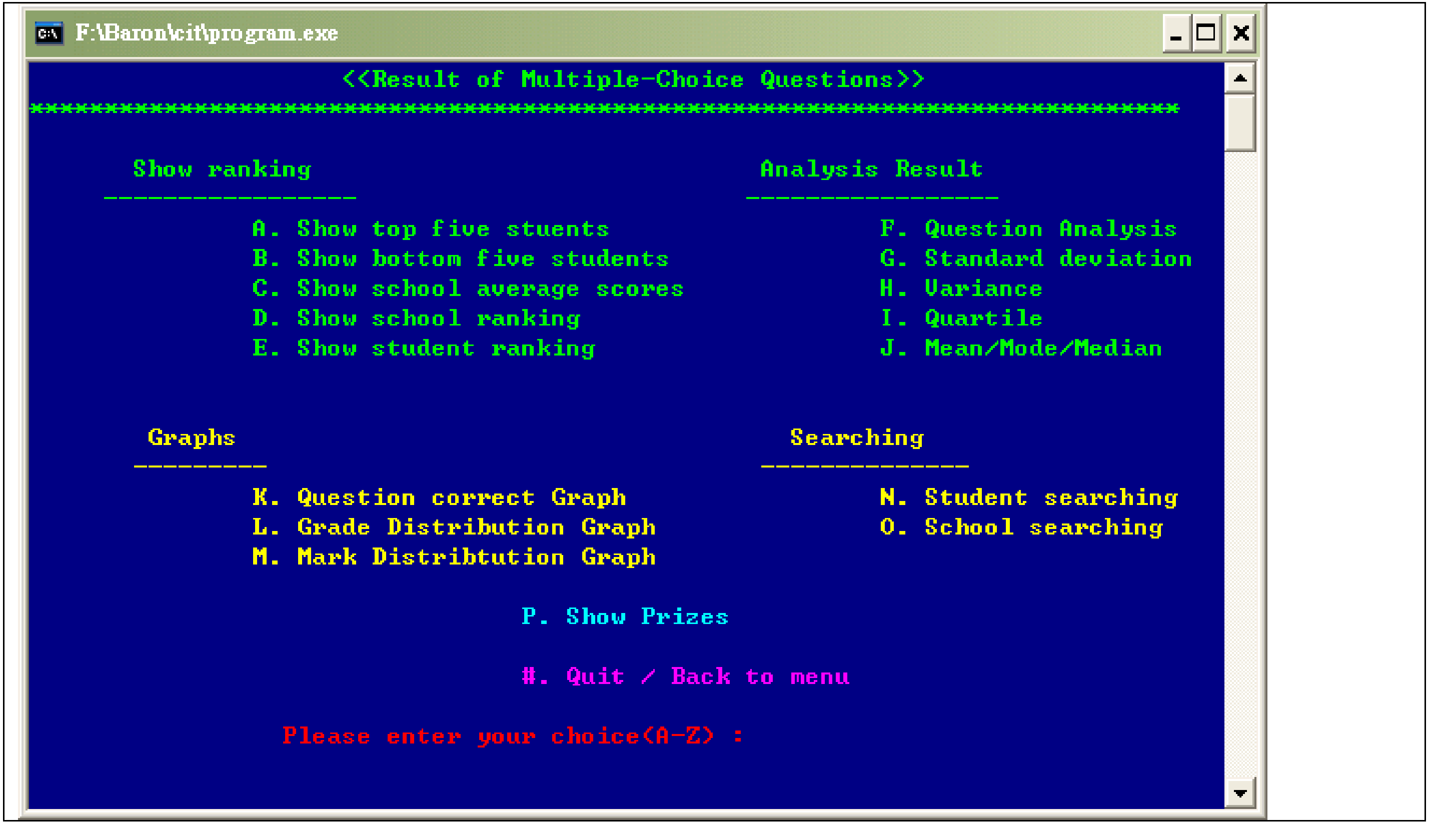
6.2. *Sorting school scores*

Bubble sort is also used to sort the school score here. The program coding of this section is similar to the previous section:

```
. procedure sort_sch_score;                                   {the procedure for sorting school score}
var
   k,j :integer;
   tmp_schname        : string[45];                           {temporary school name}
   tmp_score : real;                                          {temporary school score}
   begin
   {Bubble Sort}
   for k := 1 to sch_count-1 do
     for j := 1 to sch_count-k do
        if sch_avg[j] < sch_avg[j+1] then          {comparing j th school score with the school's score    behind it}
   begin
         tmp_schname := sch_name[j];                       {Swaping school name}
         sch_name[j]:= sch_name[j+1];
         sch_name[j+1] := tmp_schname;

            tmp_score := sch_avg[j];                       {Swaping school score}
            sch_avg[j]:=sch_avg[j+1];
            sch_avg[j+1]:=tmp_score;
     end;
     end;
```

7.Show the analysis report

There is a list of analysis result for the user to browse in my program. Here is the menu of the analysis result.

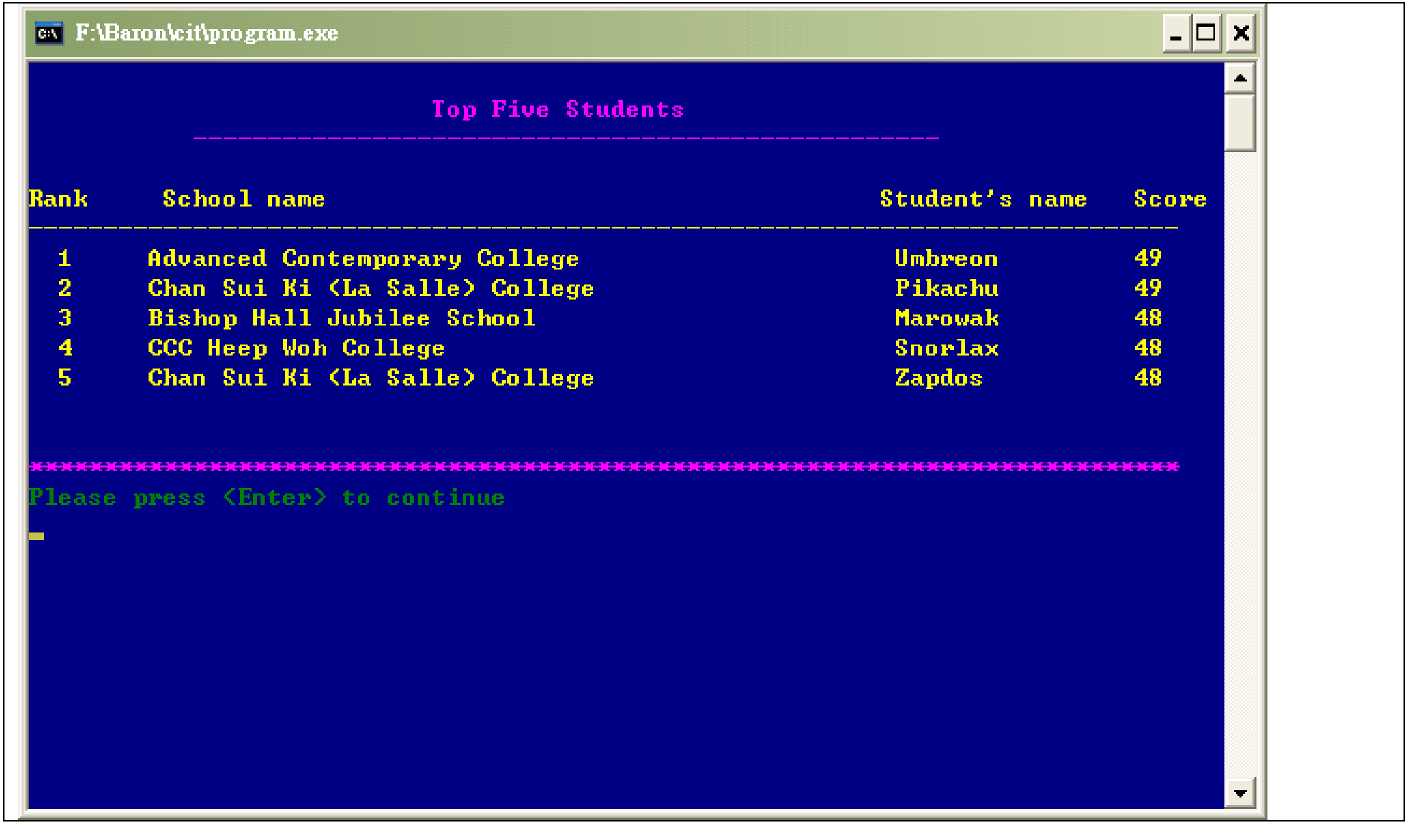


F:\Baron\cit\program.exe

```
                     <<Result of Multiple-Choice Questions>>
*****************************************************************************

      Show ranking                              Analysis Result
     -----------------                         -----------------
               A. Show top five stuents                 F. Question Analysis
               B. Show bottom five students             G. Standard deviation
               C. Show school average scores            H. Variance
               D. Show school ranking                   I. Quartile
               E. Show student ranking                  J. Mean/Mode/Median


       Graphs                                     Searching
      ---------                                 --------------
               K. Question correct Graph                N. Student searching
               L. Grade Distribution Graph              O. School searching
               M. Mark Distribtution Graph

                                 P. Show Prizes

                                 #. Quit / Back to menu

                 Please enter your choice(A-Z) :
```

7.1. Show top five

This procedure shows the top five students in the multiple-choice competition. This can be accessed by using a for do loop:

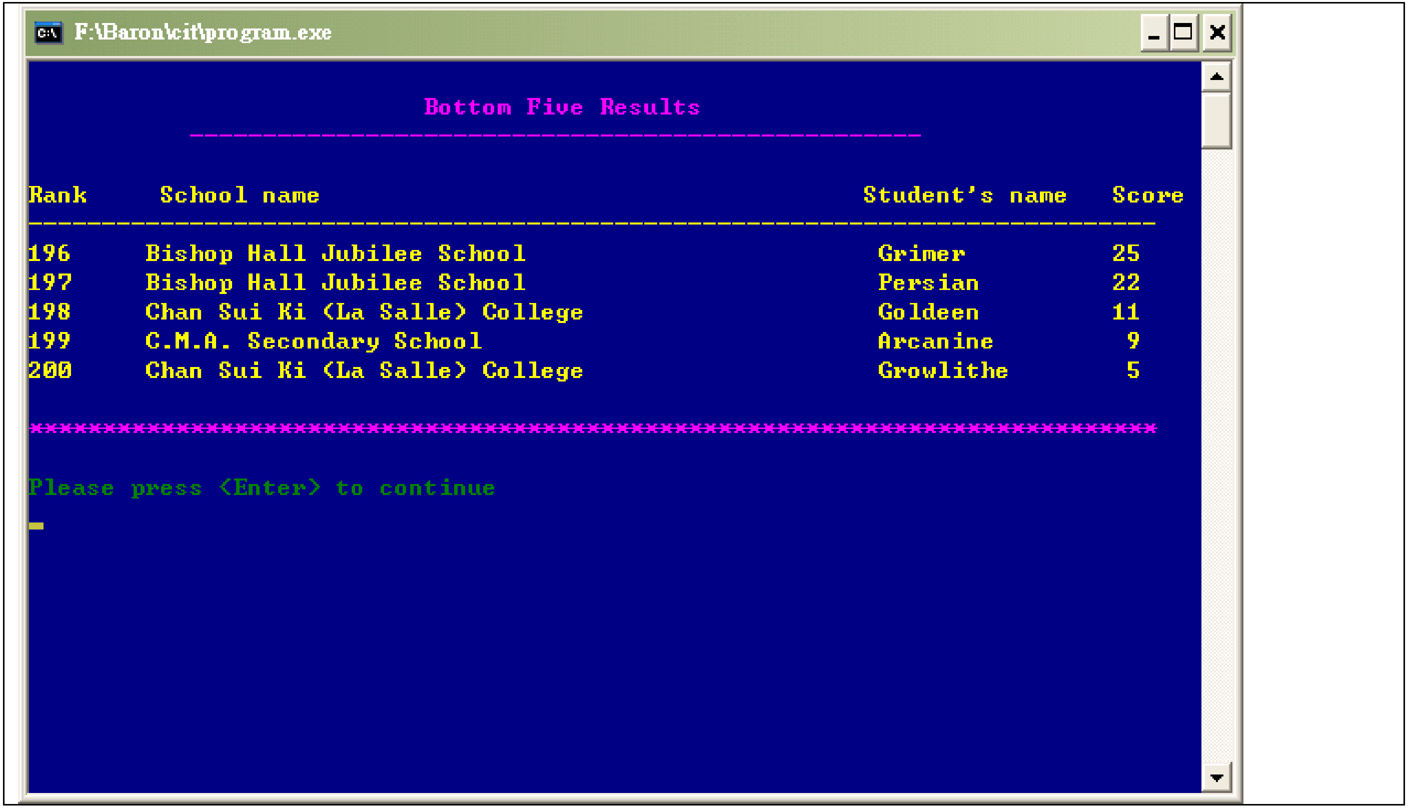


F:\Baron\cit\program.exe

```
                                  Top Five Students
           --------------------------------------------------

Rank      School name                                         Student's name    Score
-----------------------------------------------------------------------------
  1      Advanced Contemporary College                        Umbreon          49
  2      Chan Sui Ki (La Salle) College                       Pikachu          49
  3      Bishop Hall Jubilee School                           Marowak          48
  4      CCC Heep Woh College                                 Snorlax          48
  5      Chan Sui Ki (La Salle) College                       Zapdos           48


*****************************************************************************
Please press <Enter> to continue
_
```

7.2. Show bottom five

This procedure shows the bottom five students in the multiple-choice competition. This can be accessed by using a for do loop too:

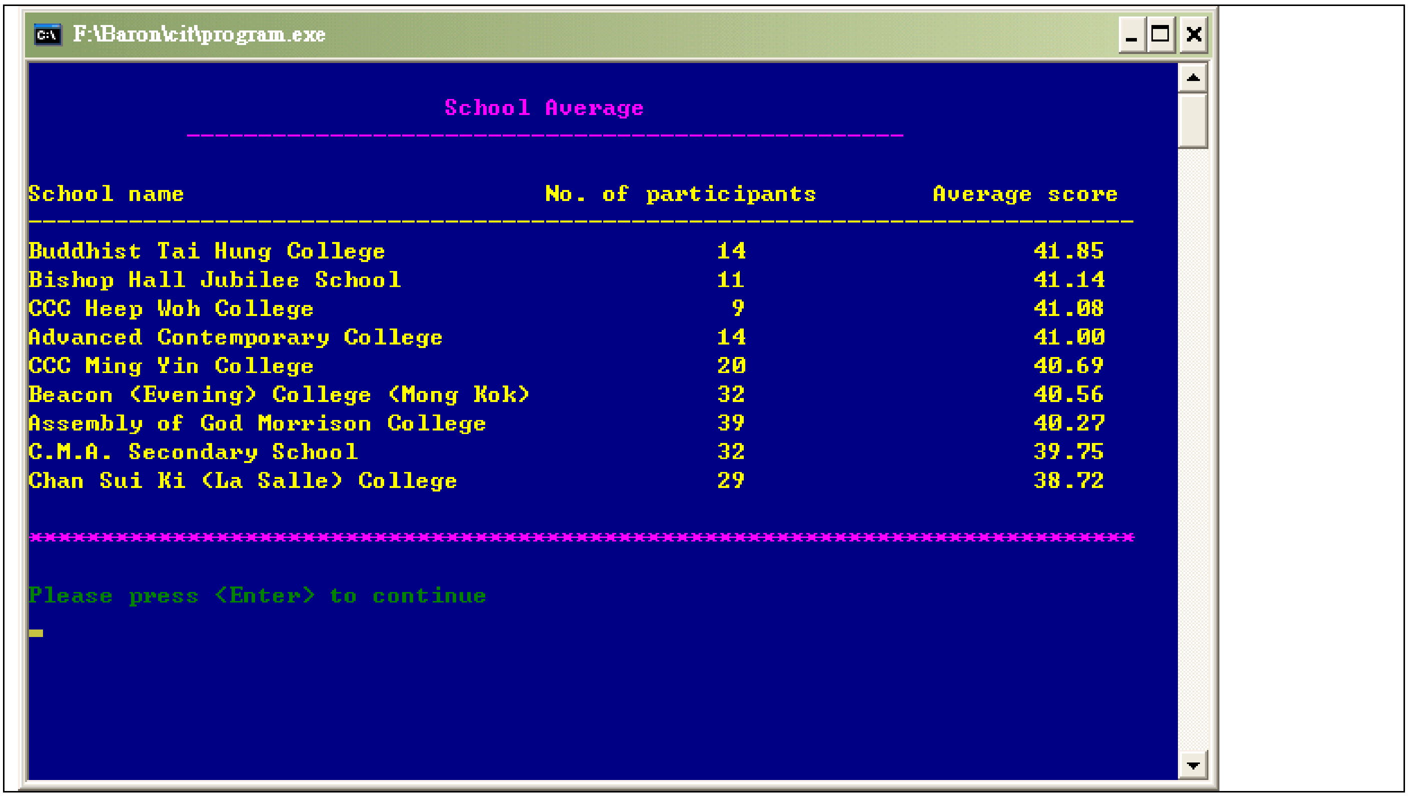


F:\Baron\cit\program.exe

```
                          Bottom Five Results
          --------------------------------------------------

Rank      School name                                           Student's name    Score
-----------------------------------------------------------------------------
196      Bishop Hall Jubilee School                              Grimer           25
197      Bishop Hall Jubilee School                              Persian          22
198      Chan Sui Ki (La Salle) College                          Goldeen          11
199      C.M.A. Secondary School                                 Arcanine          9
200      Chan Sui Ki (La Salle) College                          Growlithe         5

*****************************************************************************

Please press <Enter> to continue
_
```

7.3.Show school ranking

The school score had been calculated before and sorted before, we show the result to the user here.

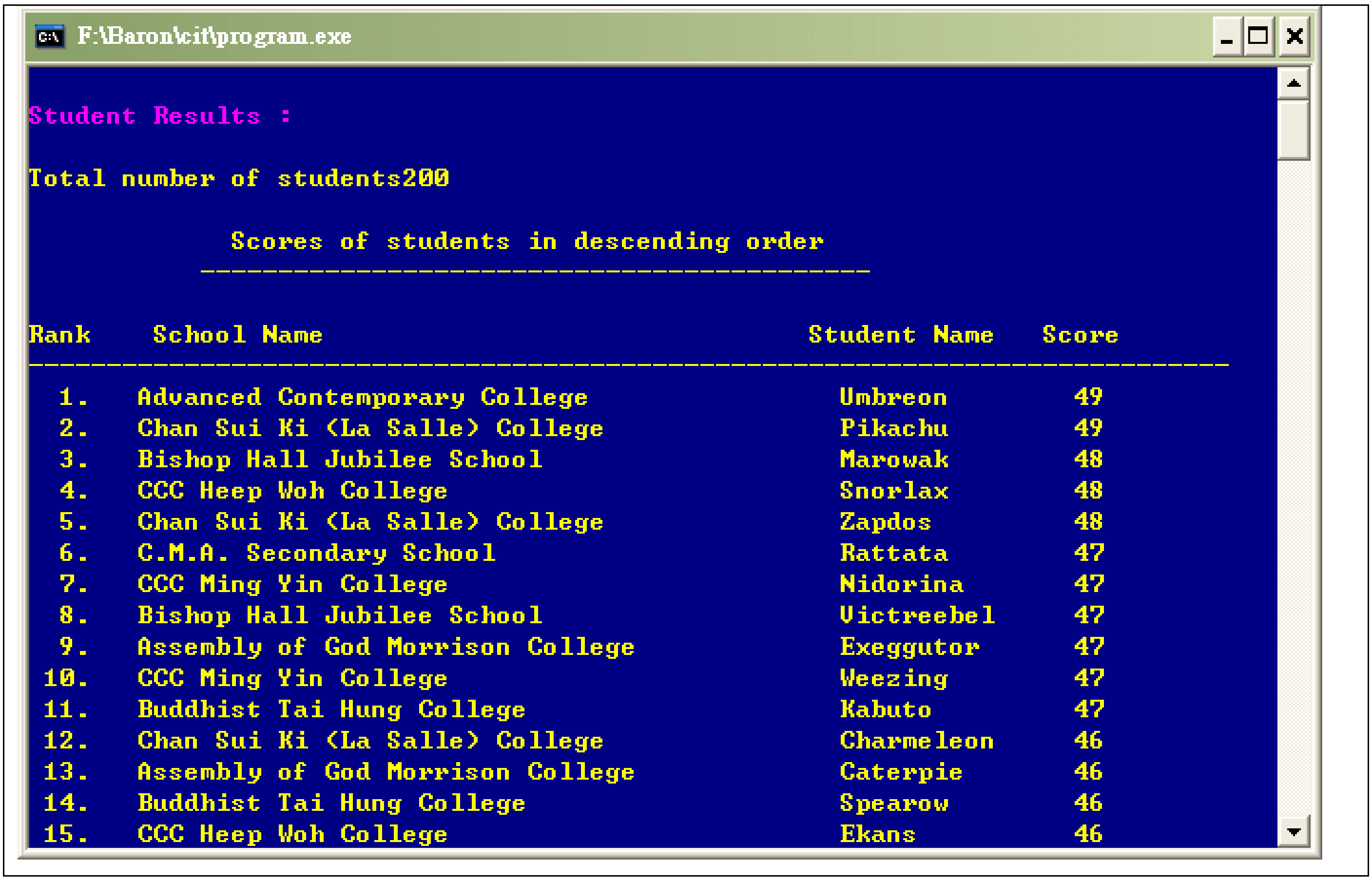


F:\Baron\cit\program.exe

```
                              School Average
          --------------------------------------------------

School name                         No. of participants        Average score
-----------------------------------------------------------------------------
Buddhist Tai Hung College                       14                     41.85
Bishop Hall Jubilee School                      11                     41.14
CCC Heep Woh College                             9                     41.08
Advanced Contemporary College                   14                     41.00
CCC Ming Yin College                            20                     40.69
Beacon (Evening) College (Mong Kok)             32                     40.56
Assembly of God Morrison College                39                     40.27
C.M.A. Secondary School                         32                     39.75
Chan Sui Ki (La Salle) College                  29                     38.72

*****************************************************************************

Please press <Enter> to continue
_
```

7.4. Show student ranking

The school score had been calculated before and sorted before, we show the result to the user here.



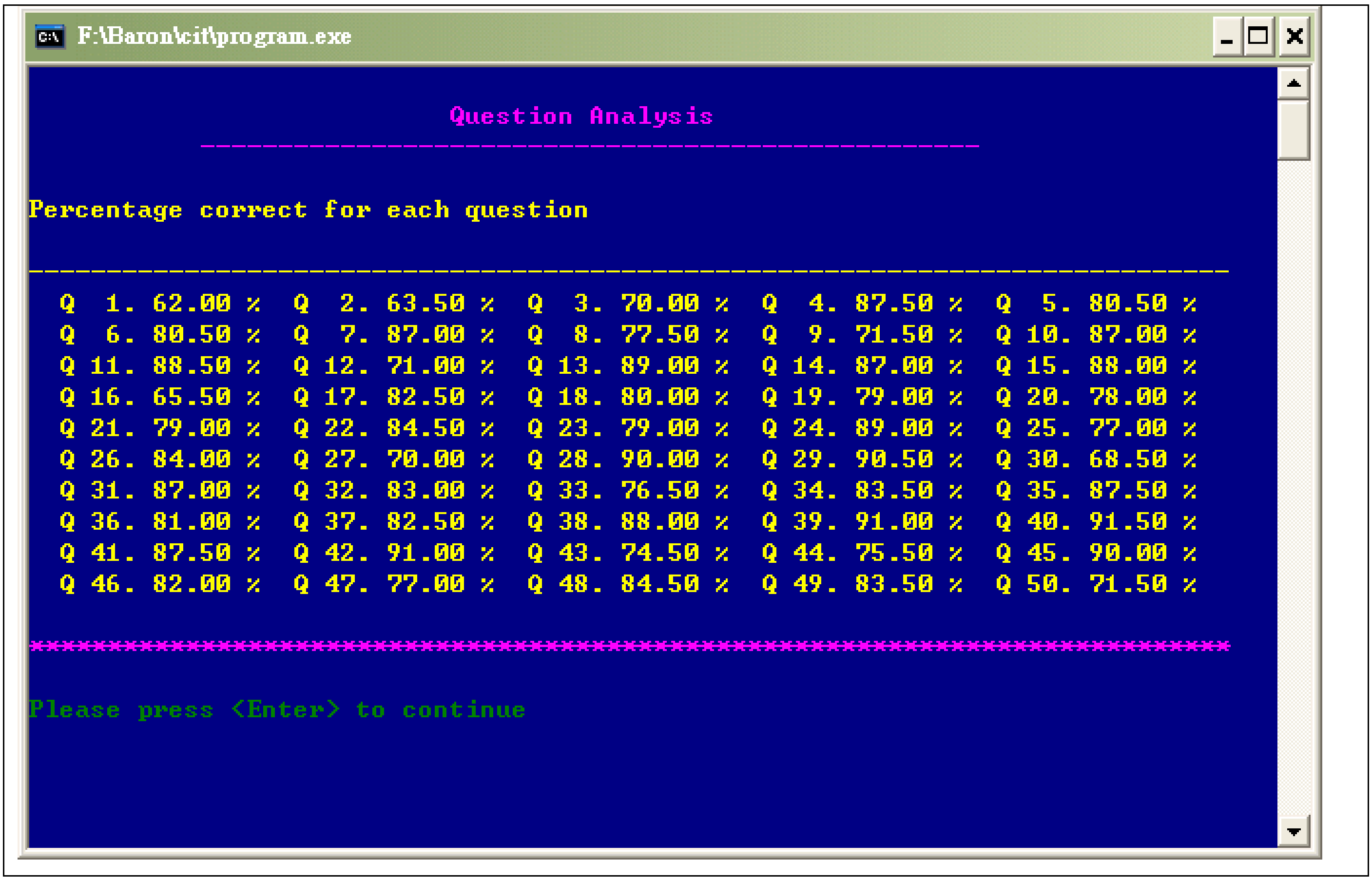
```
Student Results :

Total number of students200

             Scores of students in descending order
           --------------------------------------------

Rank     School Name                                 Student Name    Score
-------------------------------------------------------------------------------
  1.    Advanced Contemporary College                  Umbreon        49
  2.    Chan Sui Ki (La Salle) College                 Pikachu        49
  3.    Bishop Hall Jubilee School                     Marowak        48
  4.    CCC Heep Woh College                           Snorlax        48
  5.    Chan Sui Ki (La Salle) College                 Zapdos         48
  6.    C.M.A. Secondary School                        Rattata        47
  7.    CCC Ming Yin College                           Nidorina       47
  8.    Bishop Hall Jubilee School                     Victreebel     47
  9.    Assembly of God Morrison College               Exeggutor      47
 10.    CCC Ming Yin College                           Weezing        47
 11.    Buddhist Tai Hung College                      Kabuto         47
 12.    Chan Sui Ki (La Salle) College                 Charmeleon     46
 13.    Assembly of God Morrison College               Caterpie       46
 14.    Buddhist Tai Hung College                      Spearow        46
 15.    CCC Heep Woh College                           Ekans          46
```

7.5. Show question analysis

Question analysis show the percentage of students gets a question correct. This analysis can easily show the difficulties of a question. The lower percentage of students gets the question correct, the harder the question.

We had use an array call quest_corr in the section saying the procedure of calculating students' score. To calculate the percentage of students gets a question correct. We can divide the number of students get answer correct in the ith question by the total number of students count, then times 100%.

In order to show a more tidy result, I use two for loops to show the result. One is used for telling the computer how many rows I want to show, another one is used for telling the computer how many question analysis in each row.



```
                              Question Analysis
                    --------------------------------------------------

Percentage correct for each question

-----------------------------------------------------------------------------
  Q  1. 62.00 %  Q  2. 63.50 %  Q  3. 70.00 %  Q  4. 87.50 %  Q  5. 80.50 %
  Q  6. 80.50 %  Q  7. 87.00 %  Q  8. 77.50 %  Q  9. 71.50 %  Q 10. 87.00 %
  Q 11. 88.50 %  Q 12. 71.00 %  Q 13. 89.00 %  Q 14. 87.00 %  Q 15. 88.00 %
  Q 16. 65.50 %  Q 17. 82.50 %  Q 18. 80.00 %  Q 19. 79.00 %  Q 20. 78.00 %
  Q 21. 79.00 %  Q 22. 84.50 %  Q 23. 79.00 %  Q 24. 89.00 %  Q 25. 77.00 %
  Q 26. 84.00 %  Q 27. 70.00 %  Q 28. 90.00 %  Q 29. 90.50 %  Q 30. 68.50 %
  Q 31. 87.00 %  Q 32. 83.00 %  Q 33. 76.50 %  Q 34. 83.50 %  Q 35. 87.50 %
  Q 36. 81.00 %  Q 37. 82.50 %  Q 38. 88.00 %  Q 39. 91.00 %  Q 40. 91.50 %
  Q 41. 87.50 %  Q 42. 91.00 %  Q 43. 74.50 %  Q 44. 75.50 %  Q 45. 90.00 %
  Q 46. 82.00 %  Q 47. 77.00 %  Q 48. 84.50 %  Q 49. 83.50 %  Q 50. 71.50 %

*****************************************************************************

Please press <Enter> to continue
```

The program code calculating and showing the question analysis result

```
for i := 1 to 9 do
     begin
       {calculating the correct rate for the i th question}
       write('    Q',i:3,'.',quest_corr[i]/stud_count*100:6:2, ' %');
       if i mod 5=0 then
   writeln
     end;
   for i := 10 to questno do
    begin
       write('    Q',i:3,'.',quest_corr[i]/stud_count*100:6:2,' %');
       if i mod 5 =0 then
       writeln
       end;
```

7.6. Showing standard deviation

In form 5 mathematics syllabus, standard deviation is learnt and it is commonly seen in an analysis report. So, I decided to include it in my program. To calculate the standard deviation, we need to do several steps.

1. Find the mean
2. Get the absolute value for the difference between mean and each score
3. Find the square of the difference found in step 2.
4. Add all the numbers in step 3 and then divide the sum by n, where n is the total numbers of students in the competition.
5. Find the square root of the value in step4. This is the result of the standard deviation.

7.6.1 Find the mean

To find the mean, we can simply divide the total score of all students by the number of students:

```
 stud_score_mean :=0;                              {initialize students' score mean}
    {Find mean}
    stud_score_mean := stud_score_total/stud_count;
```

7.6.2 Get the absolute value for the difference between mean and each score

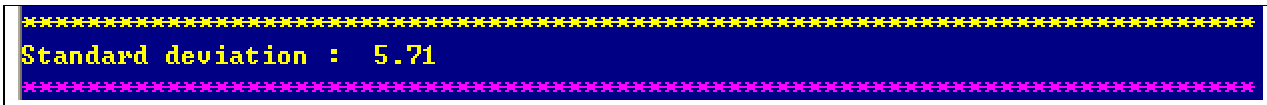
```
           for i := 1 to stud_count do           {from the 1st student to the (student count) th student}
    begin
                                        {find out difference of the i th student score and the mean}
    abs_value[i] := stud_score[i]- stud_score_mean;
```

7.6.3 Find the square of the difference found in step 2, add all the numbers in step 3 and then divide the sum by n, where n is the total numbers of students in the competition.

```
           {find out total of absolute value of the square of all students' absolute value}
    abs_value_total       := abs_value_total + sqr(abs_value[i]) ;
    end;
```

7.6.4 Find the square root of the value in step4. This is the result of the standard deviation.

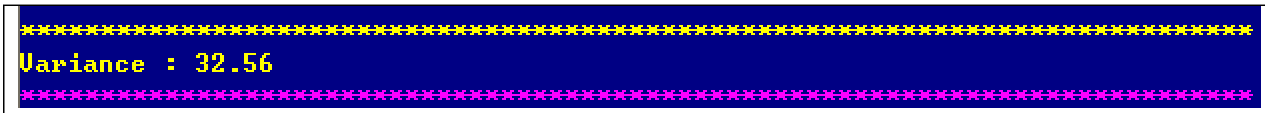
```
                                      {extract the total of absolute value over total number of students}
    sd       :=    sqrt(abs_value_total/stud_count) ;
```



```
*******************************************************************************
Standard deviation :  5.71
*******************************************************************************
```

7.7. Showing Variance

Variance is similar to standard deviation. It is the square of standard deviation.



```
*******************************************************************************
Variance : 32.56
*******************************************************************************
```

7.8.Showing quartile range

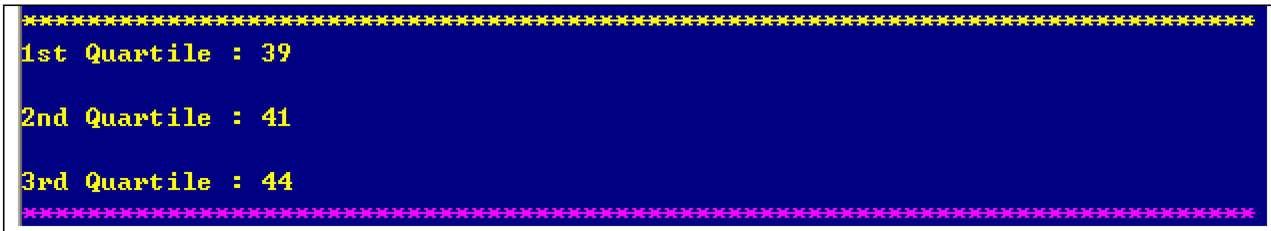
Quartile range let the user know the mark distribution situation. The 1st quartile is the mark of the participant at the place(total number students x 25%), The 2nd quartile is the mark of the participant at place(total number students x 50%), The 3rd quartile is the mark of the participant at the place(total number students x 75%)

As the rank of students can not have any decimal places, so, when we calculate the quartile range, the function trunc is used. This function helps cutting the decimal places of a number.

Eg. Trunc(1.5)=1

The quartile range is calculated and shown as follows:

```
{find out and show the 1st quartile}
    writeln('1st Quartile : ',stud_score[trunc(stud_count*0.75)]    );
    writeln;
    {find out and show the 2nd quartile}
    writeln('2nd Quartile : ',stud_score[trunc(stud_count*0.5)]     );
    writeln;
    {find out and show the 3rd quartile}
    writeln('3rd Quartile : ',stud_score[trunc(stud_count*0.25)]    );
```



```
*****************************************************************************
1st Quartile : 39

2nd Quartile : 41

3rd Quartile : 44
*****************************************************************************
```

7.9 Showing mean, mode, median

Mean, mode and median is a commonly seen analysis in a analysis report too. Mean is the average score of students, mode is the mark which has the highest number of students, median is the 2nd quartile, the (total number of students x 50%)th student..

Calculating and showing mean

```
stud_score_mean := 0;                                   {Initialize the mean}
    stud_score_mean := stud_score_total/stud_count;     {Find out the mean}
writeln('Mean:    ',stud_score_mean:5:2);               {Show mean}
```

Calculating and showing mode

Among mean mode and median, I think mode is the hardest one to be found. Mode refers to the mark which has the highest number of students. The first step we need to carry out is to find out the number of students in each mark. We use an freq[ ] to store them.

Finding out the number of students in each mark

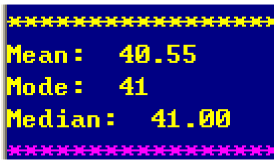
```
    for i := 0 to questno do                        {initialize all the frequency}
        freq[i] := 0;

    for i := 1 to stud_count do                     {calculating the frequency}
         freq[stud_score[i]]:= freq[stud_score[i]]+1;
```

Finding out the highest frequency,mode

```
mode := 0 ;                                         {initialize mode}
    for j := 0 to questno do
        if freq[j] > freq[mode] then                {find out the highest frequency,mode}
              mode := j;

    textcolor(14);
    write('Mode:    ');                             {show mode}
```

As the number of students of a mark may be duplicate, there may be one or more modes, so if there are one or more frequencies which are same and the highest, we show all of them

```
    for j := 0 to questno do

         if freq[j] = freq[mode] then
         write(j,'       ');
```



```
*****************
Mean:   40.55
Mode:   41
Median:   41.00
*****************
```

8. Showing graphs

There are three graphs in my program: question correct graph, grade distribution graph and mark distribution graph.

Question correct graph

This is a graph showing the number of students get the answer correct in a question. As there may be many people got a question correct, or even all the people got a correct, so if we show one ‘*’ for one people, the program screen would not have enough places. We need to reduce the number of ‘*’ shown by reducing the ratio of each bar. To achieve this, I use an array to store the result adjusted:

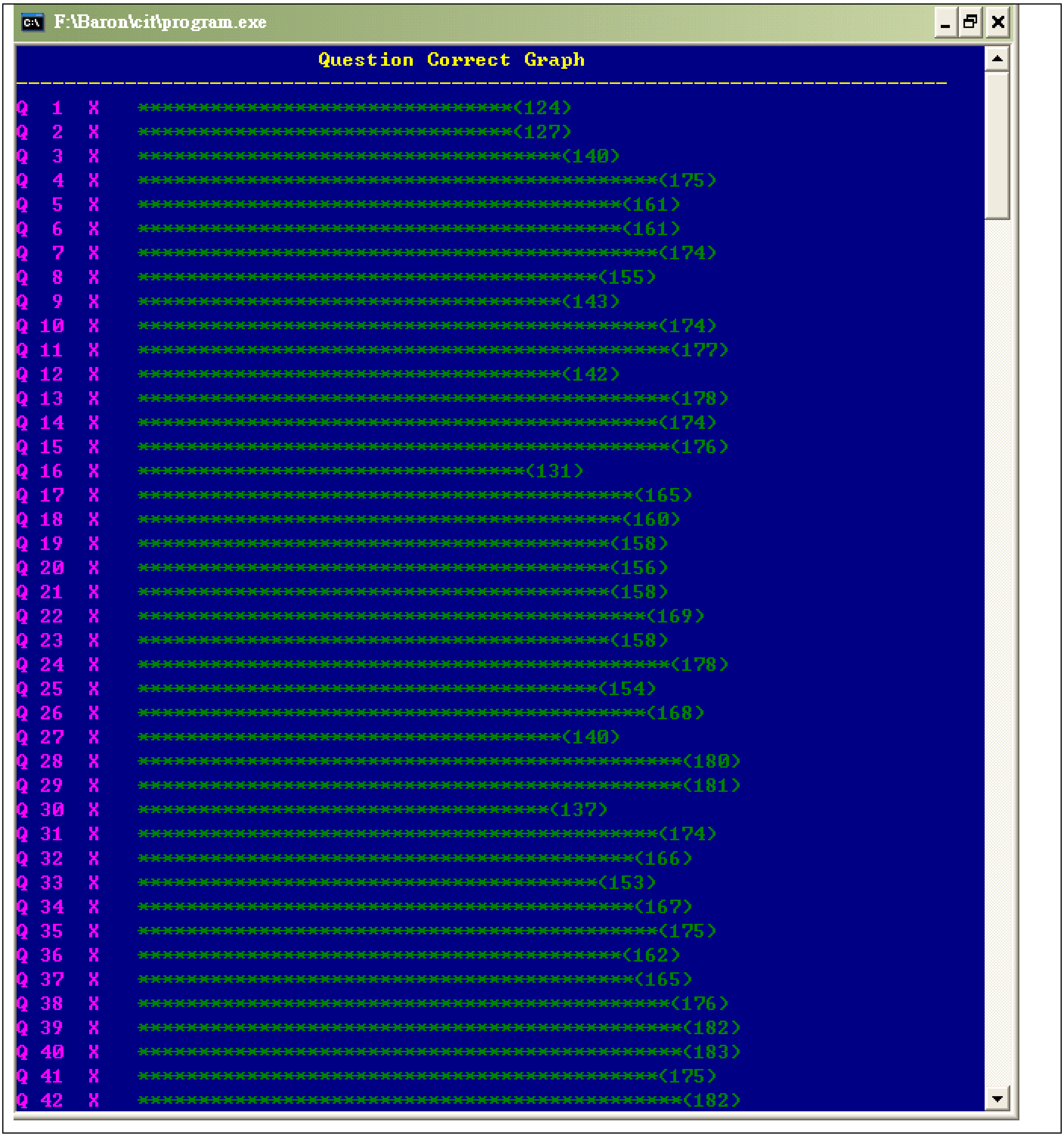
```
quest_corrbar : array[1..questno] of integer;    {array storing number of '*'s of the ith bar}
```

And the number of ‘*’ in each bar is calculated by this:

```
for i := 1 to questno do                              {from the 1st question to the (questno)th question}
        begin                                       {calculate the corresponding numbers of '*'s in its bar}
            quest_corrbar[i] := trunc((quest_corr[i]/200)*50);
        end;
```

To show the bars, we can use a for do loop:

```
for i := 1 to questno do
for j := 1 to quest_corrbar[i] do        {showing number of '*'s of the question}
                        begin
                             textcolor(18);
                             write('*');
                        end;
            writeln ('(', quest_corr[i], ')') ;          {showing number of students get the question correct}

            end;
```



```
                         Question Correct Graph
-----------------------------------------------------------------------------
Q  1  X   *******************************(124)
Q  2  X   *******************************(127)
Q  3  X   ***********************************(140)
Q  4  X   *******************************************(175)
Q  5  X   ****************************************(161)
Q  6  X   ****************************************(161)
Q  7  X   *******************************************(174)
Q  8  X   **************************************(155)
Q  9  X   ***********************************(143)
Q 10  X   *******************************************(174)
Q 11  X   ********************************************(177)
Q 12  X   ***********************************(142)
Q 13  X   ********************************************(178)
Q 14  X   *******************************************(174)
Q 15  X   ********************************************(176)
Q 16  X   ********************************(131)
Q 17  X   *****************************************(165)
Q 18  X   ****************************************(160)
Q 19  X   ***************************************(158)
Q 20  X   ***************************************(156)
Q 21  X   ***************************************(158)
Q 22  X   ******************************************(169)
Q 23  X   ***************************************(158)
Q 24  X   ********************************************(178)
Q 25  X   **************************************(154)
Q 26  X   ******************************************(168)
Q 27  X   ***********************************(140)
Q 28  X   *********************************************(180)
Q 29  X   *********************************************(181)
Q 30  X   **********************************(137)
Q 31  X   *******************************************(174)
Q 32  X   *****************************************(166)
Q 33  X   **************************************(153)
Q 34  X   *****************************************(167)
Q 35  X   *******************************************(175)
Q 36  X   ****************************************(162)
Q 37  X   *****************************************(165)
Q 38  X   ********************************************(176)
Q 39  X   *********************************************(182)
Q 40  X   *********************************************(183)
Q 41  X   *******************************************(175)
Q 42  X   *********************************************(182)
```

Grade distribution Graph

This is a graph showing the number of students get a grade(from A to F).

There is an array for counting numbers of students in a grade:

```
Count : array ['A'..'F'] of integer;
```

As there may be many people got a grade, or even all the people got a grade, so if we show one '*' for one people, the program screen would not have enough places. We need to reduce the number of '*' shown by reducing the ratio of each bar. To achieve this, I use an array to store the result adjusted:

```
Countbar : array['A'..'F'] of integer;          {for showing bars}
```

The determination of grading is according to the marks that students get. The following table shows the distribution of grading against marks.

Grade	Mark
F	0-19
E	20-25
D	26-30
C	31-40
B	41-46
A	47-50

Program code of telling the distribution of grading against mark to the computer, case function is used here.

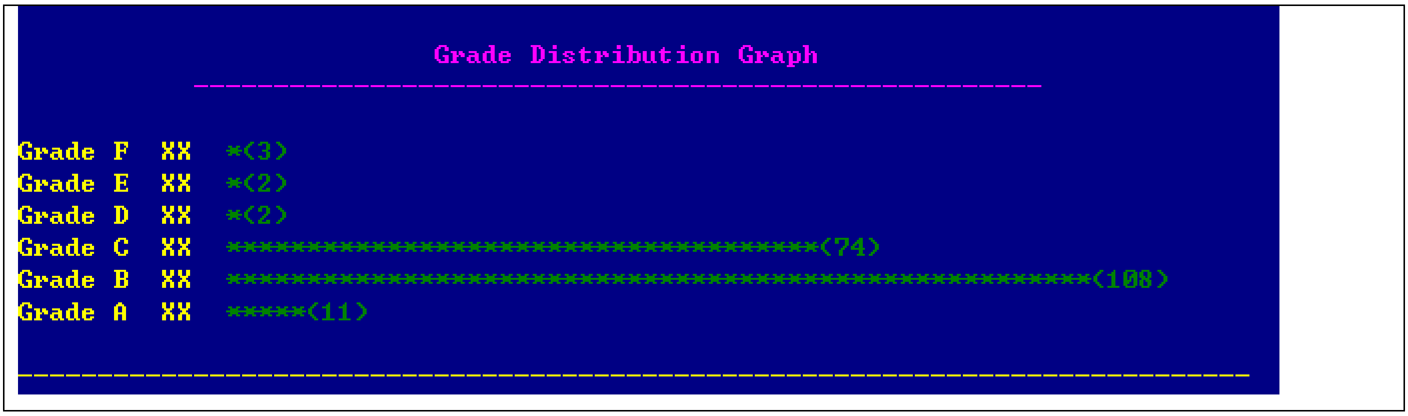
```
for Ch := 'A' to 'F' do                {from grade 'A' to grade 'F'}
      Count[Ch] := 0;                       {Initialize the numbers of students get the grade}
  for i := 1 to stud_count do              {from the 1st student to the (total number of students)th student}
       case stud_score[i] of                          {find out the total number of students get that grade}
         0..19 : Count['F'] := Count['F'] +1;      { 0 to 19 mark get grade 'F'}
        20..25 : Count['E'] := Count['E'] +1;      {20 to 25 mark get grade 'E'}
        26..30 : Count['D'] := Count['D'] +1;      {26 to 30 mark get grade 'D'}
        31..40 : Count['C'] := Count['C'] +1;      {31 to 40 mark get grade 'C'}
        41..46 : Count['B'] := Count['B'] +1;      {41 to 46 mark get grade 'B'}
        47..50 : Count['A'] := Count['A'] +1;      {47 to 50 mark get grade 'A'}
       end ;
```

The number of ‘*’s in each bar is calculated by this:

```
   {calculate the corresponding numbers of '*'s in its bar}
       Countbar[Ch] :=   trunc((Count[Ch]/200*100))   ;
```

Showing the bars:

```
for Ch := 'F' downto 'A' do
       begin
for i := 1 to Countbar[Ch] do           {showing the bar}
           write('*');
           writeln ('(', Count[Ch], ')')         {showing the total number of students get that grade}
           end;
```



```
                          Grade Distribution Graph
           ------------------------------------------------------

Grade F  XX   *(3)
Grade E  XX   *(2)
Grade D  XX   *(2)
Grade C  XX   **************************************(74)
Grade B  XX   *******************************************************(108)
Grade A  XX   *****(11)


-------------------------------------------------------------------------------
```

Mark distribution graph

This is a graph showing the number of students get a mark, it can be to show the trend of the competition, if there are many students get the mark from 41 to 50, that's mean the participants behave well in the competition. Vice versa, the participants do very bar.

There is an array storing number of students get a mark:

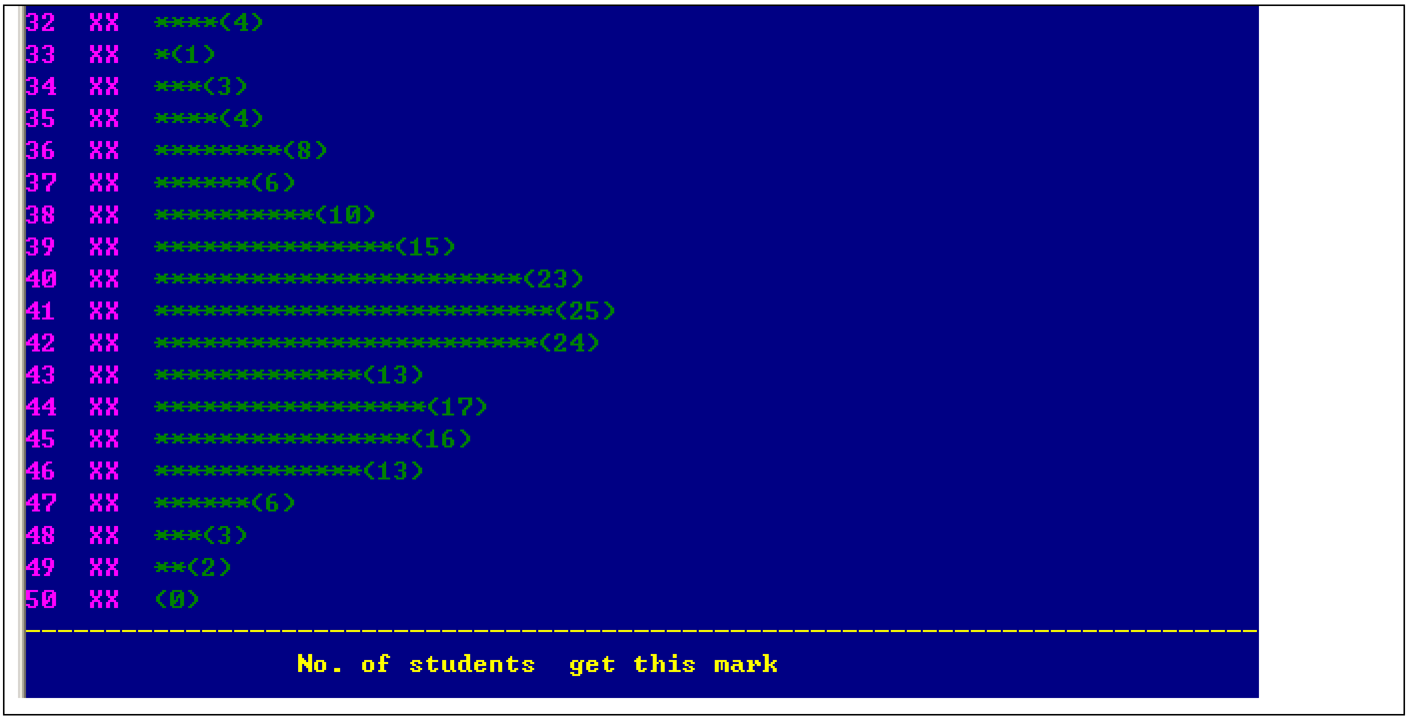
```
freq : array[0..questno] of integer;
```

Counting number of students in a mark

```
for i := 0 to questno do
    freq[i] := 0;                          {initialize frequencies}
                                           {from the 1st student to the (total number of students) th student}
for i := 1 to stud_count do
    freq[stud_score[i]]:= freq[stud_score[i]]+1;    {calculating the corresponding frequency}
```

Showing the bars and the result

```
for i := 0 to questno do                   {from the 0 mark to 50 mark }
    begin
        for j := 1 to freq[i] do           {showing number of '*' of the question bar}
        write('*');
        writeln ('(', freq[i], ')')        {showing the frequency of the question}
    end;
```



```
32  XX  ****(4)
33  XX  *(1)
34  XX  ***(3)
35  XX  ****(4)
36  XX  ********(8)
37  XX  ******(6)
38  XX  **********(10)
39  XX  ***************(15)
40  XX  ***********************(23)
41  XX  *************************(25)
42  XX  ************************(24)
43  XX  *************(13)
44  XX  *****************(17)
45  XX  ****************(16)
46  XX  *************(13)
47  XX  ******(6)
48  XX  ***(3)
49  XX  **(2)
50  XX  (0)
------------------------------------------------------------------------------
                 No. of students  get this mark
```

9. Searching

After checking participants' answer and sorting the result, if the user wants to find a participant's rank and score or a school's rank and score, he can use this function in my program to achieve.

Searching process is to compare if the searching target is equal to the data in the program. If after comparing all the data with the searching target, the data is not found, then tell the user that the searching target is not found, else tell the user the searching target's detail.

Right trimming function in the program

There are spaces behind each student name and each school name, as they are different in length, I need to add space behind all of them to the same length for reading data, but it is a problem in searching. If the user hadn't input the spaces after the student names and school names, the result cannot be found even the student or school name is valid. So, to address this problem, I use this right trimming function to cancel all the spaces behind the student and the school names.

```
Advanced Contemporary College                    Umbreon
```

```
Function RTrim (Var S : String) : String ;    {function for deleting space in a student name string}
        {RTrim – remove trailing blanks }
        Var
            i : Byte ;
        begin { RTrim }
            for i := Length(S) downto 1 do
                if S[i] > ' ' then begin
                    S        := Copy(S,1,i) ;
                    RTrim := S ;
                    Exit
                end ;
            { if we reach this point then S contains only BLANKS
                so we return a null string}
            S       := '' ;
            RTrim := S
        end ; { RTrim }
```

Searching Process

1. Asking the user to input the target to be searched

```
write('Enter the student name to searched:      ');
readln(Target);
```

2. Comparing target with data

```
                                        {from the 1st student to the (total number of students) th student}
     for i := 1 to stud_count do
                                        {compare the student name list with the name the uesr inputted}
          if RTrim(stud_name[i])   = Target then
            begin                                   {if they are equal}
              found_index:=i;
                              {the position where we found the student name is equal to the i th student}
              found := true;                   {the student is found}
            end;
```

3. Show details of the target

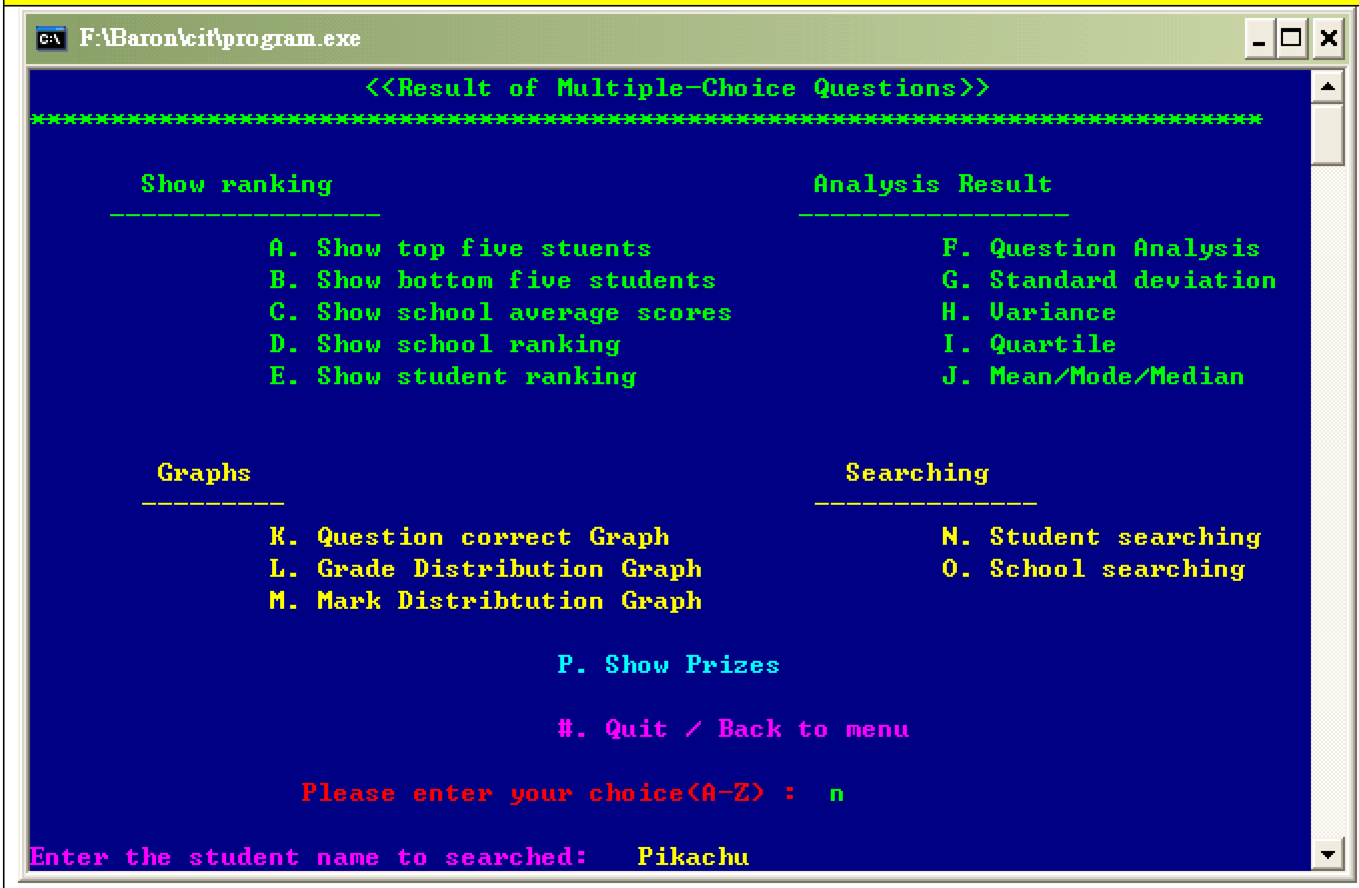
if the target is found

```
writeln('The data is in the list!') ;
writeln('Here is his/her rank:');
writeln('Rank','Student''s school name':25,'Student name': 35,'Score':12);
writeln('————————————————————————————————————');

writeln(found_index,stud_sch[found_index]:50,stud_name[found_index],stud_score[found_index]:15);
```

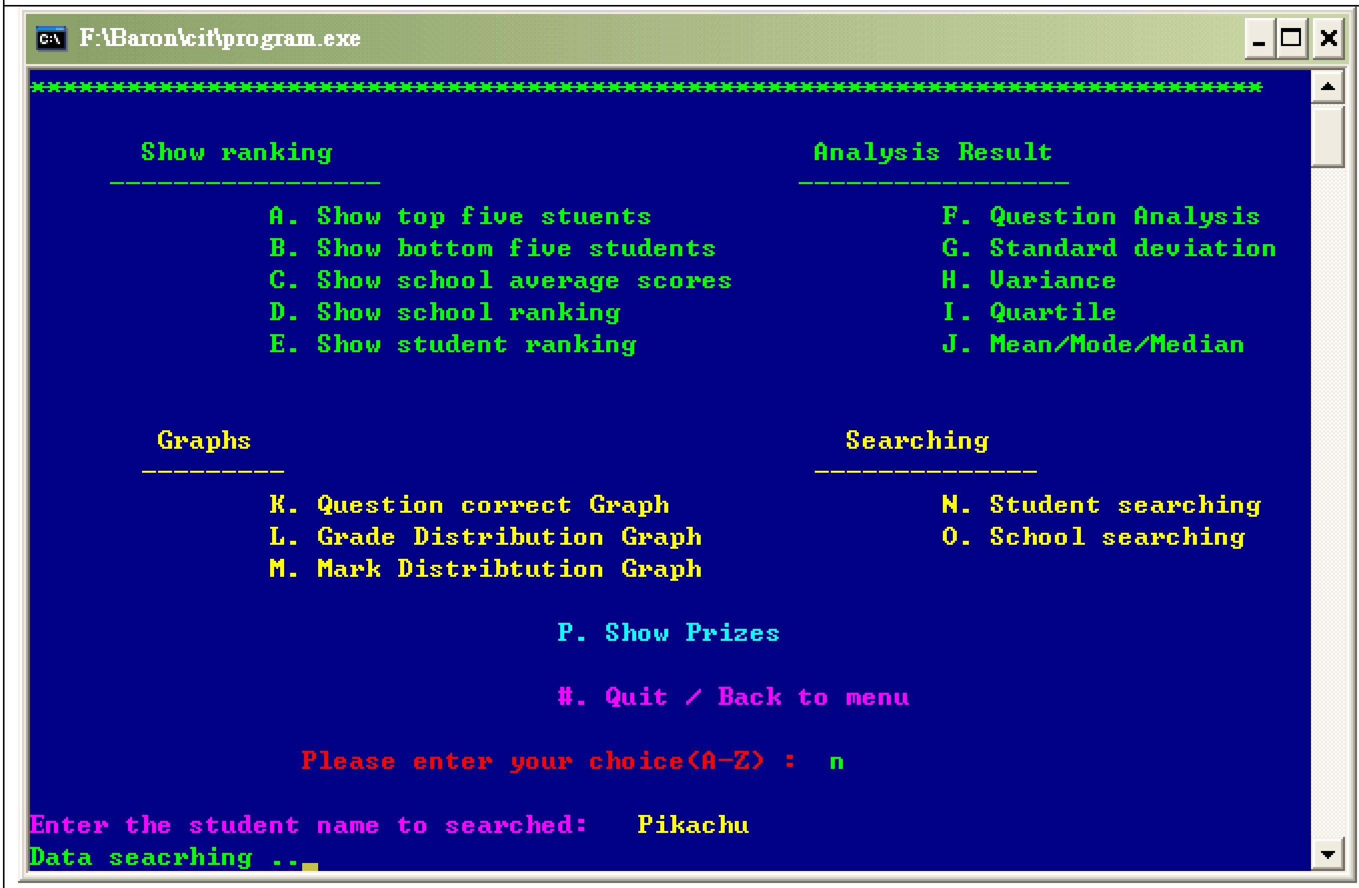
if the target is not found

```
writeln('Sorry. The data is not in the list.');
```

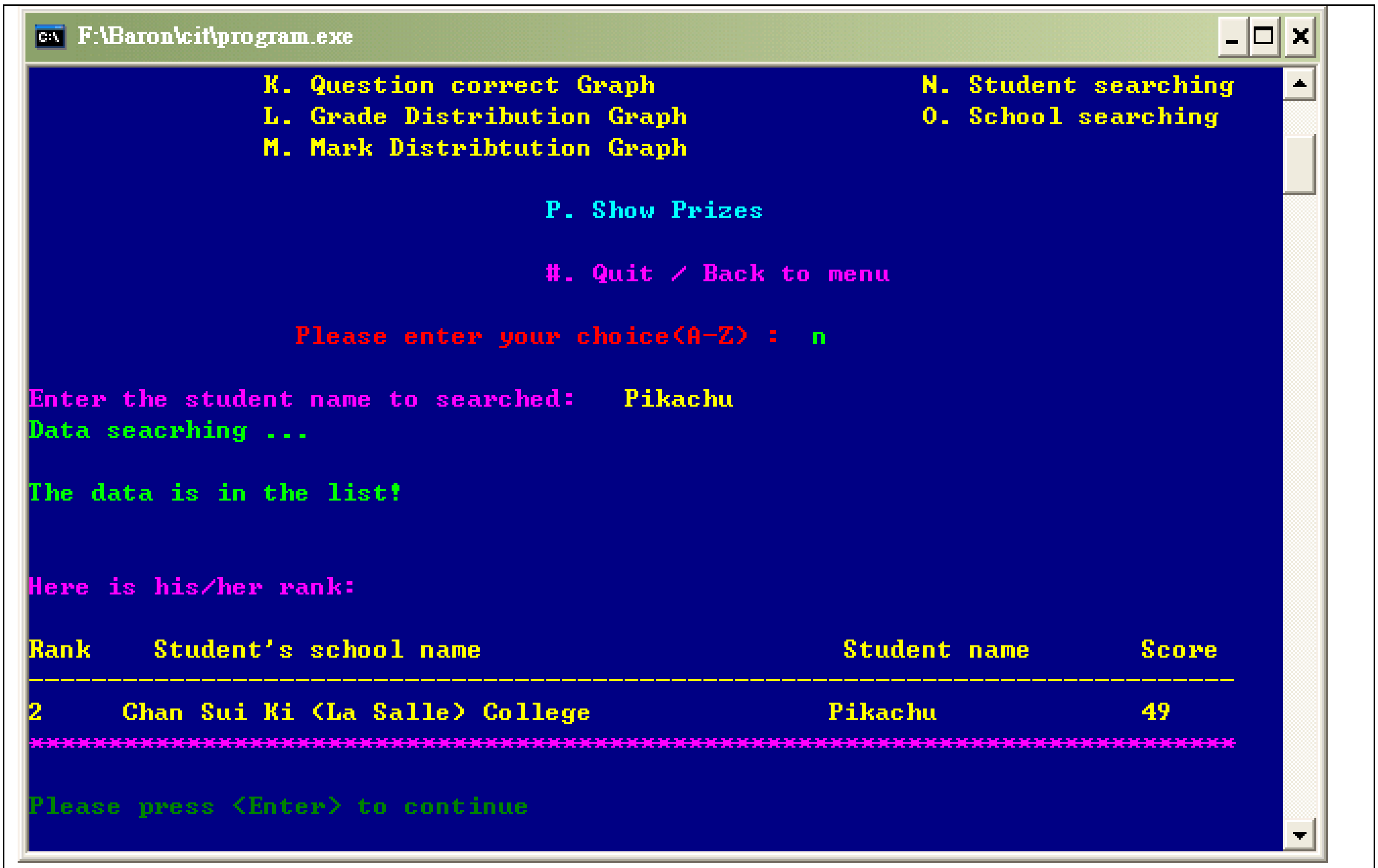
Student searching



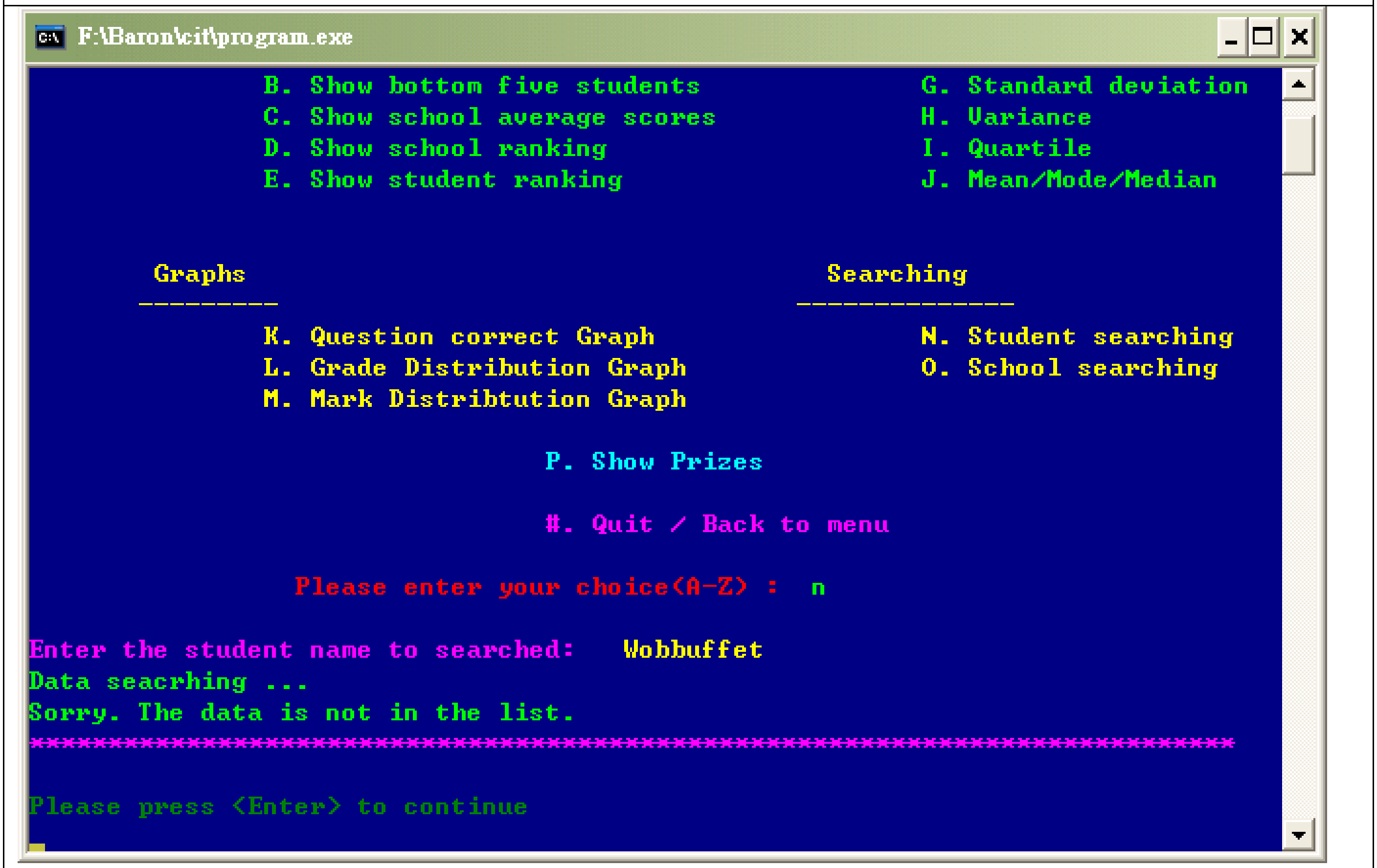
```
                    <<Result of Multiple-Choice Questions>>
******************************************************************************

     Show ranking                              Analysis Result
    -----------------                         -----------------
              A. Show top five stuents                  F. Question Analysis
              B. Show bottom five students              G. Standard deviation
              C. Show school average scores             H. Variance
              D. Show school ranking                    I. Quartile
              E. Show student ranking                   J. Mean/Mode/Median


      Graphs                                    Searching
     ---------                                ---------------
              K. Question correct Graph                 N. Student searching
              L. Grade Distribution Graph               O. School searching
              M. Mark Distribtution Graph

                             P. Show Prizes

                             #. Quit / Back to menu

                  Please enter your choice(A-Z) :  n

Enter the student name to searched:   Pikachu
```



```
******************************************************************************

     Show ranking                              Analysis Result
    -----------------                         -----------------
              A. Show top five stuents                  F. Question Analysis
              B. Show bottom five students              G. Standard deviation
              C. Show school average scores             H. Variance
              D. Show school ranking                    I. Quartile
              E. Show student ranking                   J. Mean/Mode/Median


      Graphs                                    Searching
     ---------                                ---------------
              K. Question correct Graph                 N. Student searching
              L. Grade Distribution Graph               O. School searching
              M. Mark Distribtution Graph

                             P. Show Prizes

                             #. Quit / Back to menu

                  Please enter your choice(A-Z) :  n

Enter the student name to searched:   Pikachu
Data seacrhing ...
```

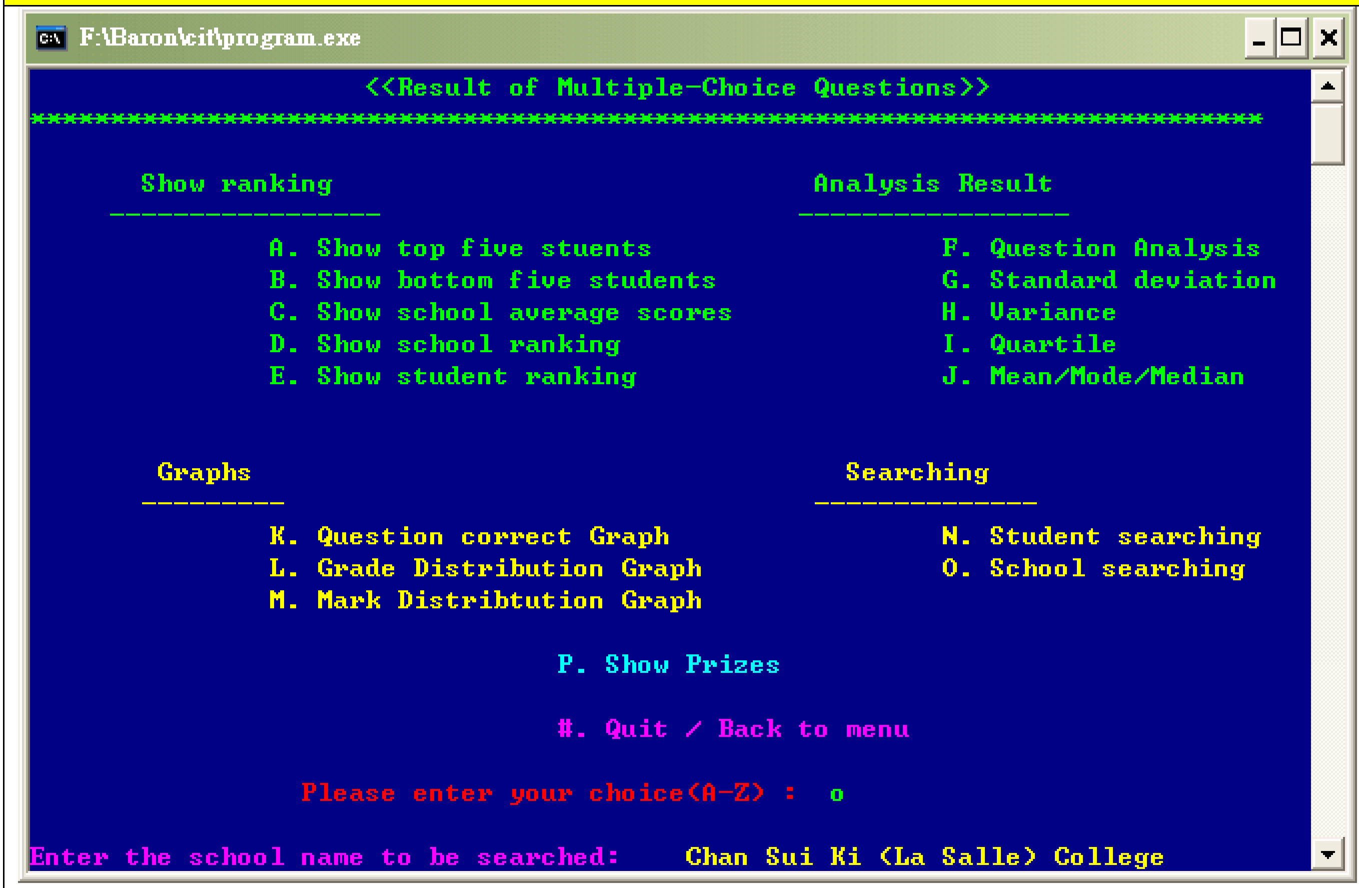


```
                 K. Question correct Graph                  N. Student searching
                 L. Grade Distribtution Graph               O. School searching
                 M. Mark Distribtution Graph

                                    P. Show Prizes

                                    #. Quit / Back to menu

                   Please enter your choice(A-Z) :  n

Enter the student name to searched:   Pikachu
Data seacrhing ...

The data is in the list!


Here is his/her rank:

Rank     Student's school name                              Student name        Score
-------------------------------------------------------------------------------------
2      Chan Sui Ki (La Salle) College                      Pikachu             49
*************************************************************************************

Please press <Enter> to continue
```

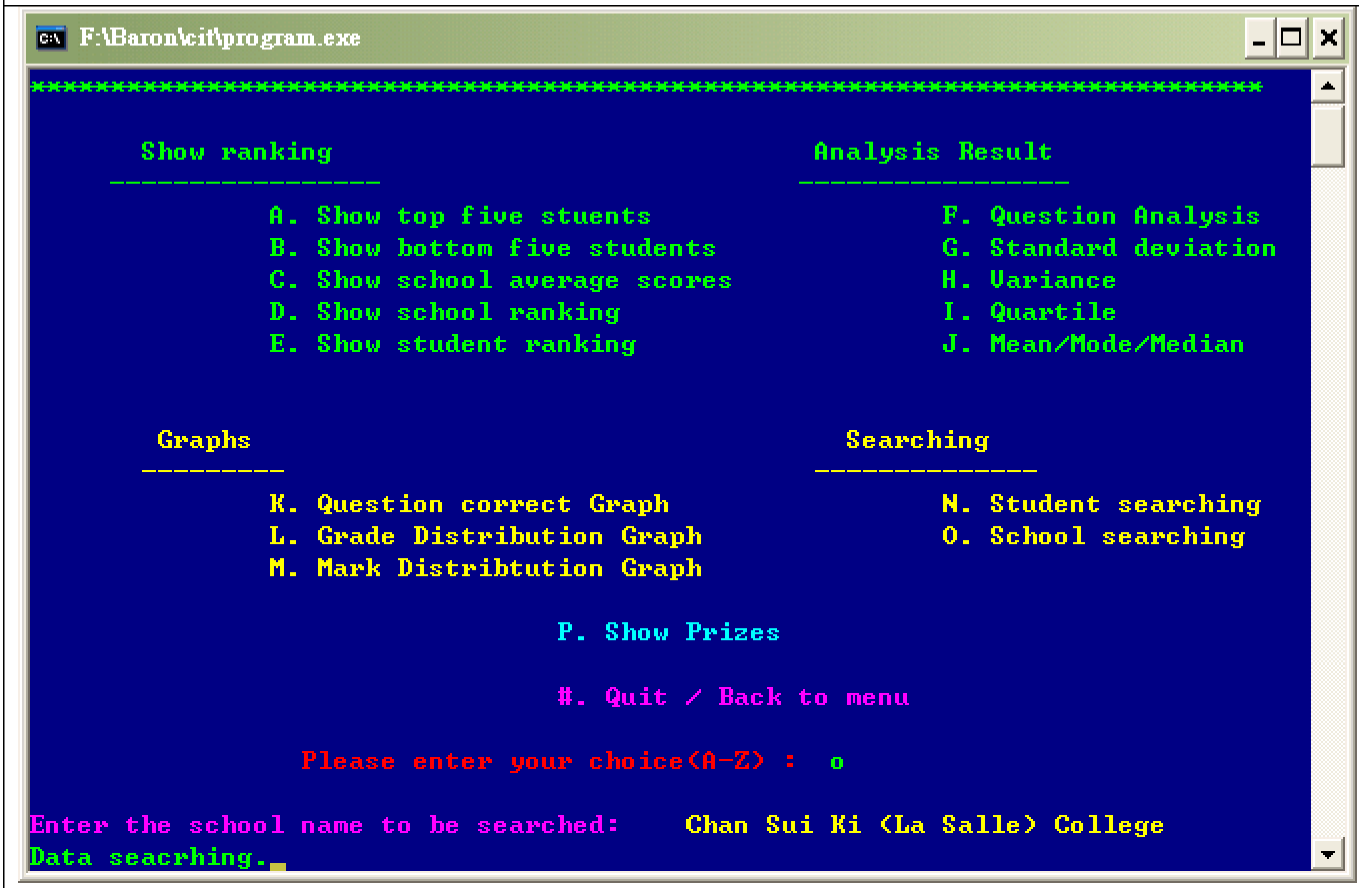


```
                 B. Show bottom five students               G. Standard deviation
                 C. Show school average scores              H. Variance
                 D. Show school ranking                     I. Quartile
                 E. Show student ranking                    J. Mean/Mode/Median


        Graphs                                     Searching
       ----------                                 ---------------
                 K. Question correct Graph                  N. Student searching
                 L. Grade Distribtution Graph               O. School searching
                 M. Mark Distribtution Graph

                                    P. Show Prizes

                                    #. Quit / Back to menu

                   Please enter your choice(A-Z) :  n

Enter the student name to searched:   Wobbuffet
Data seacrhing ...
Sorry. The data is not in the list.
*************************************************************************************

Please press <Enter> to continue
```

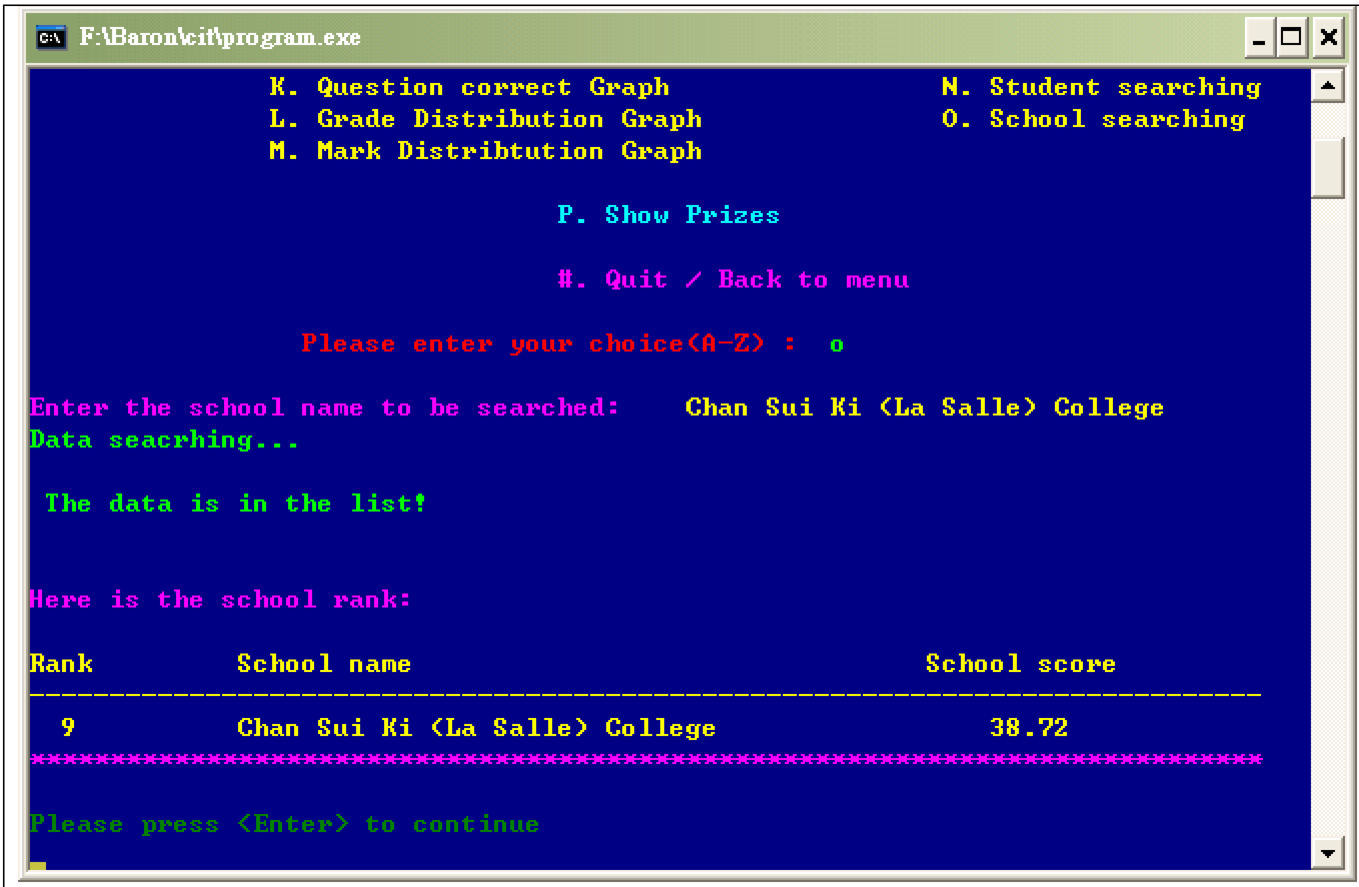
School searching



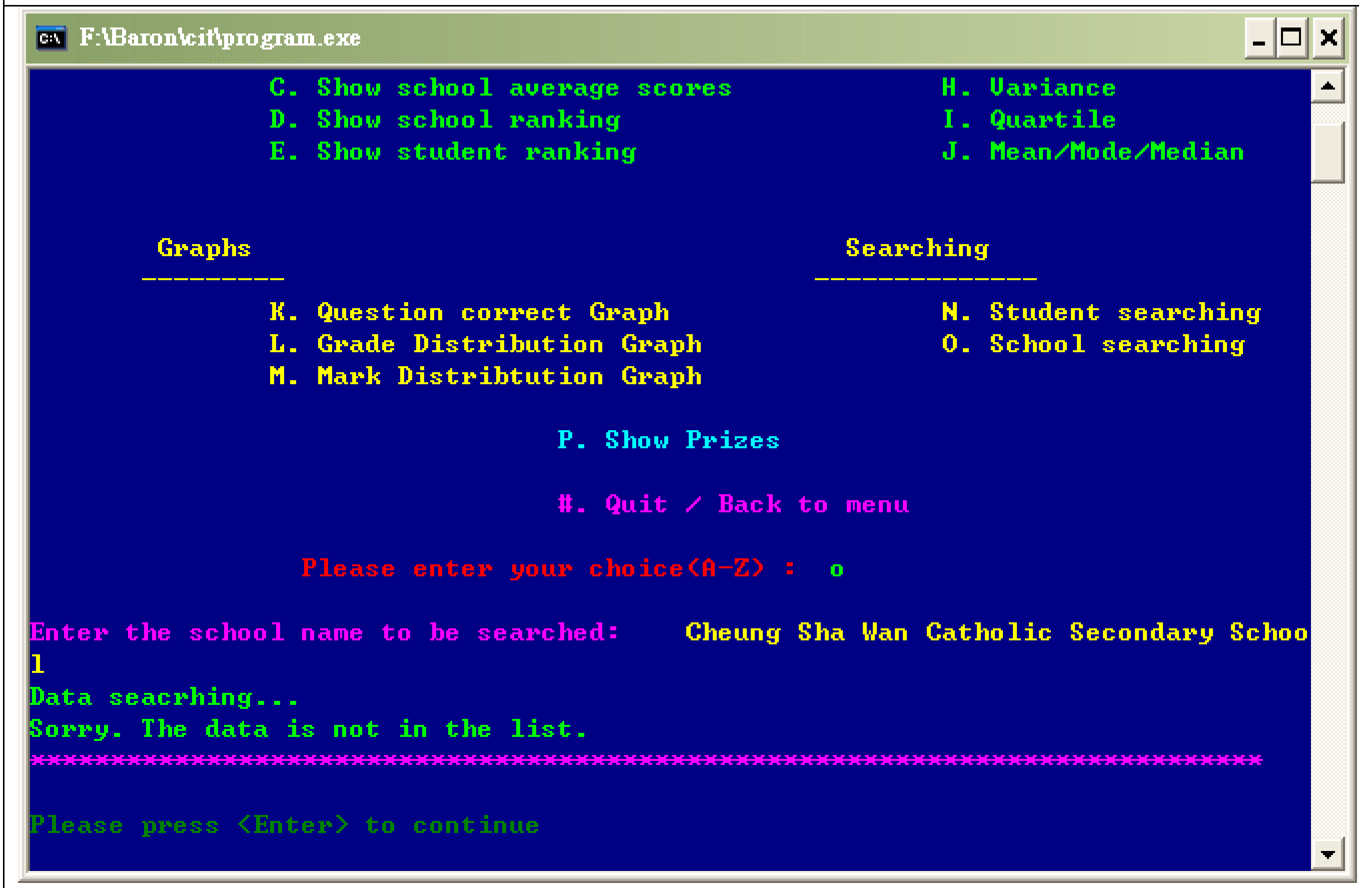
```
                    <<Result of Multiple-Choice Questions>>
*****************************************************************************

      Show ranking                              Analysis Result
     -----------------                         -----------------
               A. Show top five stuents                  F. Question Analysis
               B. Show bottom five students              G. Standard deviation
               C. Show school average scores             H. Variance
               D. Show school ranking                    I. Quartile
               E. Show student ranking                   J. Mean/Mode/Median


       Graphs                                     Searching
      ---------                                ---------------
               K. Question correct Graph                 N. Student searching
               L. Grade Distribution Graph               O. School searching
               M. Mark Distribtution Graph

                                 P. Show Prizes

                                 #. Quit / Back to menu

                 Please enter your choice(A-Z) :  o

Enter the school name to be searched:    Chan Sui Ki (La Salle) College
```



```
*****************************************************************************

      Show ranking                              Analysis Result
     -----------------                         -----------------
               A. Show top five stuents                  F. Question Analysis
               B. Show bottom five students              G. Standard deviation
               C. Show school average scores             H. Variance
               D. Show school ranking                    I. Quartile
               E. Show student ranking                   J. Mean/Mode/Median


       Graphs                                     Searching
      ---------                                ---------------
               K. Question correct Graph                 N. Student searching
               L. Grade Distribution Graph               O. School searching
               M. Mark Distribtution Graph

                                 P. Show Prizes

                                 #. Quit / Back to menu

                 Please enter your choice(A-Z) :  o

Enter the school name to be searched:    Chan Sui Ki (La Salle) College
Data seacrhing._
```



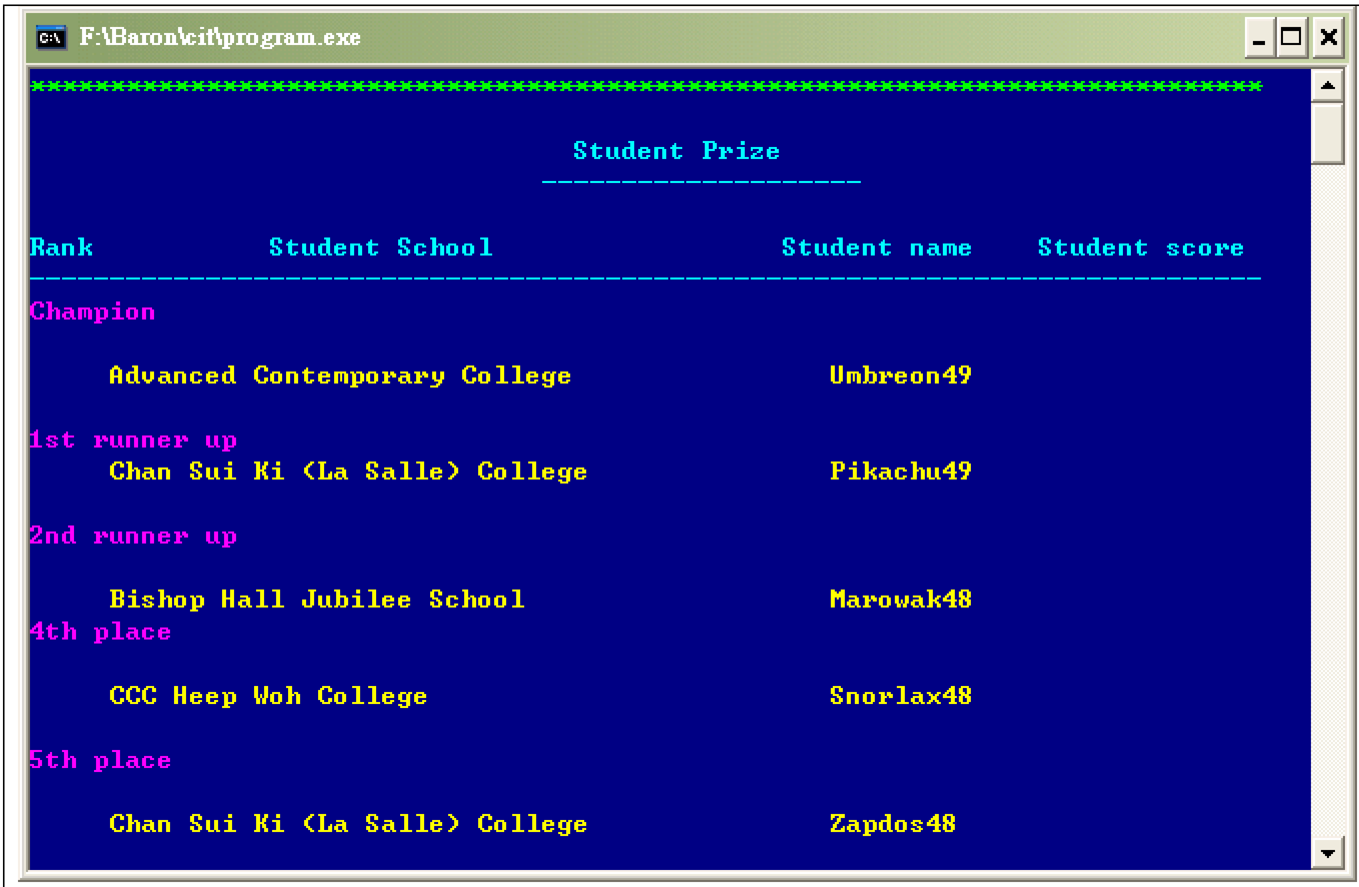
```
               K. Question correct Graph                  N. Student searching
               L. Grade Distribution Graph                O. School searching
               M. Mark Distribtution Graph

                                 P. Show Prizes

                                 #. Quit / Back to menu

                 Please enter your choice(A-Z) :  o

Enter the school name to be searched:    Chan Sui Ki (La Salle) College
Data seacrhing...

 The data is in the list!


Here is the school rank:

Rank         School name                                 School score
------------------------------------------------------------------------------
  9          Chan Sui Ki (La Salle) College                  38.72
******************************************************************************

Please press <Enter> to continue
```



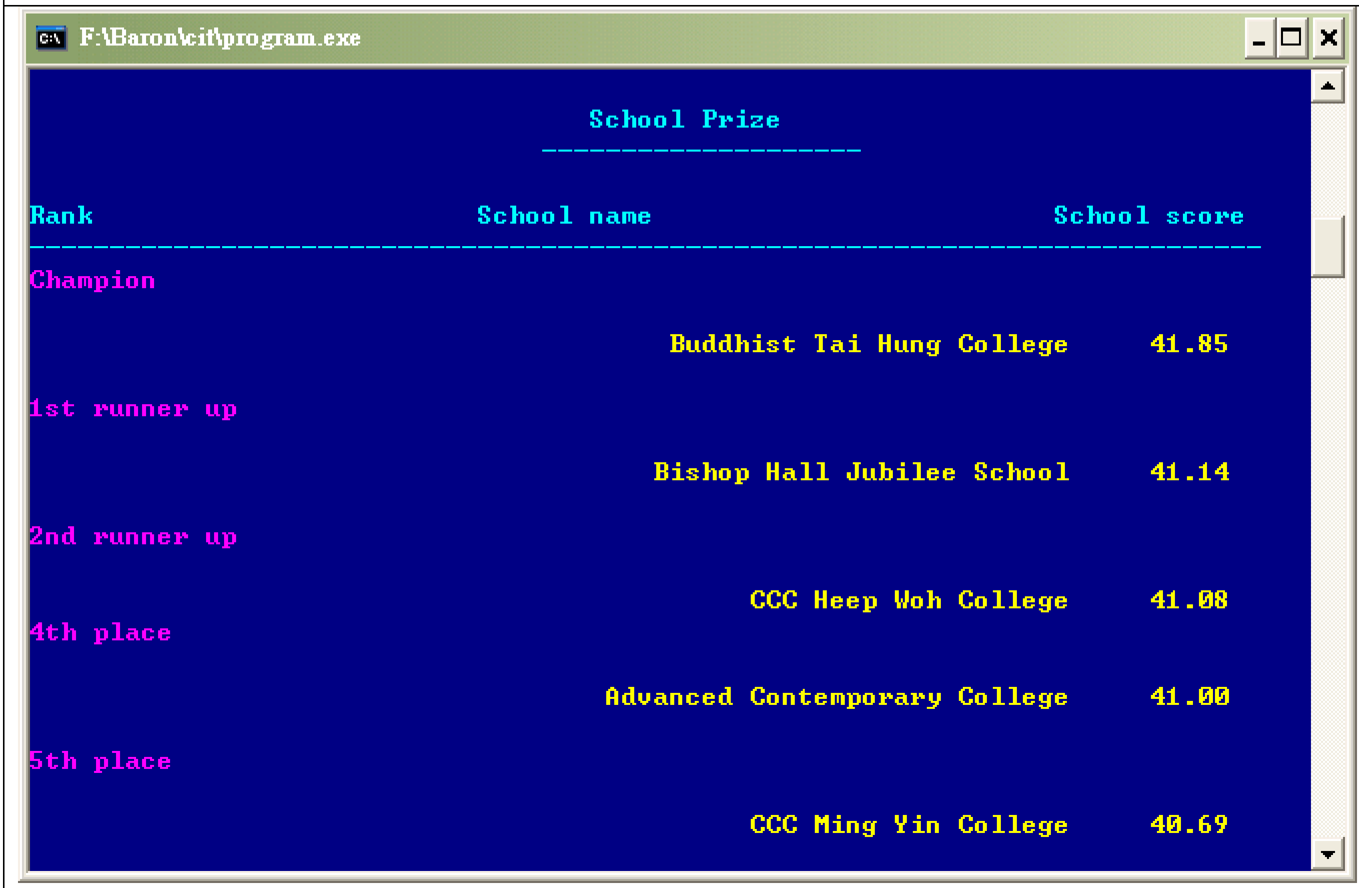
```
               C. Show school average scores              H. Variance
               D. Show school ranking                     I. Quartile
               E. Show student ranking                    J. Mean/Mode/Median


        Graphs                                     Searching
       ---------                                  --------------
               K. Question correct Graph                  N. Student searching
               L. Grade Distribution Graph                O. School searching
               M. Mark Distribtution Graph

                                 P. Show Prizes

                                 #. Quit / Back to menu

                 Please enter your choice(A-Z) :  o

Enter the school name to be searched:    Cheung Sha Wan Catholic Secondary Schoo
l
Data seacrhing...
Sorry. The data is not in the list.
******************************************************************************

Please press <Enter> to continue
```

10.Show prizes

There are individual awards and school awards in this program. Individual award have 10 places, school awards has five places



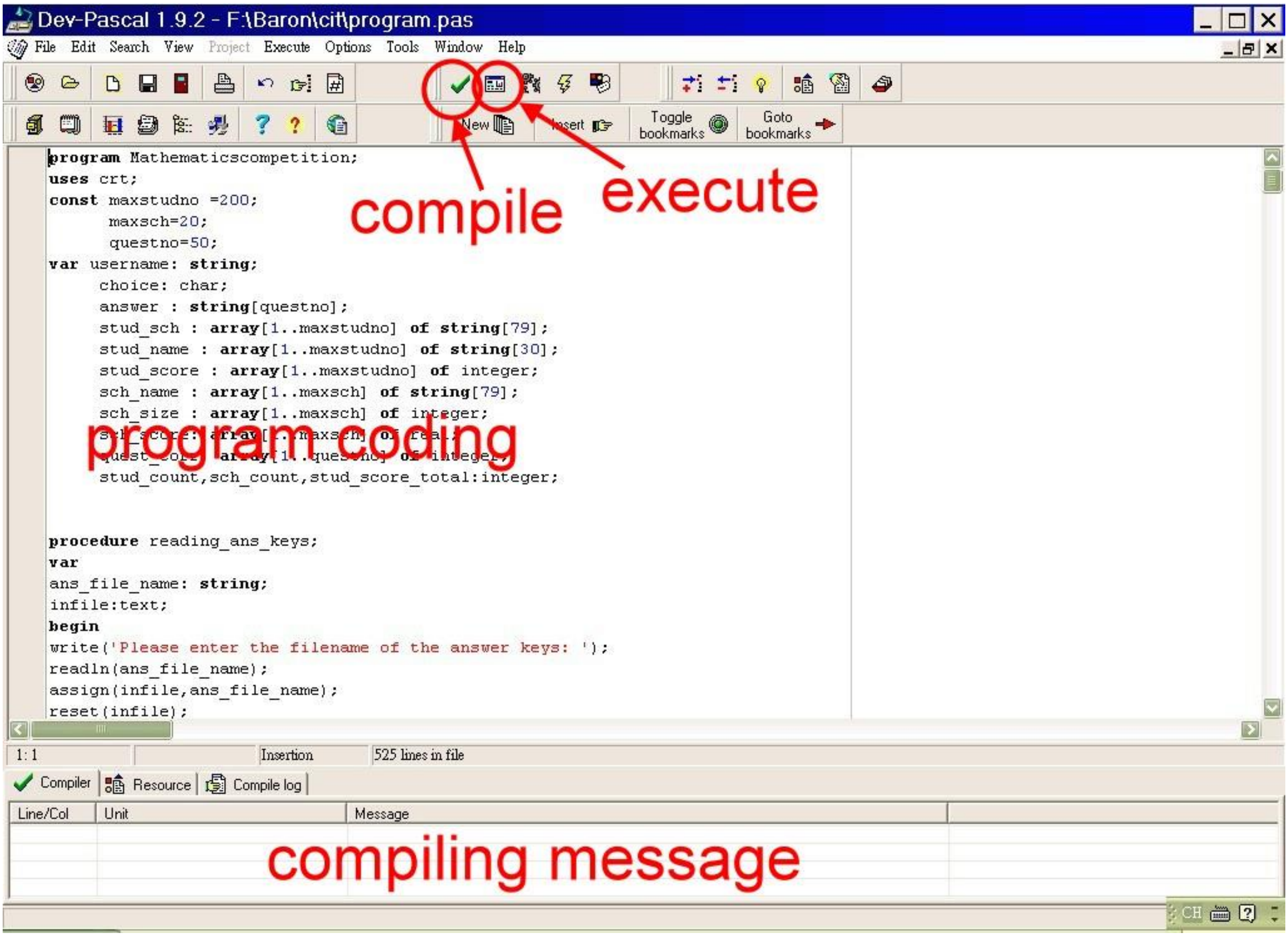
```
******************************************************************************

                                       Student Prize
                                    ---------------------

Rank               Student School                          Student name     Student score
------------------------------------------------------------------------------
Champion

     Advanced Contemporary College                            Umbreon49

1st runner up
     Chan Sui Ki (La Salle) College                           Pikachu49

2nd runner up

     Bishop Hall Jubilee School                               Marowak48
4th place

     CCC Heep Woh College                                     Snorlax48

5th place

     Chan Sui Ki (La Salle) College                           Zapdos48
```



```
                                        School Prize
                                    ---------------------

Rank                           School name                          School score
------------------------------------------------------------------------------
Champion

                                        Buddhist Tai Hung College      41.85

1st runner up

                                       Bishop Hall Jubilee School      41.14

2nd runner up

                                             CCC Heep Woh College      41.08
4th place

                                    Advanced Contemporary College      41.00

5th place

                                             CCC Ming Yin College      40.69
```

4.4 Program Coding

In this program, I choose Dev-Pascal for Pascal coding. It is because Dev-Pascal. Although it need to type readln at the end of the program for viewing result, but it seems not a big problem to me. Dev-Pascal is user-friendly, its interface looks like Microsoft word and it has many hot keys(compile= Ctrl+F9, execute =F9) which help me to do the program faster. it provides clear error message and it is also suitable for program learners.



```
program Mathematicscompetition;
uses crt;
const maxstudno =200;
      maxsch=20;
      questno=50;
var username: string;
     choice: char;
     answer : string[questno];
     stud_sch : array[1..maxstudno] of string[79];
     stud_name : array[1..maxstudno] of string[30];
     stud_score : array[1..maxstudno] of integer;
     sch_name : array[1..maxsch] of string[79];
     sch_size : array[1..maxsch] of integer;
     sch_score: array[1..maxsch] of real;
     quest_col : array[1..questno] of integer;
     stud_count,sch_count,stud_score_total:integer;


procedure reading_ans_keys;
var
ans_file_name: string;
infile:text;
begin
write('Please enter the filename of the answer keys: ');
readln(ans_file_name);
assign(infile,ans_file_name);
reset(infile);
```

Filename of the source program: program.pas

Filename of the object program: program.exe

Complete source code: The complete source code is pasted at the appendix, please refer to Appendix

4.5 Program Execution

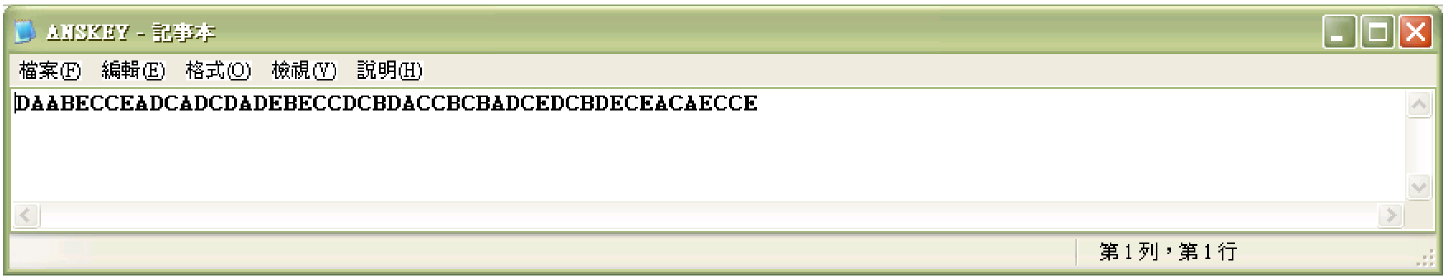
1.Steps in execution of program

To execute the program, user can just open the exe file,'PROGRAM.EXE' by double clicking it or pressing enter. Then, user can follow the instructions of the program. (inputting the answer key file name, inputting the participants' information and answers file name)

2.Data files should be prepared before execution

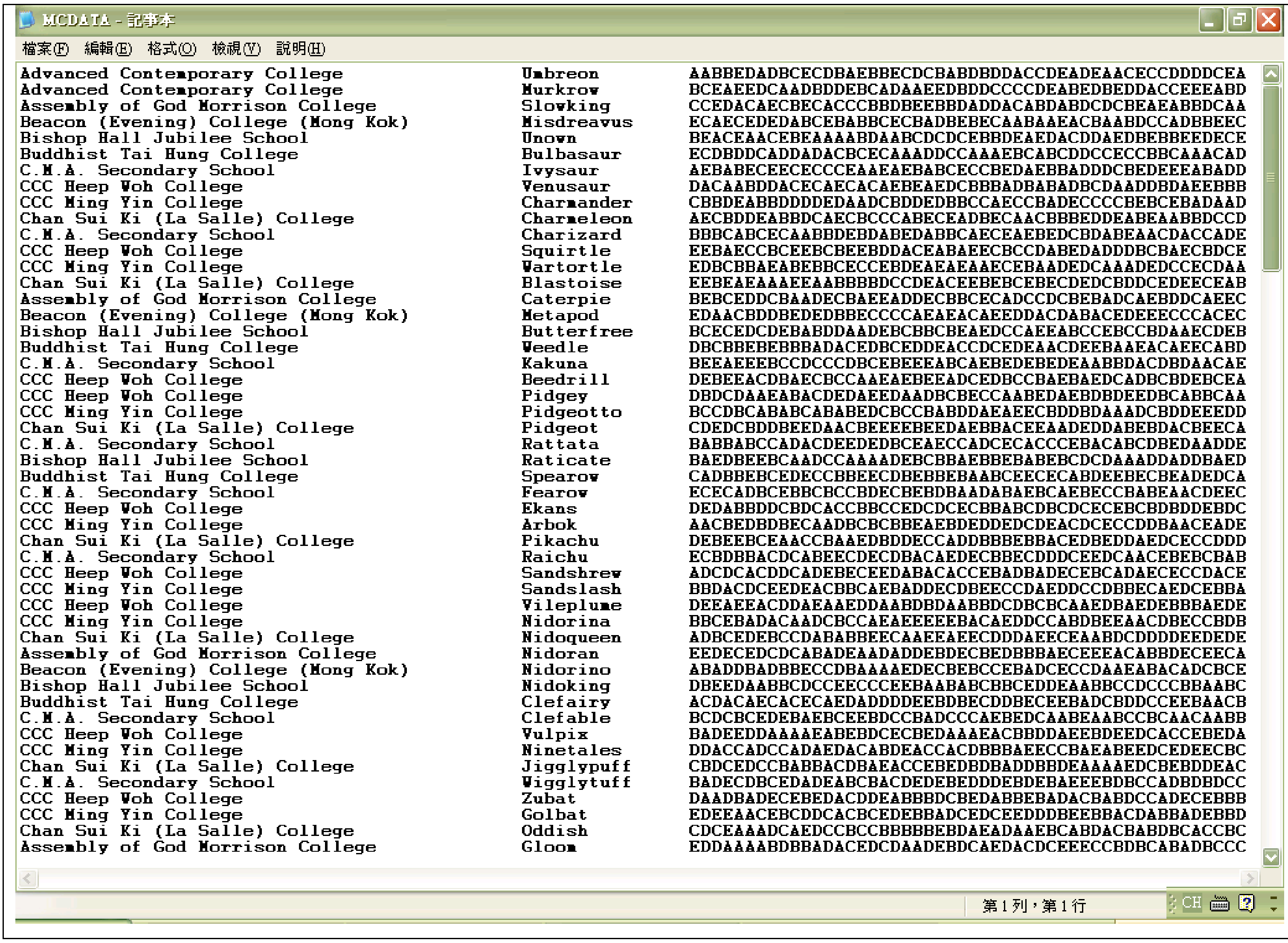
There are two files which should be prepared before the execution of program.

-the text file storing the answer keys (ANSKEY.TXT/ANSKEY2.TXT/ANSKEY3.TXT)



```
DAABECCEADCADCDADEBECCDCBDACCBCBADCEDCBDECEACAECCE
```

-the text file storing the participants; answers (MCDATA.TXT/MCDATA2.TXT)



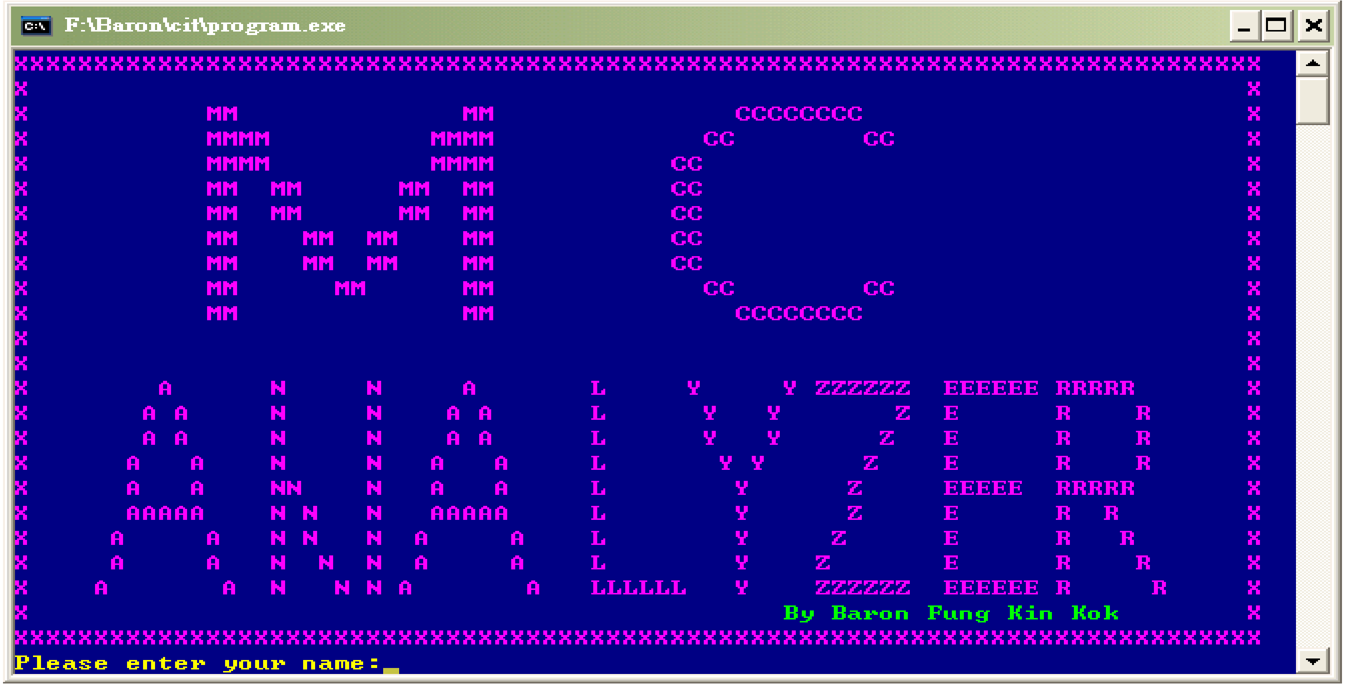
```
Advanced Contemporary College                Umbreon        AABBEDADBCECDBAEBBECDCBABDBDDACCDEADEAACECCDDDDCEA
Advanced Contemporary College                Murkrow        BCEAEEDCAADBDDEBCADAAEEDBDDCCCCDEABEDBEDDACCEEEABD
Assembly of God Morrison College             Slowking       CCEDACAECBECACCCBBDBEEBBDADDACABDABDCDCBEAEABBDCAA
Beacon (Evening) College (Mong Kok)          Misdreavus     ECAECEDEDABCEBABBCECBADBEBECAABAAEACBAABDCCADBBEEC
Bishop Hall Jubilee School                   Unown          BEACEAACEBEAAAABDAABCDCDCEBBDEAEDACDDAEDBEBBEEDECE
Buddhist Tai Hung College                    Bulbasaur      ECDBDDCADDADACBCECAAADDCCAAAEBCABCDDCCECCBBCAAACAD
C.M.A. Secondary School                      Ivysaur        AEBABECEECECCCEAAEAEBABCECCBEDAEBBADDDCBEDEEEABADD
CCC Heep Woh College                         Venusaur       DACAABDDACECAECACAEBEAEDCBBBADBABADBCDAADDBDAEEBBB
CCC Ming Yin College                         Charmander     CBBDEABBDDDDEDAADCBDDEDBBCCAECCBADECCCCBEBCEBADAAD
Chan Sui Ki (La Salle) College               Charmeleon     AECBDDEABBDCAECBCCCABECEADBECAACBBBEDDEABEAABBDCCD
C.M.A. Secondary School                      Charizard      BBBCABCECAABBDEBDABEDABBCAECEAEBEDCBDABEAACDACCADE
CCC Heep Woh College                         Squirtle       EEBAECCBCEEBCBEEBDDACEABAEECBCCDABEDADDDBCBAECBDCE
CCC Ming Yin College                         Wartortle      EDBCBBAEABEBBCECCEBDEAEAEAAECEBAADEDCAAADEDCCECDAA
Chan Sui Ki (La Salle) College               Blastoise      EEBEAEAAAEEAABBBBDCCDEACEEBEBCEBECDEDCBDDCEDEECEAB
Assembly of God Morrison College             Caterpie       BEBCEDDCBAADECBAEEADDECBBCECADCCDCBEBADCAEBDDCAEEC
Beacon (Evening) College (Mong Kok)          Metapod        EDAACBDDBEDEDBBECCCCAEAEACAEEDDACDABACEDEEECCCACEC
Bishop Hall Jubilee School                   Butterfree     BCECEDCDEBABDDAADEBCBBCBEAEDCCAEEABCCEBCCBDAAECDEB
Buddhist Tai Hung College                    Weedle         DBCBBEBEBBBADACEDBCEDDEACCDCEDEAACDEEBAAEACAEECABD
C.M.A. Secondary School                      Kakuna         BEEAEEEBCCDCCCDBCEBEEEABCAEBEDEBEDEAABBDACDBDAACAE
CCC Heep Woh College                         Beedrill       DEBEEACDBAECBCCAAEAEBEEADCEDBCCBAEBAEDCADBCBDEBCEA
CCC Heep Woh College                         Pidgey         DBDCDAAEABACDEDAEEDAADBCBECCAABEDAEBDBDEEDBCABBCAA
CCC Ming Yin College                         Pidgeotto      BCCDBCABABCABABEDCBCCBABDDAEAEECBDDBDAAADCBDDEEEDD
Chan Sui Ki (La Salle) College               Pidgeot        CDEDCBDDBEEDAACBEEEEBEEDAEBBACEEAADEDDABEBDACBEECA
C.M.A. Secondary School                      Rattata        BABBABCCADACDEEDEDBCEAECCADCECACCCEBACABCDBEDAADDE
Bishop Hall Jubilee School                   Raticate       BAEDBEEBCAADCCAAAADEBCBBAEBBEBABEBCDCDAAADDADDBAED
Buddhist Tai Hung College                    Spearow        CADBBEBCEDECCBBEECDBEBBEBAABCEECECABDEEBECBEADEDCA
C.M.A. Secondary School                      Fearow         ECECADBCEBBCBCCBDECBEBDBAADABAEBCAEBECCBABEAACDEEC
CCC Heep Woh College                         Ekans          DEDABBDDCBDCACCBBCCEDCDCECBBABCDBCDCECEBCBDBDDEBDC
CCC Ming Yin College                         Arbok          AACBEDBDBECAADBCBCBBEAEBDEDDEDCDEACDCECCDDBAACEADE
Chan Sui Ki (La Salle) College               Pikachu        DEBEEBCEAACCBAAEDBDDECCADDBBBEBBACEDBEDDAEDCECCDDD
C.M.A. Secondary School                      Raichu         ECBDBBACDCABEECDECDBACAEDECBBECDDDCEEDCAACEBEBCBAB
CCC Heep Woh College                         Sandshrew      ADCDCACDDCADEBECEEDABACACCEBADBADECEBCADAECECCDACE
CCC Ming Yin College                         Sandslash      BBDACDCEEDEACBBCAEBADDECDBEECCDAEDDCCDBBECAEDCEBBA
CCC Heep Woh College                         Vileplume      DEEAEEACDDAEAAEDDAABDBDAABBDCDBCBCAAEDBAEDEBBBAEDE
CCC Ming Yin College                         Nidorina       BBCEBADACAADCBCCAEAEEEEEBACAEDDCCABDBEEAACDBECCBDB
Chan Sui Ki (La Salle) College               Nidoqueen      ADBCEDEBCCDABABBEECAAEEAEECDDDAEECEAABDCDDDDEEDEDE
Assembly of God Morrison College             Nidoran        EEDECEDCDCABADEAADADDEBDECBEDBBBAECEEEACABBDECEECA
Beacon (Evening) College (Mong Kok)          Nidorino       ABADDBADBBECCDBAAAAEDECBEBCCEBADCECCDAAEABACADCBCE
Bishop Hall Jubilee School                   Nidoking       DBEEDAABBCDCCEECCCEEBAABABCBBCEDDEAABBCCDCCCBBAABC
Buddhist Tai Hung College                    Clefairy       ACDACAECACECAEDADDDDEEBDBECDDBECEEBADCBDDCCEEBAACB
C.M.A. Secondary School                      Clefable       BCDCBCEDEBAEBCEEBDCCBADCCCAEBEDCAABEAABCCBCAACAABB
CCC Heep Woh College                         Vulpix         BADEEDDAAAAEABEBDCECBEDAAAEACBBDDAEEBDEEDCACCEBEDA
CCC Ming Yin College                         Ninetales      DDACCADCCADAEDACABDEACCACDBBBAEECCBAEABEEDCEDEECBC
Chan Sui Ki (La Salle) College               Jigglypuff     CBDCEDCCBABBACDBAEACCEBEDBDBADDBBDEAAAAEDCBEBDDEAC
C.M.A. Secondary School                      Wigglytuff     BADECDBCEDADEABCBACDEDEBEDDDEBDEBAEEEBDBCCADBDBDCC
CCC Heep Woh College                         Zubat          DAADBADECEBEDACDDEABBBDCBEDABBEBADACBABDCCADECEBBB
CCC Ming Yin College                         Golbat         EDEEAACEBCDDCACBCEDEBBADCEDCEEDDDBEEBBACDABBADEBBD
Chan Sui Ki (La Salle) College               Oddish         CDCEAAADCAEDCCBCCBBBBBEBDAEADAAEBCABDACBABDBCACCBC
Assembly of God Morrison College             Gloom          EDDAAAABDBBADACEDCDAADEBDCAEDACDCEEECCBDBCABADBCCC
```

Please pay attention to this

The program file and data files should be put into the same folder / location before execution unless the program cannot run successfully.

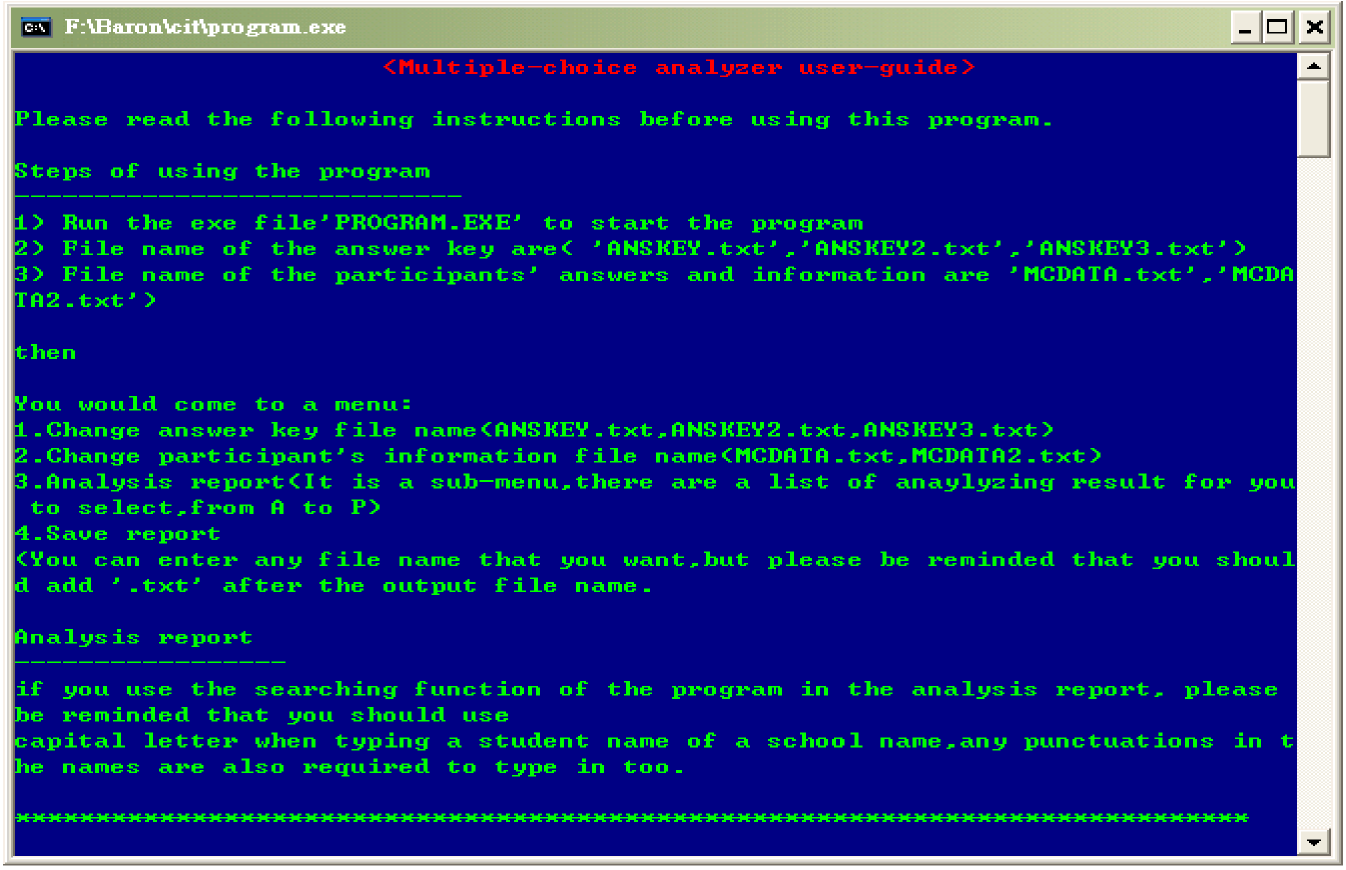
The data files are prepared by MS Notepad for program testing.

3.User-interface of the program



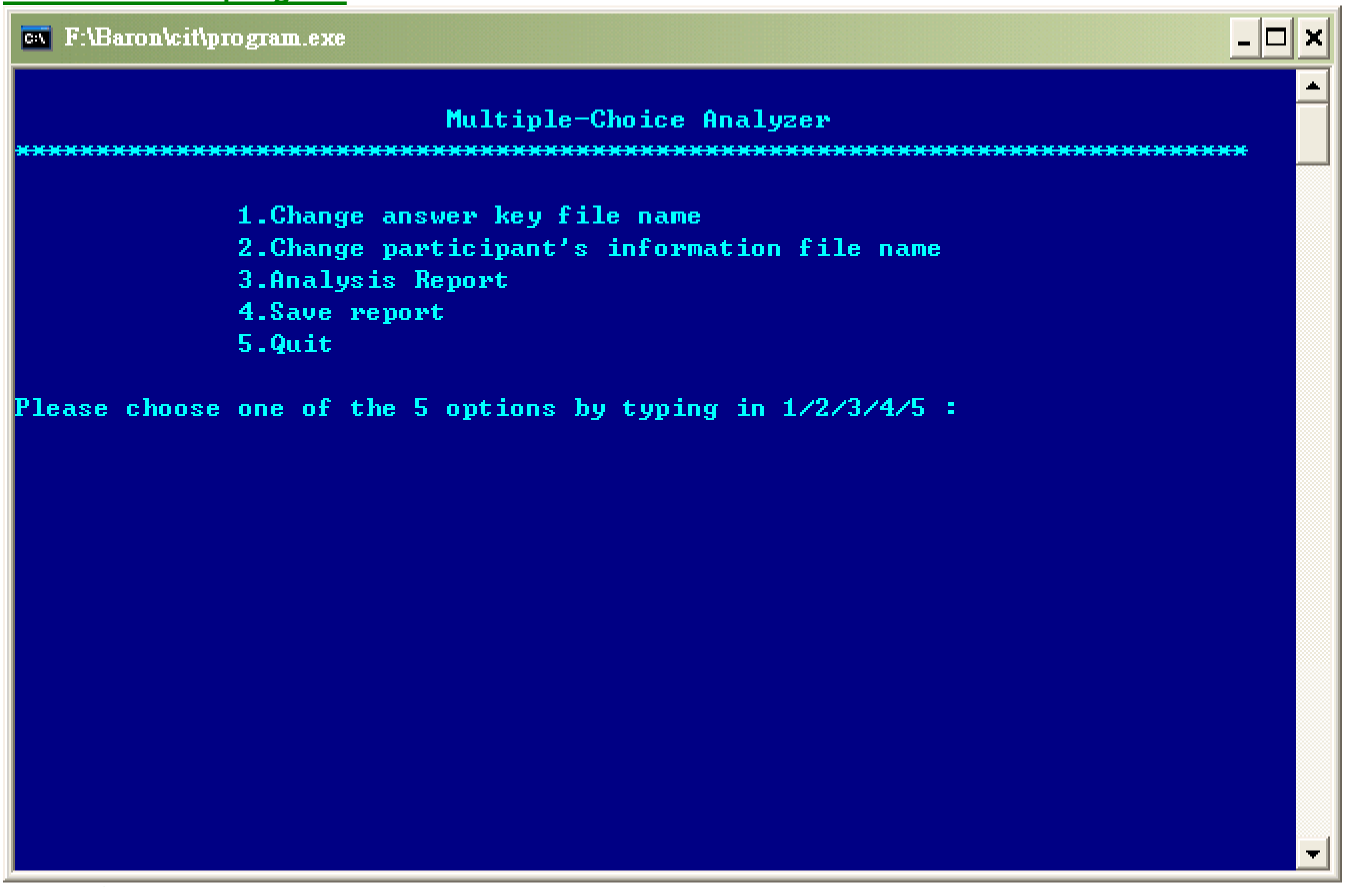
```
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X                                                                             X
X           MM              MM               CCCCCCCC                         X
X           MMMM          MMMM             CC        CC                       X
X           MMMM          MMMM           CC                                   X
X           MM  MM      MM  MM           CC                                   X
X           MM  MM      MM  MM           CC                                   X
X           MM    MM  MM    MM           CC                                   X
X           MM    MM  MM    MM           CC                                   X
X           MM      MM      MM             CC        CC                       X
X           MM              MM               CCCCCCCC                         X
X                                                                             X
X                                                                             X
X        A      N     N     A       L     Y     Y ZZZZZZ  EEEEEE RRRRR        X
X       A A     N     N    A A      L      Y   Y       Z  E      R    R       X
X       A A     N     N    A A      L      Y   Y      Z   E      R    R       X
X      A   A    N     N   A   A     L       Y Y      Z    E      R    R       X
X      A   A    NN    N   A   A     L        Y      Z     EEEEE  RRRRR        X
X      AAAAA    N N   N   AAAAA     L        Y      Z     E      R  R         X
X     A     A   N N   N  A     A    L        Y     Z      E      R   R        X
X     A     A   N  N  N  A     A    L        Y    Z       E      R    R       X
X    A       A  N   N N A       A   LLLLLL   Y    ZZZZZZ  EEEEEE R     R      X
X                                               By Baron Fung Kin Kok         X
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Please enter your name:_
```

4. User-guide interface



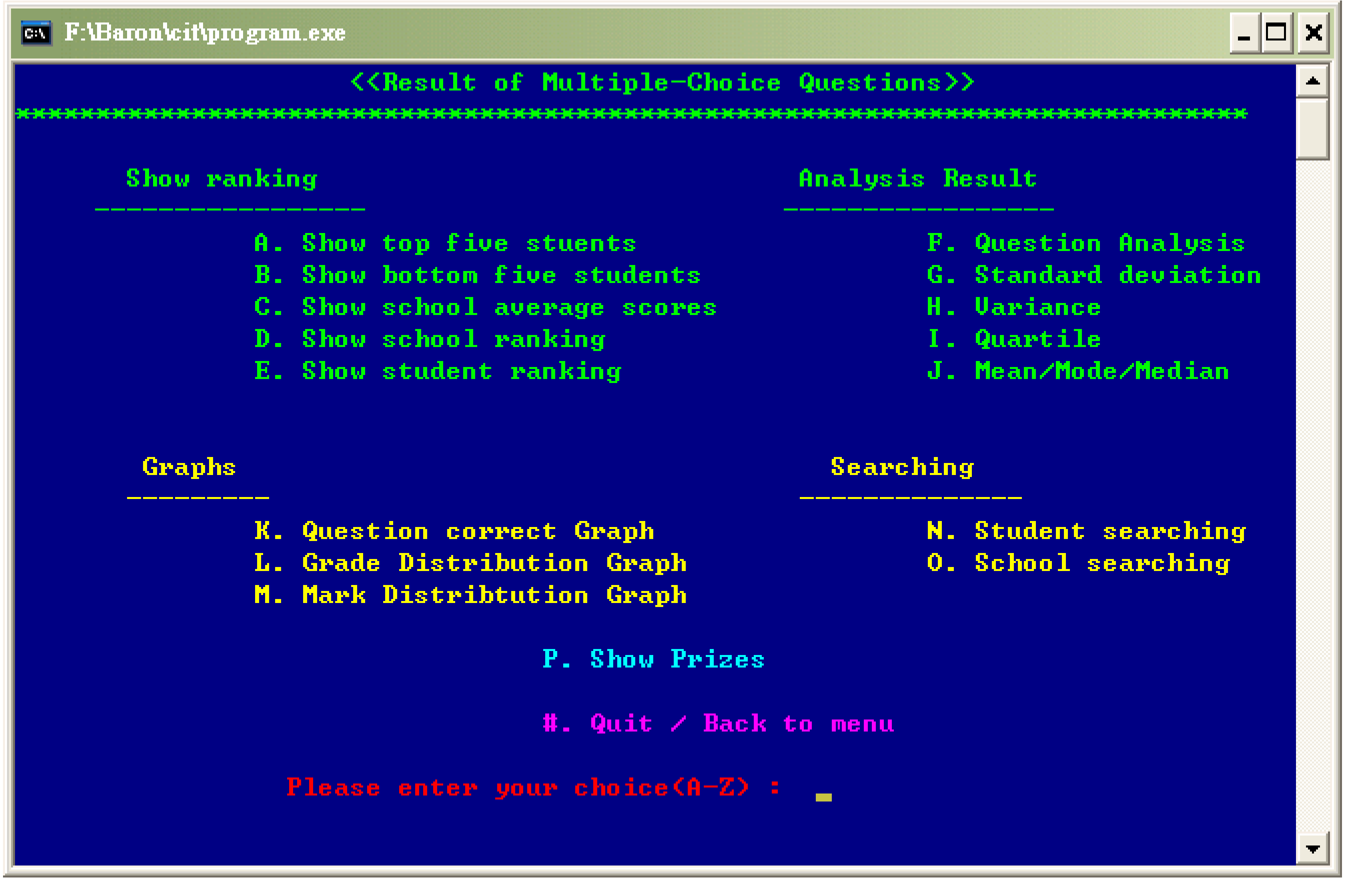
```
                       <Multiple-choice analyzer user-guide>

Please read the following instructions before using this program.

Steps of using the program
----------------------------
1> Run the exe file'PROGRAM.EXE' to start the program
2> File name of the answer key are( 'ANSKEY.txt','ANSKEY2.txt','ANSKEY3.txt')
3> File name of the participants' answers and information are 'MCDATA.txt','MCDA
TA2.txt')

then

You would come to a menu:
1.Change answer key file name(ANSKEY.txt,ANSKEY2.txt,ANSKEY3.txt)
2.Change participant's information file name(MCDATA.txt,MCDATA2.txt)
3.Analysis report(It is a sub-menu,there are a list of anaylyzing result for you
 to select,from A to P)
4.Save report
(You can enter any file name that you want,but please be reminded that you shoul
d add '.txt' after the output file name.

Analysis report
-----------------
if you use the searching function of the program in the analysis report, please
be reminded that you should use
capital letter when typing a student name of a school name,any punctuations in t
he names are also required to type in too.

*****************************************************************************
```

5.Menu of the program



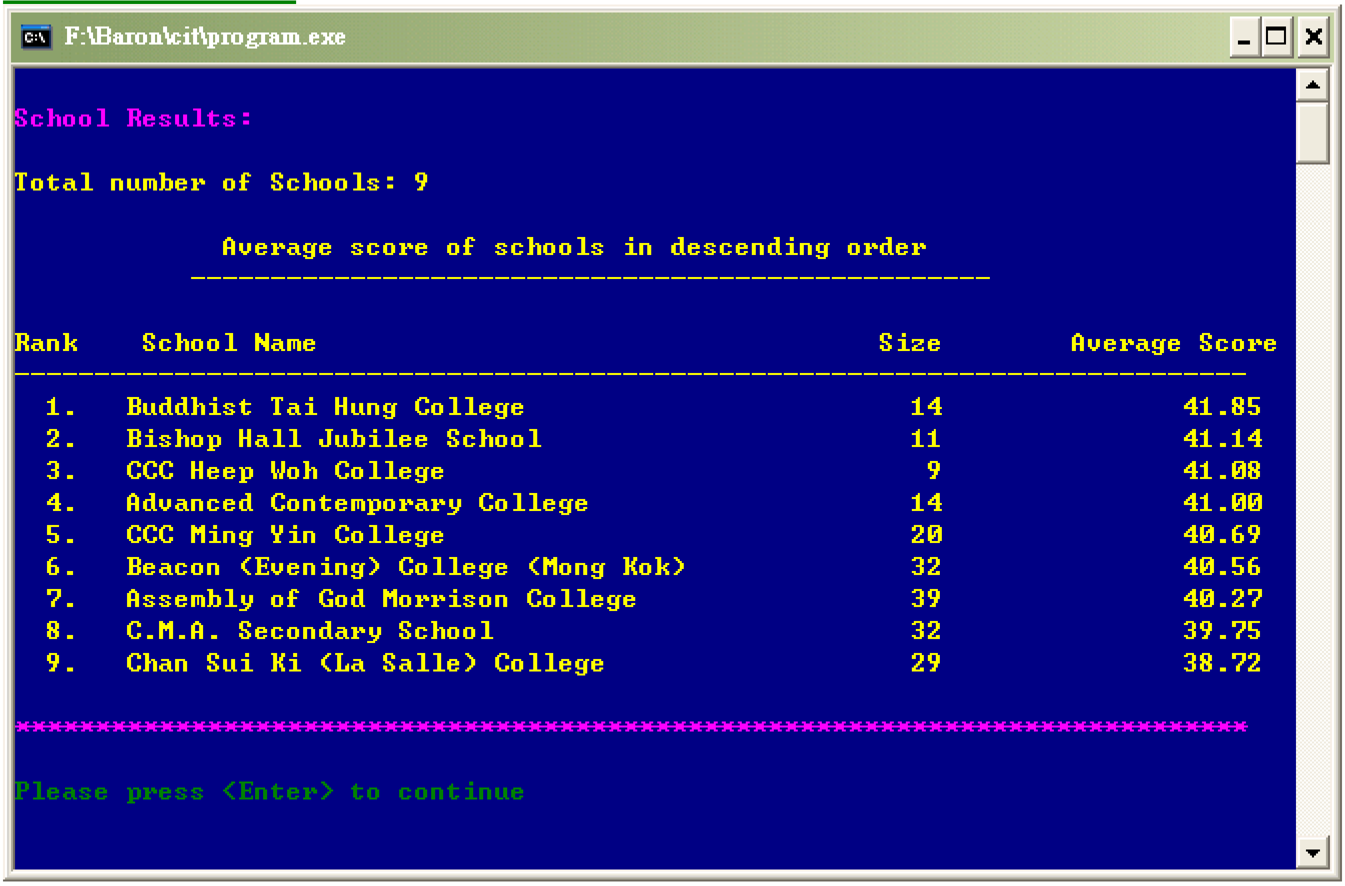
```
                          Multiple-Choice Analyzer
****************************************************************************

             1.Change answer key file name
             2.Change participant's information file name
             3.Analysis Report
             4.Save report
             5.Quit

Please choose one of the 5 options by typing in 1/2/3/4/5 :
```

6. Analysis Report menu



```
                    <<Result of Multiple-Choice Questions>>
****************************************************************************

       Show ranking                          Analysis Result
     -----------------                     -----------------
              A. Show top five stuents               F. Question Analysis
              B. Show bottom five students           G. Standard deviation
              C. Show school average scores          H. Variance
              D. Show school ranking                 I. Quartile
              E. Show student ranking                J. Mean/Mode/Median


        Graphs                                 Searching
       ---------                             --------------
              K. Question correct Graph              N. Student searching
              L. Grade Distribution Graph            O. School searching
              M. Mark Distribtution Graph

                                 P. Show Prizes

                                 #. Quit / Back to menu

                 Please enter your choice(A-Z) :  _
```

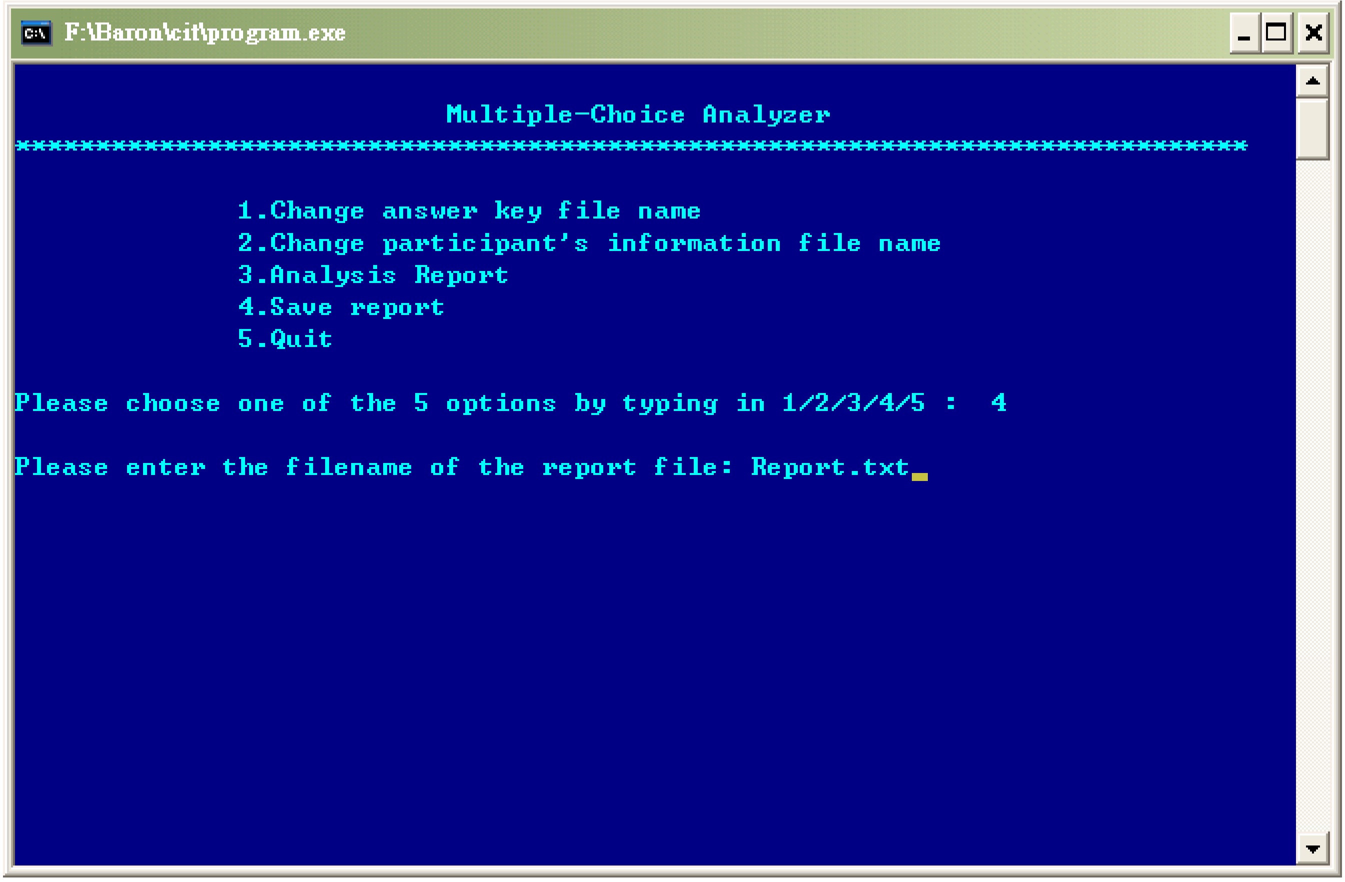
7.Result on scsreen



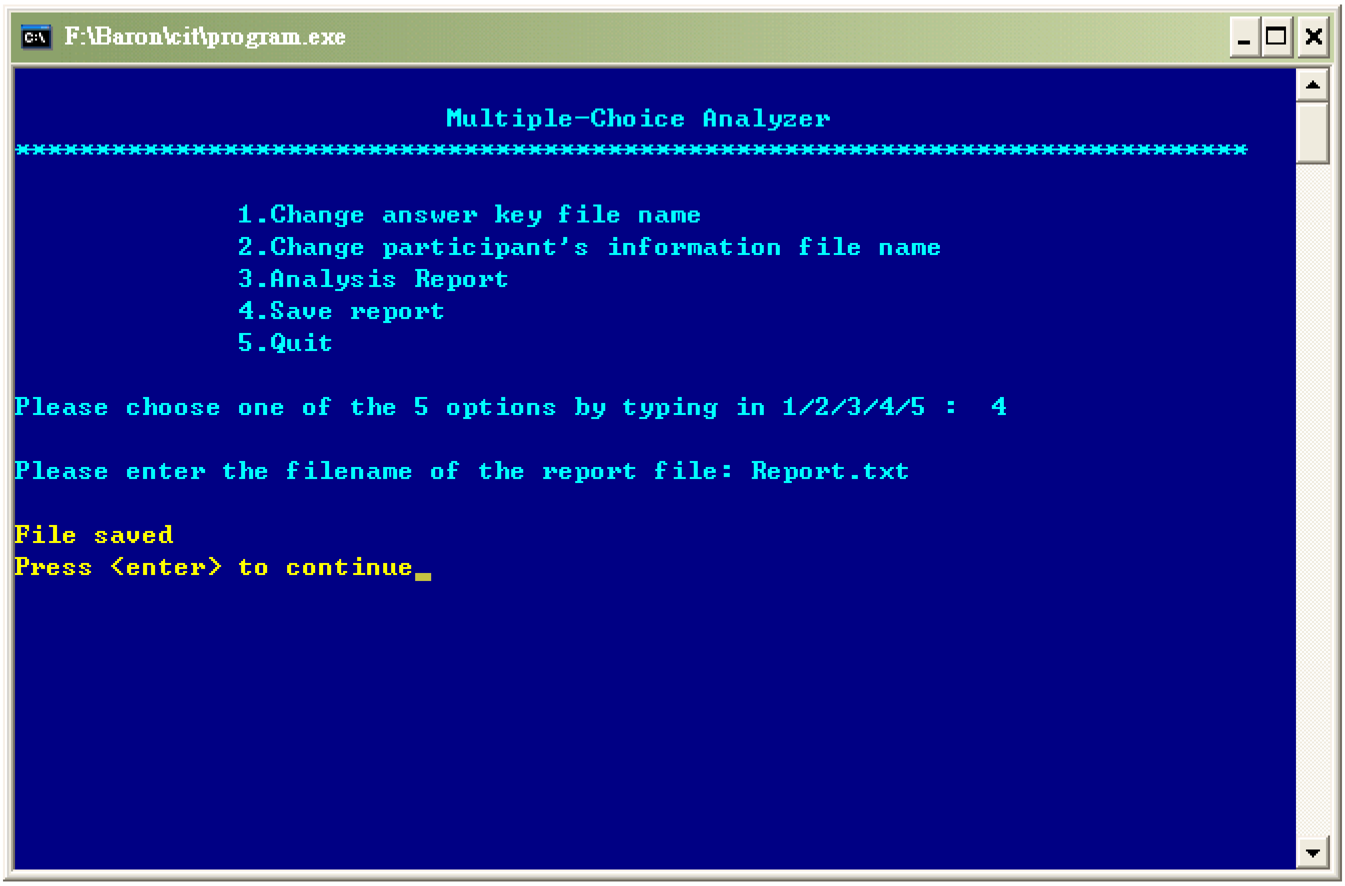
```
School Results:

Total number of Schools: 9

             Average score of schools in descending order
           ---------------------------------------------------

Rank     School Name                                   Size          Average Score
------------------------------------------------------------------------------
  1.    Buddhist Tai Hung College                        14                41.85
  2.    Bishop Hall Jubilee School                       11                41.14
  3.    CCC Heep Woh College                              9                41.08
  4.    Advanced Contemporary College                    14                41.00
  5.    CCC Ming Yin College                             20                40.69
  6.    Beacon (Evening) College (Mong Kok)              32                40.56
  7.    Assembly of God Morrison College                 39                40.27
  8.    C.M.A. Secondary School                          32                39.75
  9.    Chan Sui Ki (La Salle) College                   29                38.72

******************************************************************************

Please press <Enter> to continue
```

(This screen shoot showing school results)

8. Saving report interface

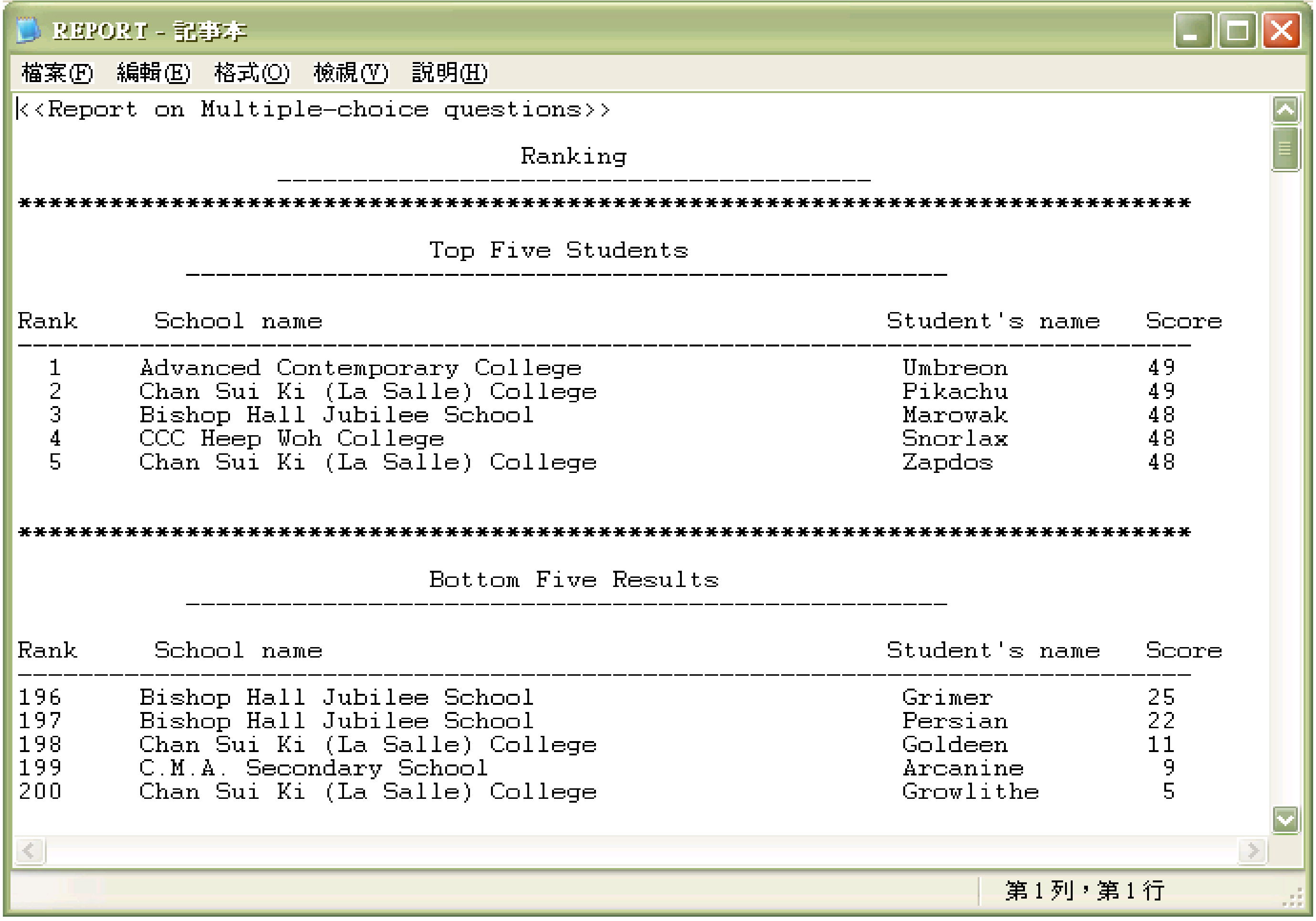


```
                           Multiple-Choice Analyzer
******************************************************************************

              1.Change answer key file name
              2.Change participant's information file name
              3.Analysis Report
              4.Save report
              5.Quit

Please choose one of the 5 options by typing in 1/2/3/4/5 :  4

Please enter the filename of the report file: Report.txt_
```



```
                         Multiple-Choice Analyzer
******************************************************************************

              1.Change answer key file name
              2.Change participant's information file name
              3.Analysis Report
              4.Save report
              5.Quit

Please choose one of the 5 options by typing in 1/2/3/4/5 :  4

Please enter the filename of the report file: Report.txt

File saved
Press <enter> to continue_
```

9. Report file



```
<<Report on Multiple-choice questions>>

                                  Ranking
                 ----------------------------------------
******************************************************************************

                            Top Five Students
           ---------------------------------------------------

Rank      School name                                     Student's name    Score
------------------------------------------------------------------------------
  1      Advanced Contemporary College                     Umbreon          49
  2      Chan Sui Ki (La Salle) College                    Pikachu          49
  3      Bishop Hall Jubilee School                        Marowak          48
  4      CCC Heep Woh College                              Snorlax          48
  5      Chan Sui Ki (La Salle) College                    Zapdos           48


******************************************************************************

                            Bottom Five Results
           ---------------------------------------------------

Rank      School name                                     Student's name    Score
------------------------------------------------------------------------------
196      Bishop Hall Jubilee School                        Grimer           25
197      Bishop Hall Jubilee School                        Persian          22
198      Chan Sui Ki (La Salle) College                    Goldeen          11
199      C.M.A. Secondary School                           Arcanine          9
200      Chan Sui Ki (La Salle) College                    Growlithe         5
```

Chapter 5 Testing & Evaluation

5.1 Brief Description

The purposes of program testing and evaluation

Program testing and evaluation is a very important step in programming. If this step had not been taken, the program may not run successfully or the program may have calculation error, and may lead to unfairness of the competition.

Program testing and evaluation helps:

- to find out the bugs (logical and run-time errors) in the program,
- to check whether the program can achieve its purposes,
- to see whether the program is user-friendly,
- to see the users' evaluation towards the program,
- to see whether can use it easily,
- to see whether the program is tidy,
- to see whether the program is reusable
- to see whether the program analysis result is detailed enough
- to debug and improve the program based on the testing and evaluation results

5.2 Testing and Evaluation Plan

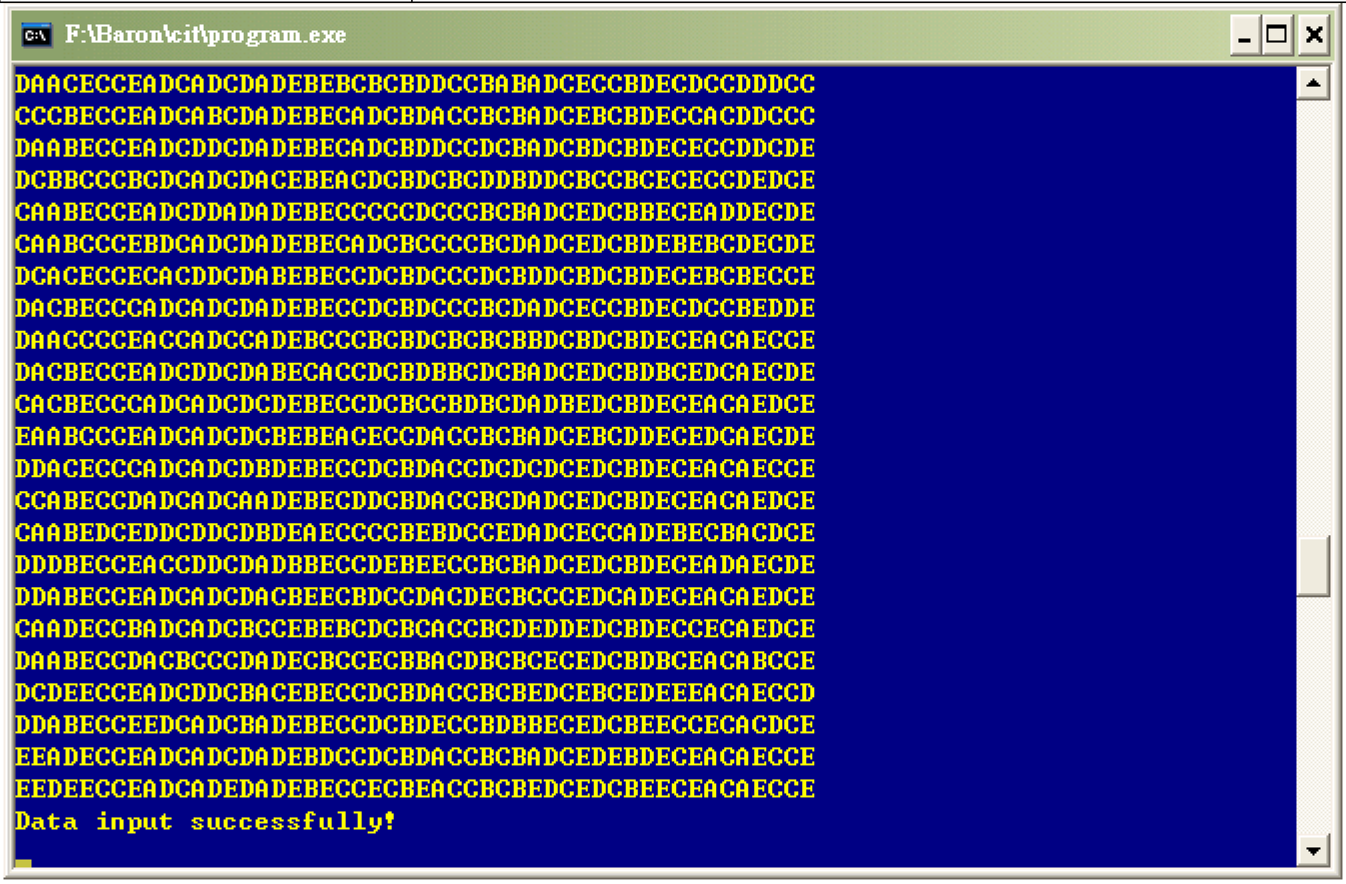
The program will be tested and evaluated according to the following plan:

1. Internal testing and evaluation / Tested and evaluated by me (the programmer):
   - The program will be tested intensively by me – the programmer
   - I will prepare different test cases to test the program thoroughly
   - The test cases include some correct input data (from files & keyboard) with known results for checking the correctness of the program, some incorrect input data to see whether the program can handle invalid input reasonably, etc.
   - I will test if the program can calculate some special statistics event accurately(standard deviation, variance)
   - I will test if the program display result untidily
   - I will also evaluate the programs according to its user-friendliness, performance, flexibility for future development, reusability of program codes, etc.
   -
2. External testing and evaluation / Tested and evaluated by users:
   - I will invite some (e.g. 10) targeted users/my classmates/friends to test and evaluate the program. E.g.
     - I will upload the object program (the .exe file) and some sample data files onto a share folder in our school e-learning platform to let some users to try.
     - I will upload the corresponding files to my blog / Web site and ask my friends to try
     - I will let my classmates try on my program after schools
   - The users are invited to report the bugs they find and give their comments and suggestions on my program

I will try to modify the program according to the reported bugs and suggestions. The new version of program after making modifications will be shown in Appendix 1.

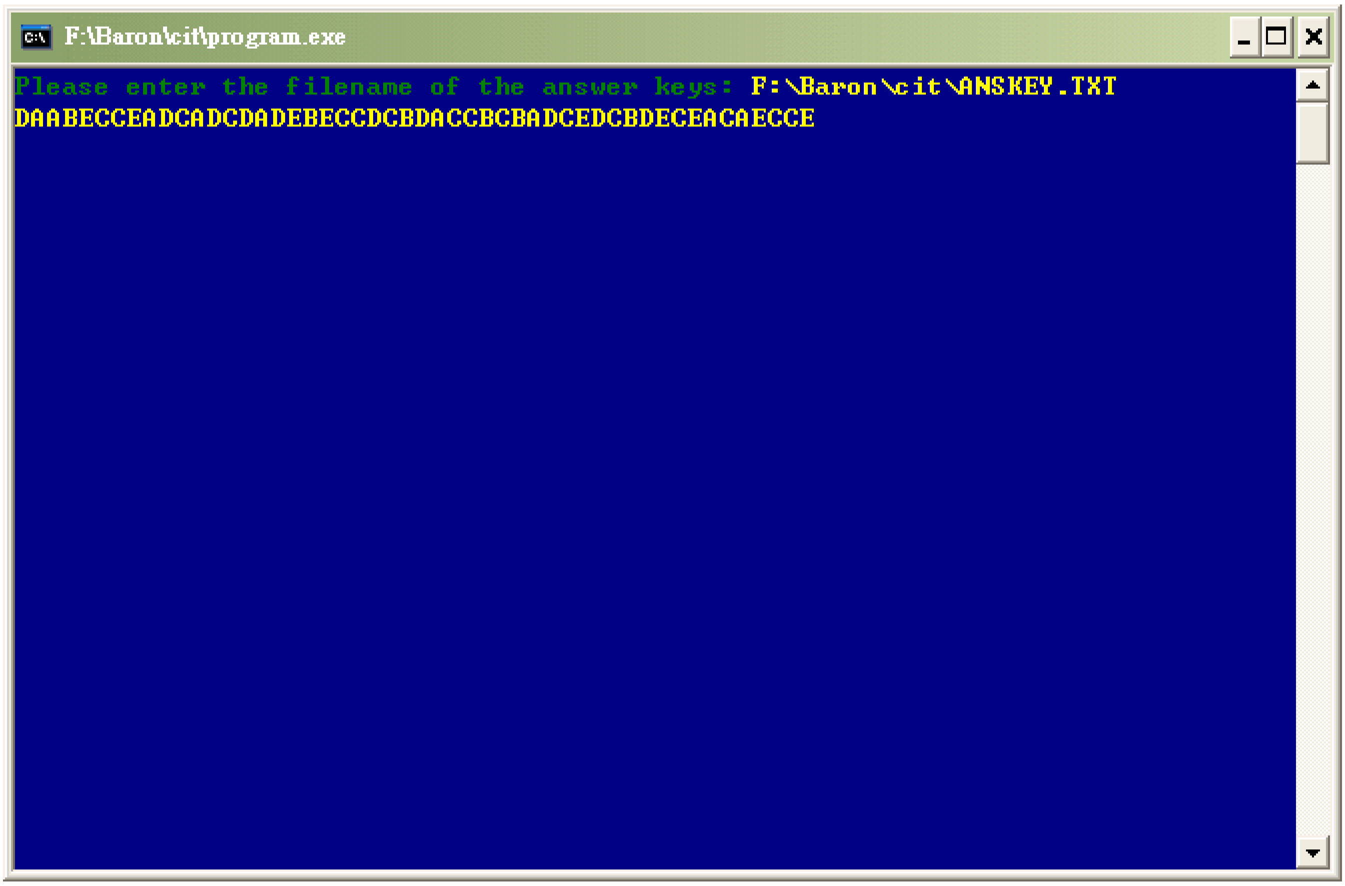
5.3 Internal Testing

Test case number	1
Purpose	Test if the data text file(participants' information and answer) can read successfully)
Expected result:	Show students' answer and data input successfully
Actual result:	Show students' answer and data input successfully
Test result	Test is passed
Follow-up Action:	nil



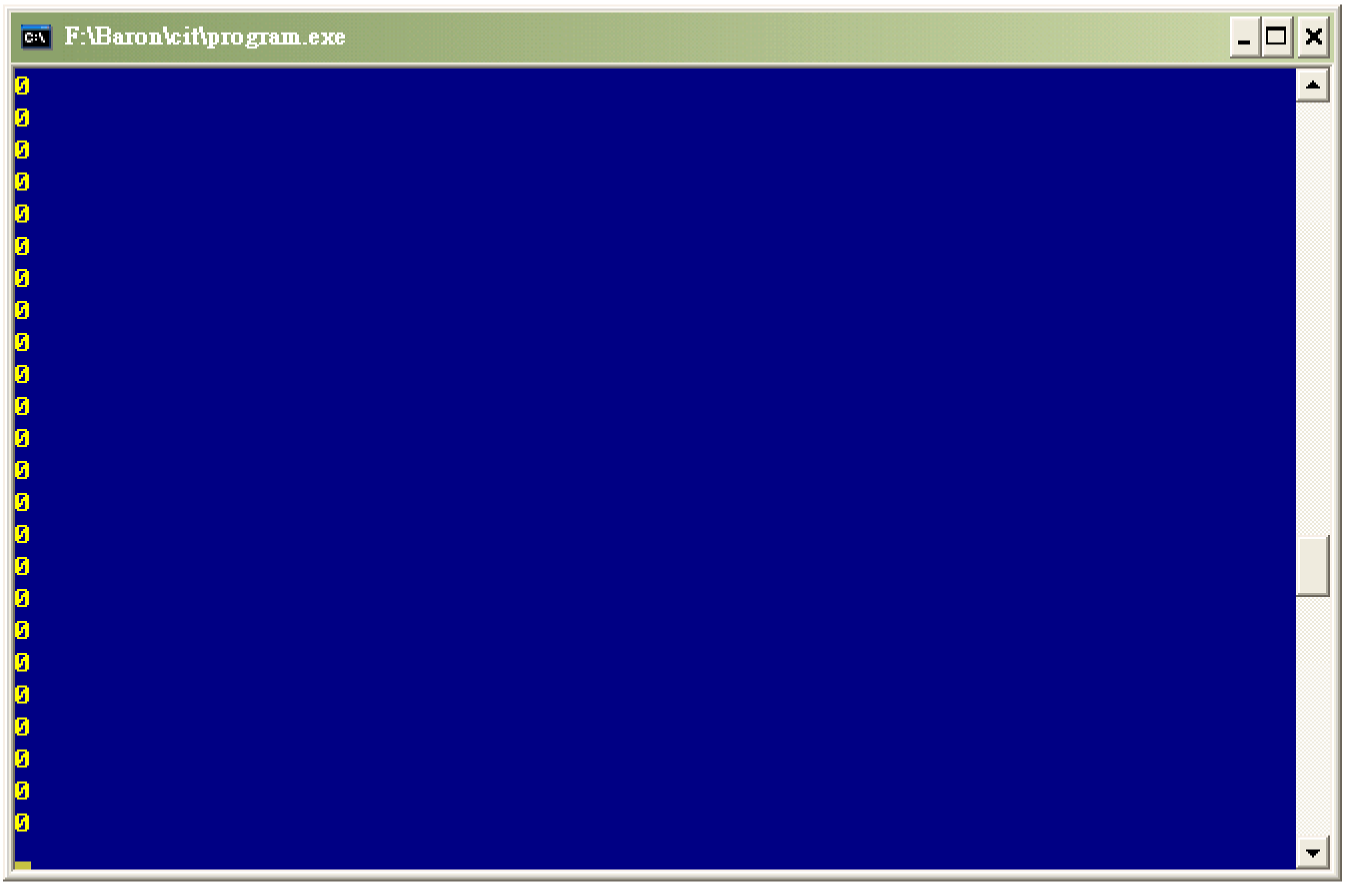
```
DAACECCEADCADCDADEBEBCBCBDDCCBABADCECCBDECDCCDDDCC
CCCBECCEADCABCDADEBECADCBDACCBCBADCEBCBDECCACDDCCC
DAABECCEADCDDCDADEBECADCBDDCCDCBADCBDCBDECECCDDCDE
DCBBCCCBCDCADCDACEBEACDCBDCBCDDBDDCBCCBCECECCDEDCE
CAABECCEADCDDADADEBECCCCCDCCCBCBADCEDCBBECEADDECDE
CAABCCCEBDCADCDADEBECADCBCCCCBCDADCEDCBDEBEBCDECDE
DCACECCECACDDCDABEBECCDCBDCCCDCBDDCBDCBDECEBCBECCE
DACBECCCADCADCDADEBECCDCBDCCCBCDADCECCBDECDCCBEDDE
DAACCCCEACCADCCADEBCCCBCBDCBCBCBBDCBDCBDECEACAECCE
DACBECCEADCDDCDABECACCDCBDBBCDCBADCEDCBDBCEDCAECDE
CACBECCCADCADCDCDEBECCDCBCCBDBCDADBEDCBDECEACAEDCE
EAABCCCEADCADCDCBEBEACECCDACCBCBADCEBCDDECEDCAECDE
DDACECCCADCADCDBDEBECCDCBDACCDCDCDCEDCBDECEACAECCE
CCABECCDADCADCAADEBECDDCBDACCBCDADCEDCBDECEACAEDCE
CAABEDCEDDCDDCDBDEAECCCCBEBDCCEDADCECCADEBECBACDCE
DDDBECCEACCDDCDADBBECCDEBEECCBCBADCEDCBDECEADAECDE
DDABECCEADCADCDACBEECBDCCDACDECBCCCEDCADECEACAEDCE
CAADECCBADCADCBCCEBEBCDCBCACCBCDEDDEDCBDECCECAEDCE
DAABECCDACBCCCDADECBCCECBBACDBCBCECEDCBDBCEACABCCE
DCDEECCEADCDDCBACEBECCDCBDACCBCBEDCEBCEDEEEACAECCD
DDABECCEEDCADCBADEBECCDCBDECCBDBBECEDCBEECCECACDCE
EEADECCEADCADCDADEBDCCDCBDACCBCBADCEDEBDECEACAECCE
EEDEECCEADCADEDADEBECCECBEACCBCBEDCEDCBEECEACAECCE
Data input successfully!
```

Test case number	2 3
Purpose	Test if the answer key can read successfully Test if the students’ answer can be corrected
Expected result:	Show answer key the students’ answer can be corrected
Actual result:	Show answer key All students have mark
Test result	Test is passed Test is failed
Follow-up Action:	nil Check if there is logic error

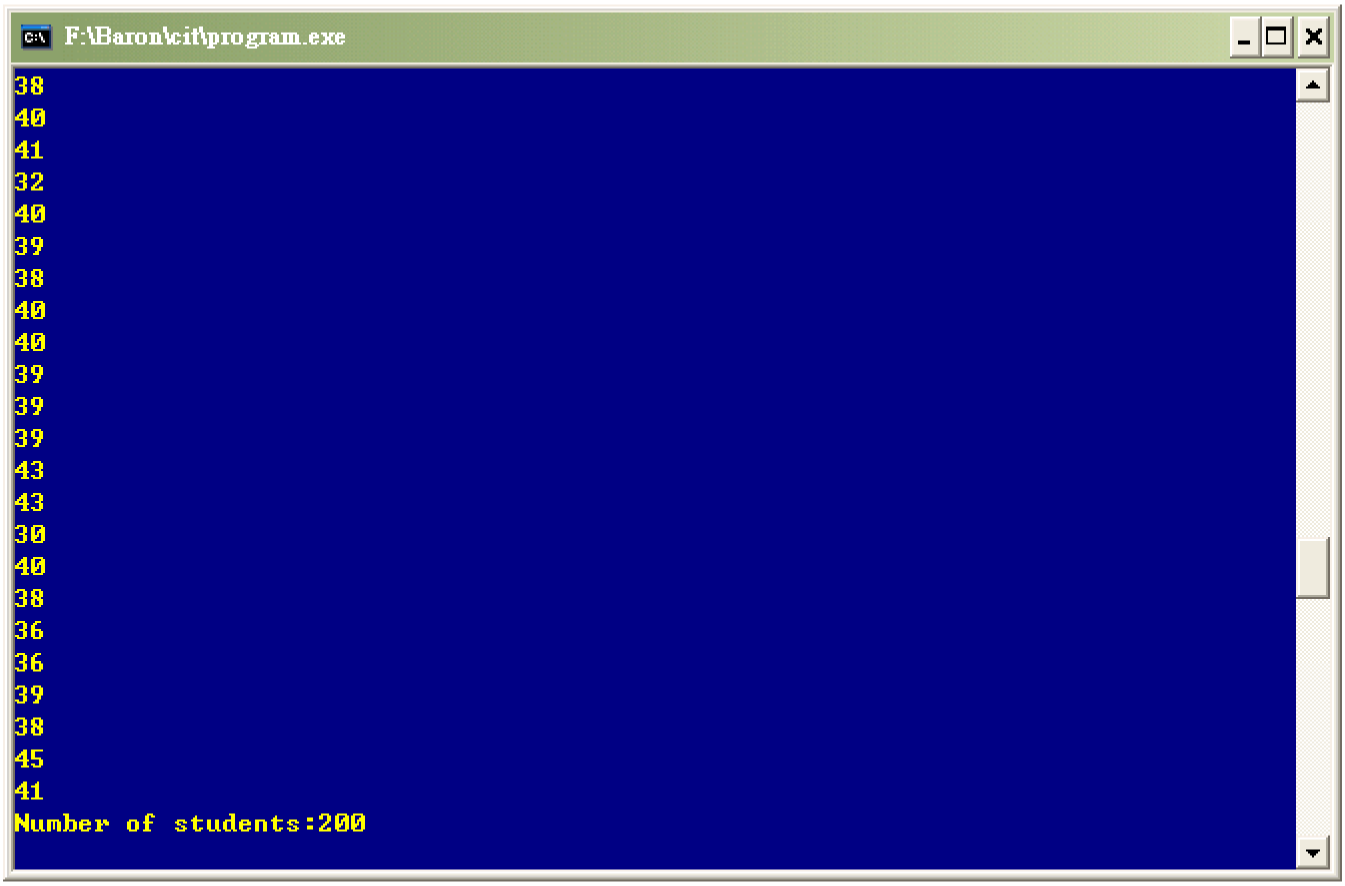


```
Please enter the filename of the answer keys: F:\Baron\cit\ANSKEY.TXT
DAABECCEADCADCDADEBECCDCBDACCBCBADCEDCBDECEACAECCE
```

Test case number	4
Purpose	Test if the students' answer can be corrected
Expected result:	the students' answer can be corrected and the total number of students can be count
Actual result:	the students' answer can be corrected and the total number of students can be count
Test result	Test is passed
Follow-up Action:	nil

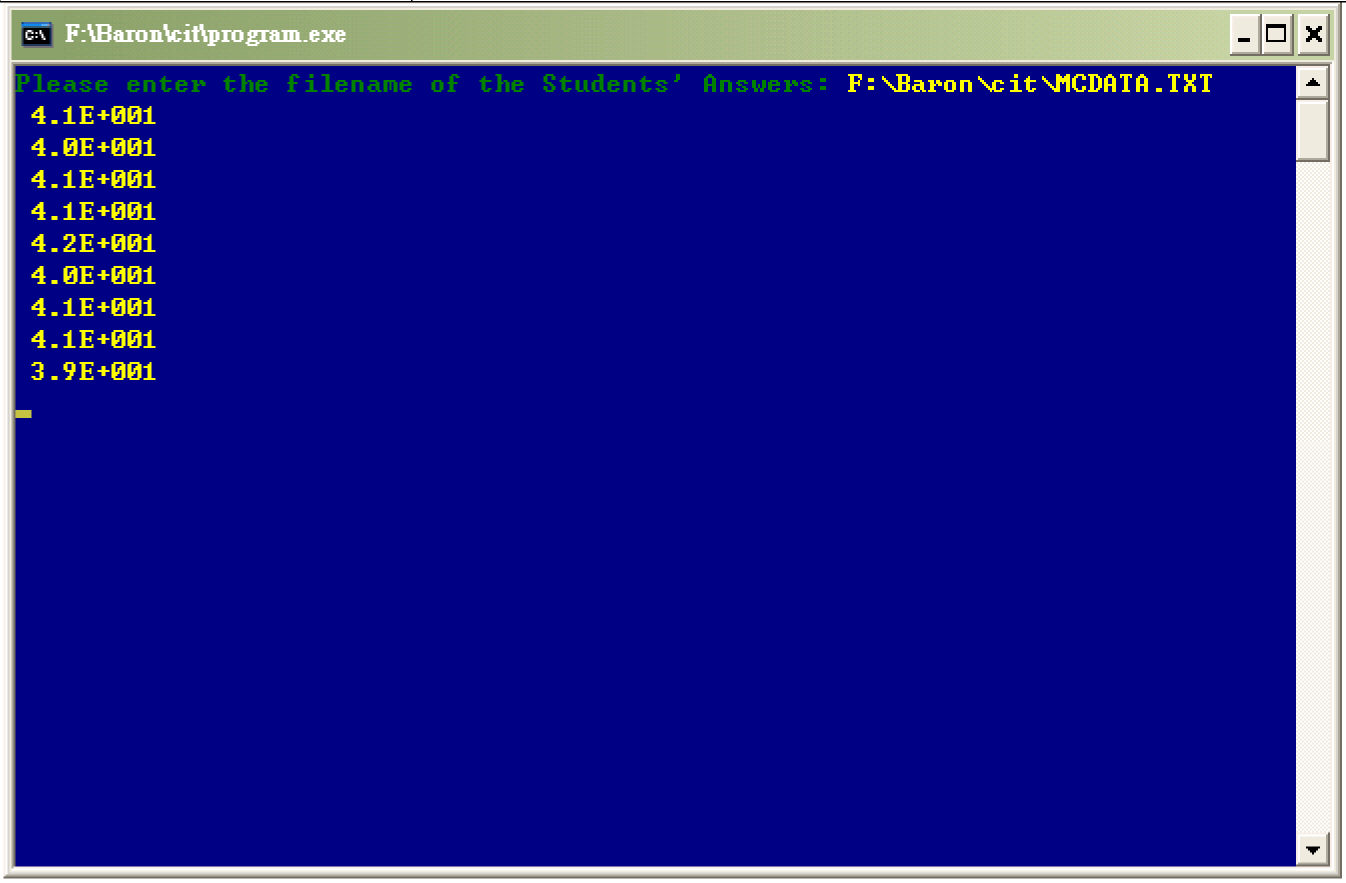


```
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
0
```

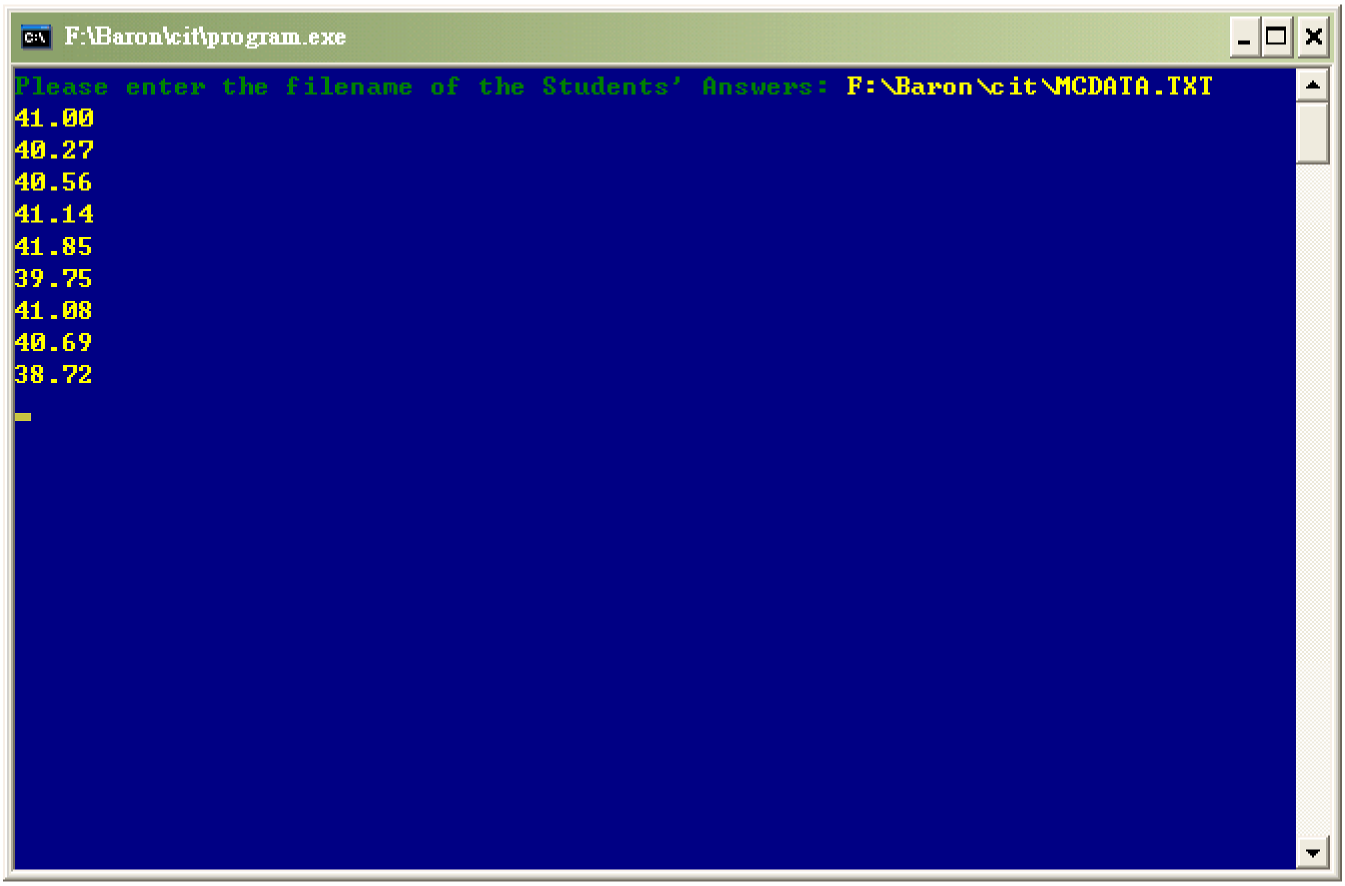


```
38
40
41
32
40
39
38
40
40
39
39
39
43
43
30
40
38
36
36
39
38
45
41
Number of students:200
```

Test case number	5 6
Purpose	Test if the schools' answer can be corrected
Expected result:	the schools' answer can be corrected
Actual result:	the schools' answer can be corrected Cannot show the correct mark
Test result	Test is passed Test is failed
Follow-up Action:	Check if any logic error happens



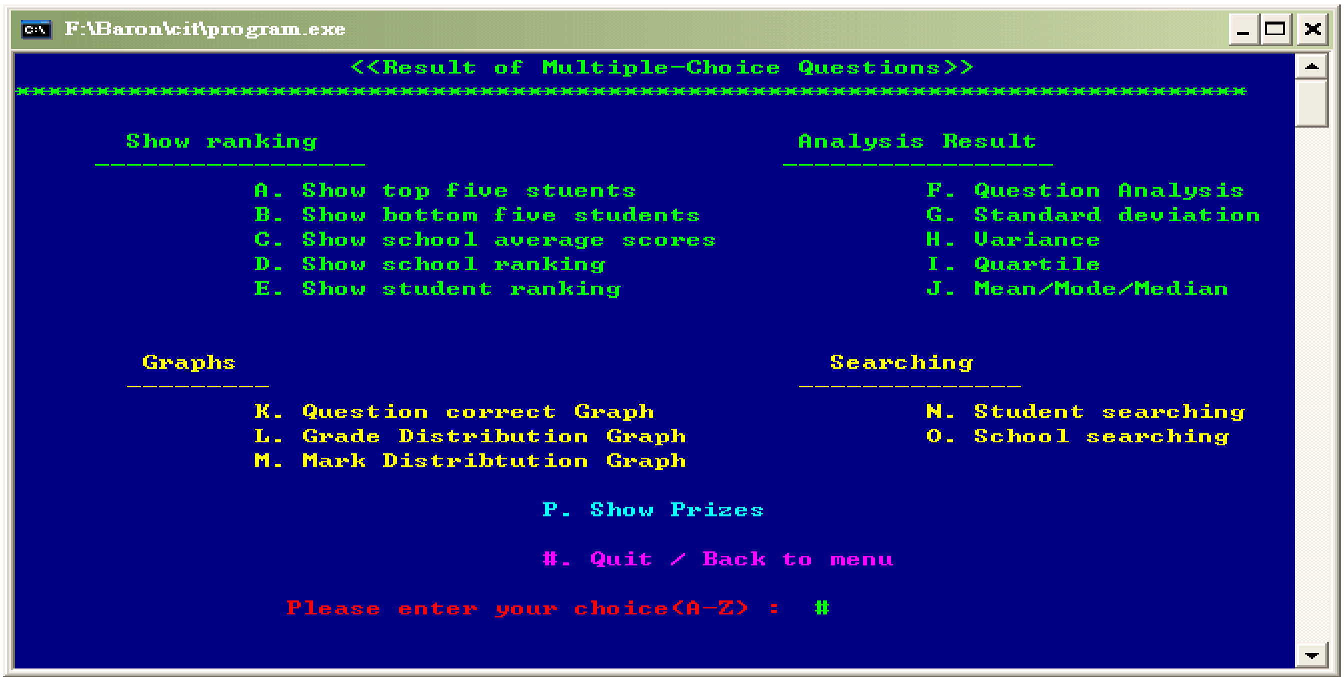
```
Please enter the filename of the Students' Answers: F:\Baron\cit\MCDATA.TXT
 4.1E+001
 4.0E+001
 4.1E+001
 4.1E+001
 4.2E+001
 4.0E+001
 4.1E+001
 4.1E+001
 3.9E+001
```



```
Please enter the filename of the Students' Answers: F:\Baron\cit\MCDATA.TXT
41.00
40.27
40.56
41.14
41.85
39.75
41.08
40.69
38.72

_
```

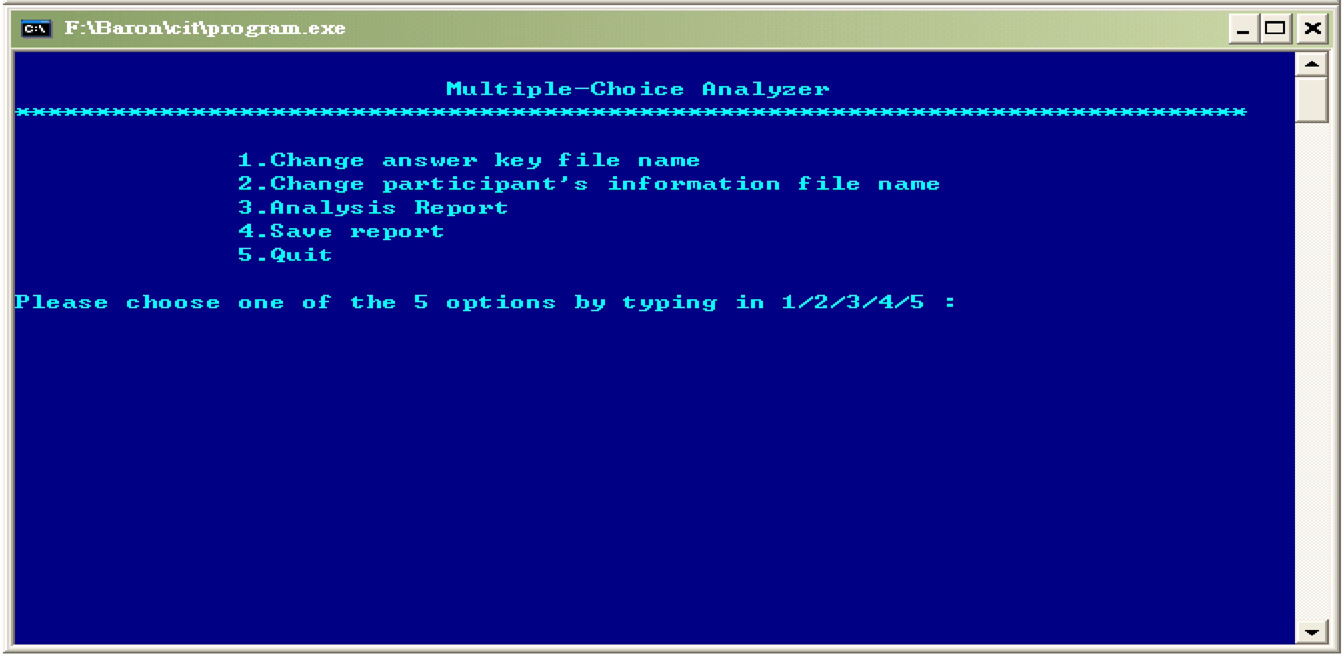
Test case number	7
Purpose	Test if the back to menu function can be used
Expected result:	Can go back to menu
Actual result:	Can go back to menu
Test result	Test is passed

Follow-up Action: nil



F:\Baron\cit\program.exe

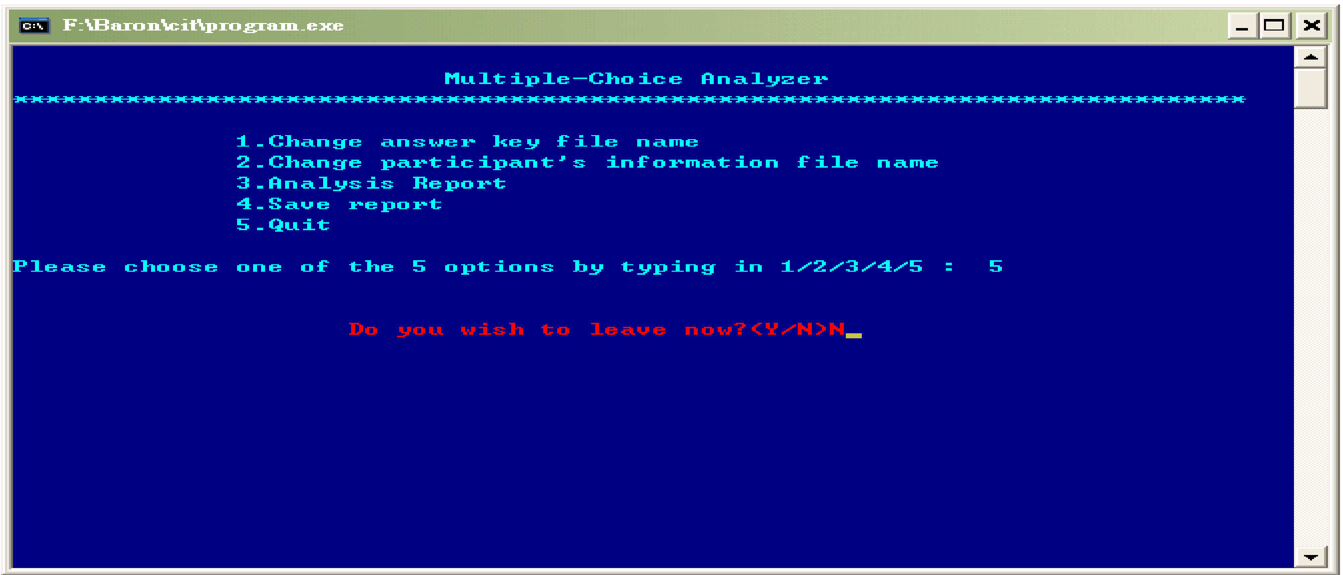
```
                      <<Result of Multiple-Choice Questions>>
******************************************************************************

      Show ranking                                  Analysis Result
     -----------------                             -----------------
               A. Show top five stuents                      F. Question Analysis
               B. Show bottom five students                  G. Standard deviation
               C. Show school average scores                 H. Variance
               D. Show school ranking                        I. Quartile
               E. Show student ranking                       J. Mean/Mode/Median


       Graphs                                         Searching
      ---------                                      --------------
               K. Question correct Graph                     N. Student searching
               L. Grade Distribution Graph                   O. School searching
               M. Mark Distribtution Graph

                                 P. Show Prizes

                                 #. Quit / Back to menu

                 Please enter your choice(A-Z) :  #
```



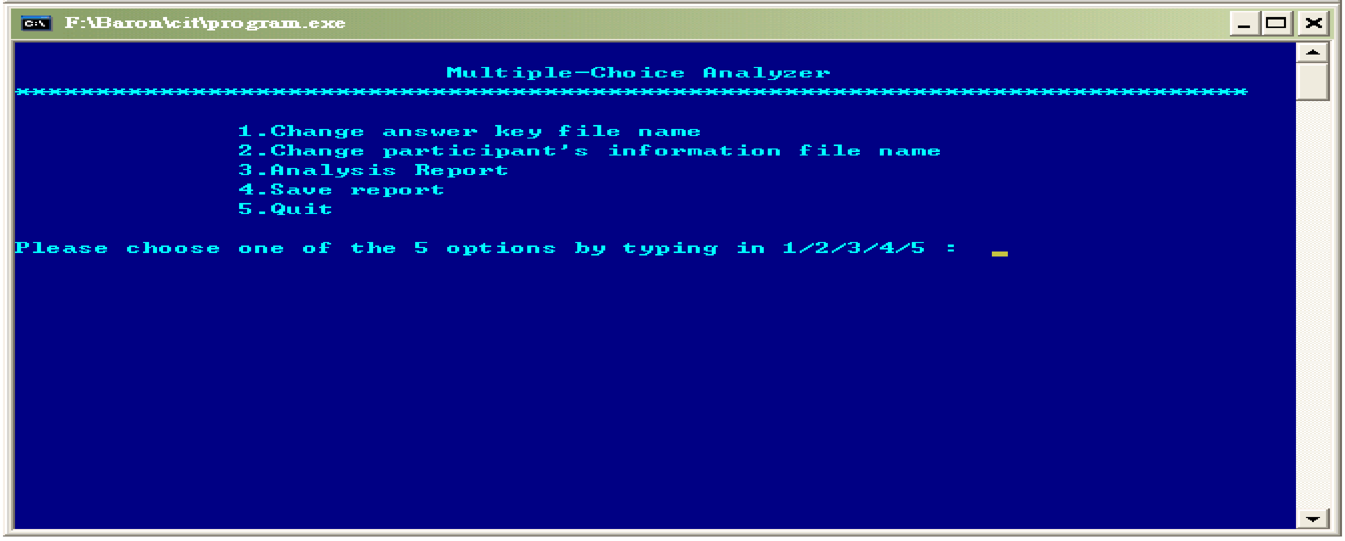
F:\Baron\cit\program.exe

```
                                 Multiple-Choice Analyzer
******************************************************************************

              1.Change answer key file name
              2.Change participant's information file name
              3.Analysis Report
              4.Save report
              5.Quit

Please choose one of the 5 options by typing in 1/2/3/4/5 :
```

Test case number	8
Purpose	Test the function(Do you want to quitY/N?)
Expected result:	Can quit and can resume
Actual result:	Can quit and can resume
Test result	Test is passed
Follow-up Action:	Nil

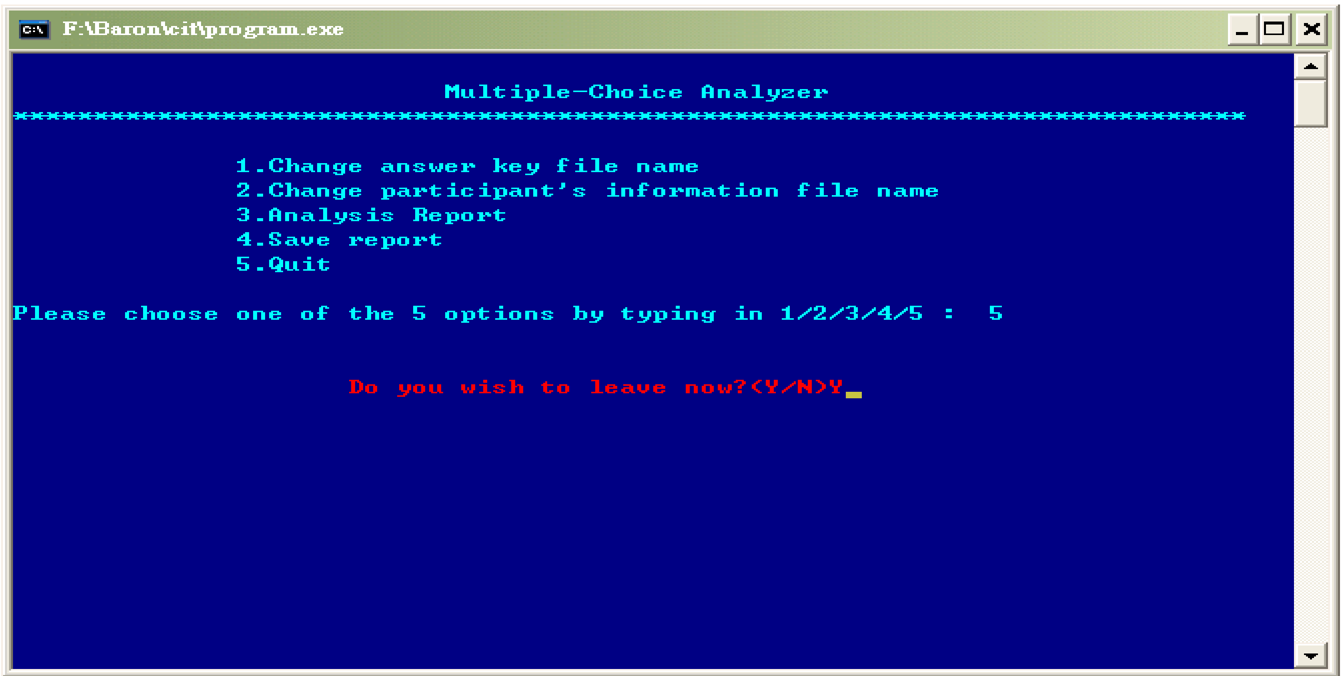


```
                           Multiple-Choice Analyzer
*****************************************************************************

              1.Change answer key file name
              2.Change participant's information file name
              3.Analysis Report
              4.Save report
              5.Quit

Please choose one of the 5 options by typing in 1/2/3/4/5 :  5


                     Do you wish to leave now?(Y/N)N_
```

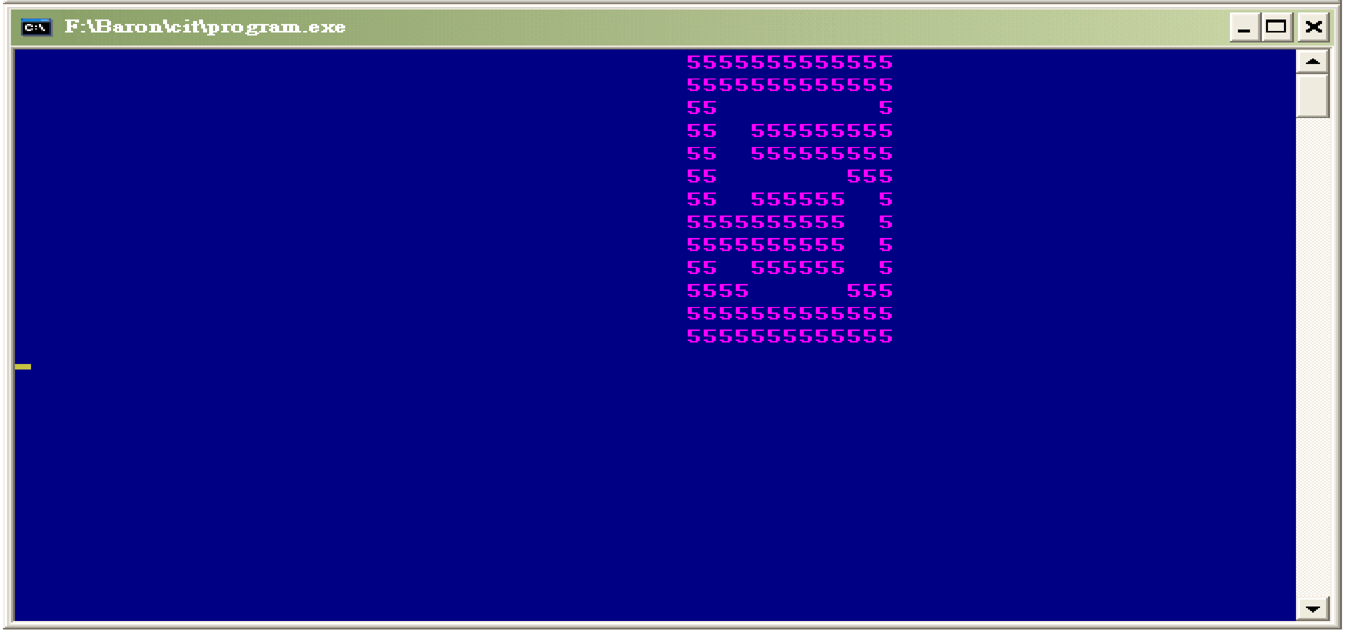


```
                           Multiple-Choice Analyzer
*****************************************************************************

              1.Change answer key file name
              2.Change participant's information file name
              3.Analysis Report
              4.Save report
              5.Quit

Please choose one of the 5 options by typing in 1/2/3/4/5 :  _
```

If the user of the program want to quit, a question message 'Do you wish to leave now?(Y/n) would be shown on the scrren. They message is used for asking the user if they really want to leave or not. If they press no, the program would resume and the question message would disappear.



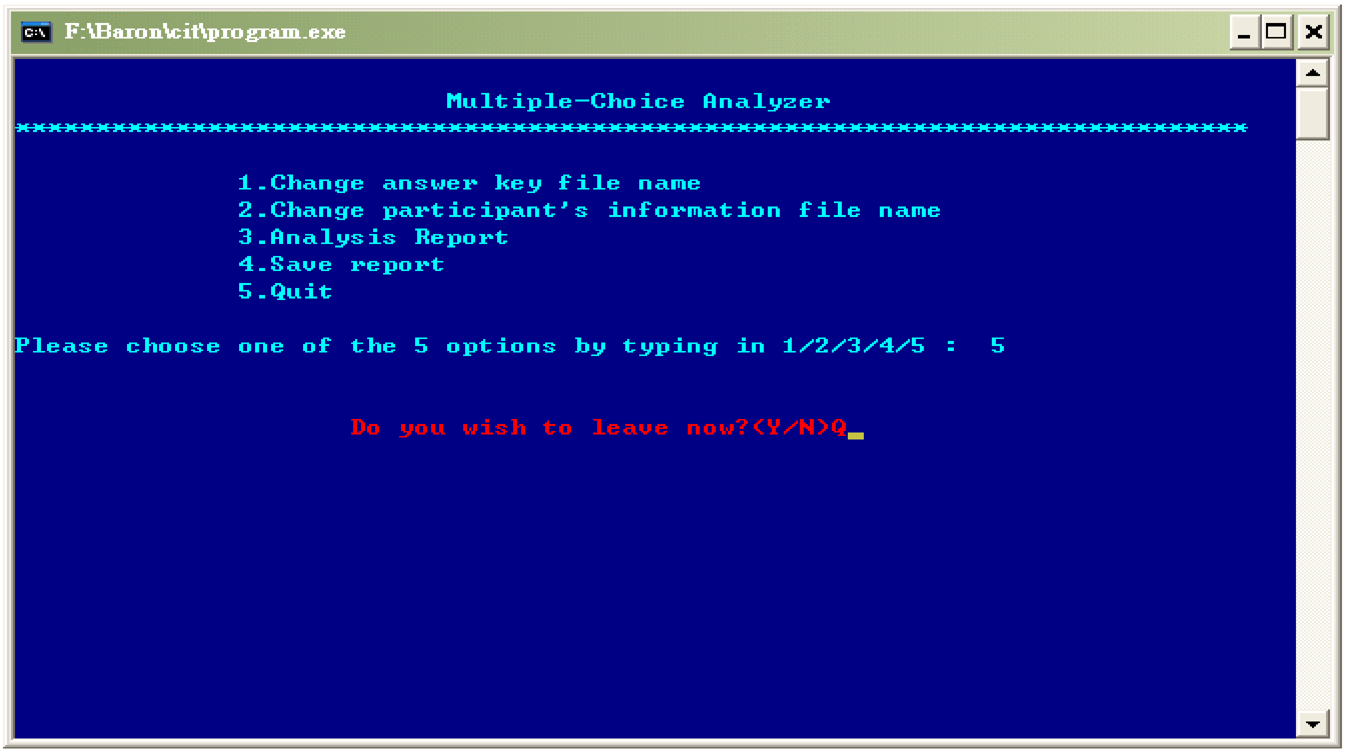
```
                           Multiple-Choice Analyzer
******************************************************************************

              1.Change answer key file name
              2.Change participant's information file name
              3.Analysis Report
              4.Save report
              5.Quit

Please choose one of the 5 options by typing in 1/2/3/4/5 :   5


                     Do you wish to leave now?(Y/N)Y_
```



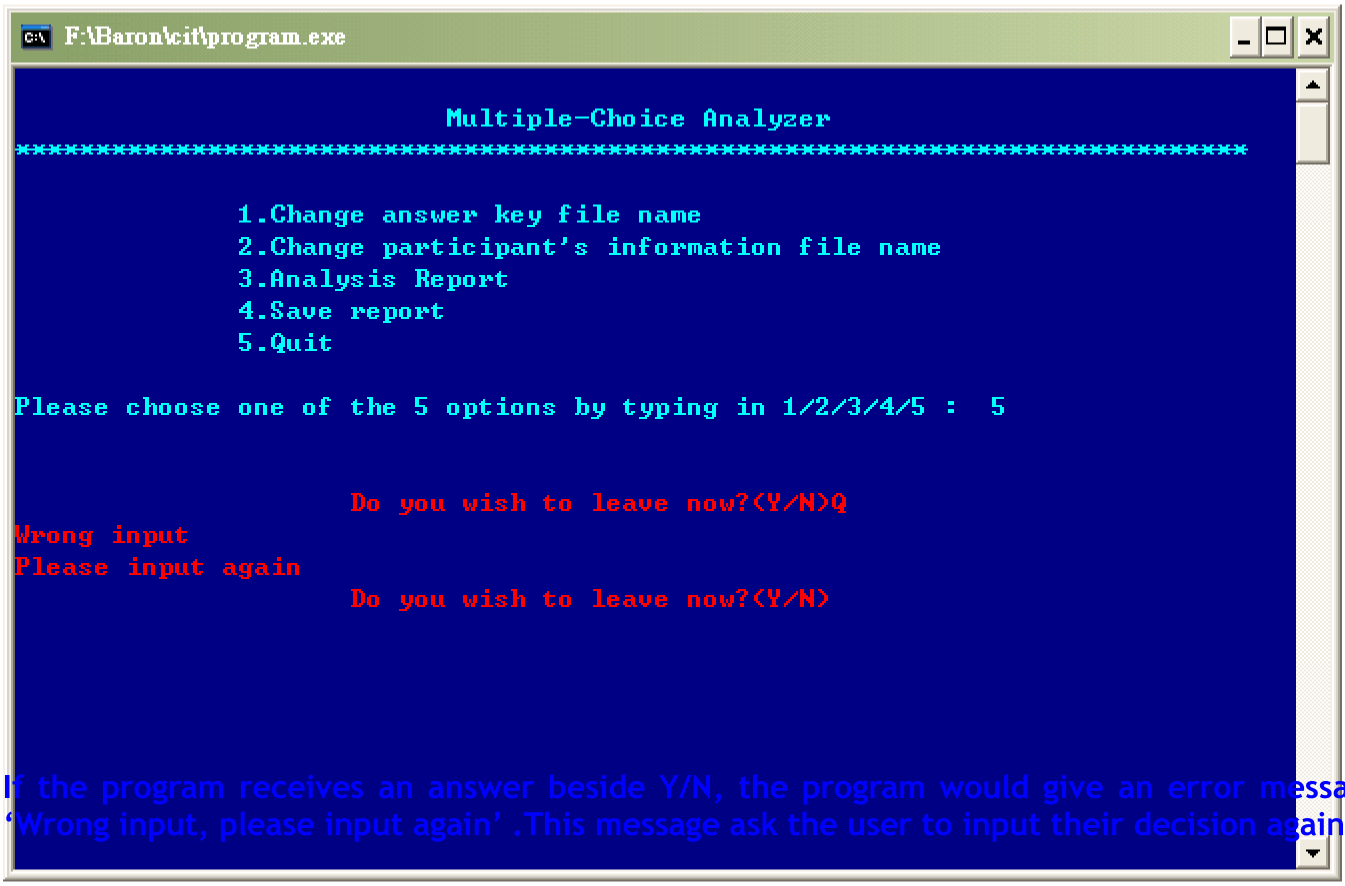
```
                                          5555555555555
                                          5555555555555
                                          55          5
                                          55  555555555
                                          55  555555555
                                          55        555
                                          55  555555  5
                                          5555555555  5
                                          5555555555  5
                                          55  555555  5
                                          5555      555
                                          5555555555555
                                          5555555555555
_
```

If the user of the program presses yes, a count down of 5 seconds will be triggered.’5..4..3..2..1..0..’!

After the 5 secounds countdown, the program window would disappear and the program would stop running.



```
                          Multiple-Choice Analyzer
******************************************************************************

              1.Change answer key file name
              2.Change participant's information file name
              3.Analysis Report
              4.Save report
              5.Quit

Please choose one of the 5 options by typing in 1/2/3/4/5 :  5


                     Do you wish to leave now?(Y/N)Q_
```



```
                          Multiple-Choice Analyzer
******************************************************************************

              1.Change answer key file name
              2.Change participant's information file name
              3.Analysis Report
              4.Save report
              5.Quit

Please choose one of the 5 options by typing in 1/2/3/4/5 :  5


                     Do you wish to leave now?(Y/N)Q
Wrong input
Please input again
                     Do you wish to leave now?(Y/N)
```

If the program receives an answer beside Y/N, the program would give an error message: 'Wrong input, please input again' .This message ask the user to input their decision again.

5.4 Self-Evaluation

Good features

User-friendly

My program can offload the hand-and-eye counting of users and thus reduce human mistakes and prevent threatening of health to users. The marker can save time for marking and counting marks after using this program, they only need to prepare the data files and the answer key files.

Reusability

My program let users to change the answer key file name and the participants' information name so that the program can be reused for many times until the user stop the program.

Special features

My program's analysis report has the graph display function which shows a very clear result to both markers and participants.

Detailed and clear analysis report

My program have many different kinds of analysis result, for example, top five, bottom five, standard deviation, quartile range, question analysis…

Beautiful and friendly interface

My program's welcome screen is made of colourful words making a large word 'MC ANALYZER'. Each instructions or result have colour, users may have good first impression towards my program.

Clear instructions

There are many instructions in my program telling and guiding the user how to use this program to attain the result, there is also a user-guide screen telling user how to use the program.

Shortcoming

For the location of data files

-If the input format is wrong, the program would end automatically.

-If there is typing mistake of the filename, the program would end automatically.

Result of program

-As the time for writing this program is not enough, the analysis results are not as many as a real analysis report.

5.5 External Testing and Evaluation

The way to carry out the external testing and evaluation

To carry out the external testing and evaluation, I can ask my classmates, friends and family members to use my program, and acquire their comments towards

I had upload my program and my data files to the e-class of school, and ask my schoolmates, classmates and friends to have a try on my program, if they had found any bugs or errors in my program, I would thank them for telling me and I would modify them as soon as possible. If they had any comments or evaluation to my program, I would listen to them with open ears.

Here is a sample of a program testing and evaluation form for users to give their comments and feedbacks,

Testing and Evaluation Form

Please help to evaluate the program: Multiple-Choice Analyzer. Thanks!

Instruction:

- Please execute the program according to the instructions in the ReadMe.txt file in the program folder or in the user guide of the program.

Report on Bugs:

No.	Description of errors

Program Evaluation:

Please answer the following questions by circling the numbers on the right hand side.

		Rating				
		Agree			Disagree	
1.	The program is user-friendly	5	4	3	2	1
2.	The design of the input screen is good	5	4	3	2	1
3.	The format of the report is good	5	4	3	2	1
4.	The analysis report is detailed and clear	5	4	3	2	1
5.	The design of data file is good	5	4	3	2	1
6.	The program is reusable	5	4	3	2	1

Which features you like most?

____

What other functions the program should provide?

____

____

____

Other Suggestions

____

____

____

Evaluator's Name: ________________________ **Date: ____________________**

Chapter 6 Conclusion & Discussion

6.1 Pros and cons of my Program

Strength

- ☺ User-friendly

  My program can offload the hand-and-eye counting of users and thus reduce human mistakes and prevent threatening of health to users.

- ☺ Reusability

  My program let users to change the answer key file name and the participants' information name so that the program can be reused for many times until the user stop the program.

- ☺ Special features

  -my program's analysis report has the graph display function which shows a very clear result to both markers and participants.

- ☺ Detailed and clear analysis report

  -my program have many different kinds of analysis result, for example, top five, bottom five, standard deviation, quartile range, question analysis…

- ☺ Beautiful and friendly interface

  -my program's welcome screen is made of colourful words making a large word 'MC ANALYZER'. Each instructions or result have colour, users may have good first impression towards my program.

- ☺ Clear instructions

  -there are many instructions in my program telling and guiding the user how to use this program to attain the result.

Weaknesses

- 😐 For the location of data files

-If the input format is wrong, the program would end automatically.

-If there is typing mistake of the filename, the program would end automatically.

- 😐 Result of program

-As the time for writing this program is not enough, the analysis results are not as many as a real analysis report.

6.2 Future Improvement

This is my first time to write a large program which can handle a list of multiple choice results, calculate marks and release a detailed and clear analysis report, so, I think that there are a lot of improvements that I should make in the future.

As I mentioned above, the analysis results in my program is not as many as those real life analysis report, if I have a chance to write a program look like this in the future, I would add more things into my analysis report, for example, answers distribution, marks distribution, scatter diagrams, stem and leaf diagrams, bar charts, etc. After adding these news results to my program, I think my program would not inferior than a real analysis report.

I wish to make a program for a multiple choice competition with more regulations, say, if a student get one correct answer, he will get 1 mark, if he get one incorrect answer, he would be deducted 1 mark, if he provide no answer, he would get 0 mark. In this program, a more complex and complicated program should be written, and I can learn more new coding in the programming process. Moreover, I want to make a program for a multiple choice competition which have several rounds, participants using different sets of question papers, the more regulation the competition have, the more complex is the program and the more knowledge I can acquire from.

6.3 Self-Reflection

I have never write a coursework in computer and information technology till now, this is the first time for me to have a try to do this huge project. In the process of writing the program and writing the report, I have met many difficulties and I don't know what to do to solve the problem. I had had a intention to give up when I met the difficulties as I had tried to solve the problem for many times but the result is not expected—failure. It is my honor to have my dear cit teacher Mr. Chu and my fellow cit students giving me support, giving me assistance, I want to thank them. Without them, I think I had given up.

I think that I had some places that I do not do well in my program. I think that I had not tried my best in doing this coursework. I always do my work reluctantly and without think thrice before I act. These acts bring me to the cul-de-sac, wasting me time. If I did my work seriously and think about the result before doing, I think I can save a lot of time for doing more things and improving the program. If I have a chance to do similar coursework in the future, I would try my best and do my best.

Chapter 7 Reference and Acknowledgement

Acknowledgement

For reference

From Internet websites:

http://www.useful.com.hk/~abc

http://rinkworks.com/namegen/ (generating students' names)

http://en.wikipedia.org/wiki/List_of_Pok%C3%A9mon(generating students' names)

http://www.hkeaa.edu.hk (for providing school names)

http://www.wikipedia.org/ (for information of different kinds of programming language and OS platform)

http://hk.yahoo.com (for searching information)

www.google.com.hk (for searching information)

http://yy2.hkcampus.net/~yy2-lch/pascal/ (for learning Pascal coding)

http://community.freepascal.org:10000/bboards/forum?forum_id=24086&old_count=1

http://www.softpanorama.org/Lang/pascal.shtml

http://www.semaphore-software.com/blog/2007/01/30/pascal-to-c-conversion.html

http://www.gamedev.net/community/forums/topic.asp?topic_id=468093

http://www.hksune.com/discuz/viewthread.php?tid=73825&extra=page%3D1

http://www.hku.hk/cc_news/ccnews91/omr.html

http://www.onosokki.co.jp/English/hp_e/patio/pascal.htmn

http://pascalprogramming.byethost15.com/articles/index.php

http://www.fearofphysics.com/Sound/sounds.html

http://pascal.unas.cz/

http://www.table-ascii.com/ (ascii table)

http://www.macdonald.egate.net/CompSci/Pascal/hstrings.html#upcase (up-case function)

http://www.programmersheaven.com/user/Actor/blog/115-Trimming-strings(right-trimming function)

http://mc-computing.com/Languages/Strings.htm

From Books

1. Pascal 語言三日通 / Sam A, Abolrous 編著 ； 招兆鏗譯
2. Pascal for students, including Turbo Pascal / Brian D. Hahn, Ray Kemp
3. 2009 Computer and Information Technology Coursework:
   Skills & Practice Module A (Algorithm and Programmming)/Frankie Tam

.

For assistance and support

My CIT teacher, Mr. Chu
My CIT classmates
Form 5D classmates and friends

Teachers who give my support:
Mr Chan, Mr Lau, Miss Chan, Miss Yip, Mr Leung…

Appendix 1 – Program Code

```
program Mathematicscompetition;                        {program name}

uses crt;

const maxstudno =200;                                  {the maximum number of participants}

      maxsch=20;                                        {the maximum number of schools}

      questno=50;                                       {the total number of questions}

      passing_mark=(questno/2);                         {passing mark of the competition}

var  username:  string;                                {The  name  of  the  user  who  use  this  MC analyzer}

     answer : string[questno];                       {Answer key variable}

     stud_sch : array[1..maxstudno] of string[45];   {students'   school array}

     stud_name : array[1..maxstudno] of string[15];  {students'   name array}

     stud_score : array[1..maxstudno] of integer;    {students'   score array}

     stud_ans: array[1..maxstudno] of   string[50];  {students'   answer array}

     sch_name : array[1..maxsch] of string[45];      {schools' name array}

     sch_size : array[1..maxsch] of integer;         {number of the students in each school array}

     sch_totalscore: array[1..maxsch] of real;       {total score of each school array}

     sch_avg: array[1..maxsch] of real;              {average score of each school array}

     quest_corr:  array[1..questno]  of  integer;    {number  of  participants  got  the  answer  correct array}

     stud_count:integer;                               {total number of students variable}

     sch_count:integer;                                {total number of schools variable}

     stud_score_total:integer;                        {total score of all students}

     passing_rate : real;                             {Passing rate of the competition}

     stud_pass :integer;                               {number of pass students}



procedure instructions ;                {telling the user how to use the program}

begin

textcolor(12);
```

```
writeln('                                              <Multiple-choice analyzer user-guide>');

writeln;

textcolor(26);

writeln('Please read the following instructions before using this program.');

writeln;

writeln('Steps of using the program ');

writeln('———————————');

writeln('1) Run the exe file''PROGRAM.EXE'' to start the program');

writeln('2) File name of the answer key are( ''ANSKEY.txt'',''ANSKEY2.txt'',''ANSKEY3.txt'')');

writeln('3) File name of the participants'' answers and information are ''MCDATA.txt'',''MCDATA2.txt'')');

writeln;

writeln('then ');

writeln;

writeln('You would come to a menu:');

writeln('1.Change answer key file name(ANSKEY.txt,ANSKEY2.txt,ANSKEY3.txt) ');

writeln('2.Change participant''s information file name(MCDATA.txt,MCDATA2.txt)');

writeln('3.Analysis report(It is a sub-menu,there are a list of anaylyzing result for you to select,from A to P)');

writeln('4.Save report');

writeln('(You can enter any file name that you want,but please be reminded that you should add ''.txt'' after the output file name. ');

writeln;

writeln('Analysis report ');

writeln('———————');

writeln('if you use the searching function of the program in the analysis report, please be reminded that you should use');

writeln('capital letter when typing a student name of a school name,any punctuations in the names are also required to type in too.');

writeln;

writeln('*****************************************************************************');

writeln;

textcolor(18);
```

```
writeln('Please press <Enter> to continue');
readln;
end;


procedure reading_ans_keys;                            {the procedure for reading the answer key}
var
ans_file_name: string;                                 {the file name variable of answer key inputted
by the user}
infile:text;                                           {the answer key file varible}
begin
clrscr;
write('Please enter the filename of the answer keys: ');
textcolor(14);                                         {the colour of the text}
readln(ans_file_name);                                 {Read answer key from the user}
assign(infile,ans_file_name);                          {Assign the file name which the user type as the
answer key}
reset(infile);
read(infile,answer);                                   {Read the answer from the answer key to the
program}
{writeln(answer);}                                     {Testing uses}
{readln; }
close(infile)


end;


procedure reading_stud_record;
  var
     stud_file_name:string;                            {the file name of the participants varible}
     infile:text;
     stud_record:  string[110];                        {this record contains the participant's name,
school name
                                                          and the corresponding answers}
```

```
        i,j: integer;                                              {Counter variable}


      begin

      clrscr;

      textcolor(18);

                                                              {asking  the  user  to  input  the  participants'
file name}

      write('Please enter the filename of the Students'' Answers: ');

      textcolor(14);

      readln(stud_file_name);

      assign(infile,stud_file_name);

      reset(infile);


      i:=0;


     while not eof(infile) do                                   {while the condition is not the end of file do}

       begin

       i := i+1;

       readln(infile,stud_record);                              {read students' record}

       stud_sch[i] := copy(stud_record,1,45);                  {copy i th student's school name}

       stud_name[i]:=copy(stud_record,46,15);                    {copy i th student's name}

       stud_ans[i]:=copy(stud_record,61,50);                    {copy i th student's answers}


       end;

       close(infile);

       stud_count :=i;                                          {count the number of students}

       {for j := 1 to stud_count do

       writeln(stud_ans[j]);                                   Test if the answer key are inputted successfully

       writeln('Data input successfully!');

       readln       }
```

```
   end;


procedure calculate_stud_scores;                              {procedure for calculating students' scores}

     var

         i,j,k,a,corr_count: integer;                         {Counter variable}

     begin

           stud_score_total:=0;                               {initialize total score of all students}

         for k :=1 to questno do                              {from the 1st question to the (questno)th question}

             quest_corr[k] := 0;                   {initialize total number of students get the k th question correct}


         for i := 1 to stud_count do               {from the 1st student to the total number of students)th student}

            begin

         corr_count:=0;                            {initialize number of correct answers for one student}


         for j :=1 to questno do                   {from the 1st question to the (questno) th question}

         begin

         if stud_ans[i][j] = answer[j] then        {compare i th student j th answer with j th answer key}

             begin

             corr_count := corr_count +1;          {if they are equal,one mark will be added to the i th student}


                             {one student would be added to the total number of students get the j th question correct}

             quest_corr[j] := quest_corr[j]+1 ;

             end;

             end;

             stud_score[i] := corr_count;          {sum up the score of the i th student}

             stud_score_total := stud_score_total+ stud_score[i];      {sum up the total score of all students}

         end;
     {for a:= 1 to stud_count do                          Test if the students' score can be corrected and
       writeln(stud_score[a]);                                 the total number of students can be count
       writeln('Number of students:',stud_count);
       readln    }
 end;


procedure calculate_sch_score;                 {the procedure for calculating school score}
var
    i, j ,t: integer;
    found : boolean;
begin
   for i := 1 to sch_count do
     begin
       sch_totalscore[i]:=0;
       sch_avg[i]:=0;
     end;
  sch_name[1] := stud_sch[1];                   {assign 1st school name= 1st student's school name}
  sch_size[1] := 1;                             {assign the number of students in the 1st school be 1}
  sch_totalscore[1]:=stud_score[1];             {assign the 1st school total score be   the 1st student's score}
  sch_count := 1;                               {assign the total number of schools be 1}
  for i :=2 to stud_count do
    begin
      j:=1;                                     {initialize counter variable}
      found := false;                           {initialize boolean variable}
      repeat
           if sch_name[j] = stud_sch[i] then      {check if j th school name is equal to i th student's school}
              begin
                 sch_size[j] := sch_size[j]+1;     {add 1 to the total number of students of the j th school}
```

```
                  sch_totalscore[j] := sch_totalscore[j] + stud_score[i];{count the j th school total score}
                  found := true                       {the school name have read before}
               end
           else
                  j := j+1                            {count the total number of schools}
        until found or (j> sch_count);

            if not found then                         {if the school name have not been read before}
                 begin
                    sch_count:=j;
                    {the number of schools is equal to the position where the school name had not been read before}
                   sch_name[sch_count] :=stud_sch[i];
{the school name of the position where we stop is equal to the i th student's school}
                   sch_size[sch_count] := 1;
{add 1 student to the number of students of the new school}
                    sch_totalscore[sch_count] := sch_totalscore[sch_count]+ stud_score[sch_count];
{calculate the total score of the new school}
                end
      end;

      for i:=1 to sch_count do
         begin                                                    {from the 1st school to the number of schools}
            sch_avg[i] := sch_totalscore[i]/sch_size[i];      {calculate the corresponding school score}
         end;
      {for t:= 1 to sch_count do                             Testing use
         writeln(sch_avg[t]:5:2);
         readln;     }
   {     for t:=1 to sch_count do                            Testing use
        writeln(sch_name[t]) ;
```

```
          readln;}
        end;


procedure sort_stud_score;                                   {the procedure for sorting students' scores}
var
    k,j :integer;
    tmp_sch : string[45];                                   {temporary school}
    tmp_studname        : string[15];                         {temporary student name}
    tmp_score : integer;                                    {temporary score }
    begin
    {Bubble Sort}
    for k := 1 to stud_count-1 do
      for j := 1 to stud_count-k do
          if stud_score[j] < stud_score[j+1] then      {compare the j th score with the score behind it}
      begin
              tmp_sch := stud_sch[j];                              {Swaping students' school name}
              stud_sch[j]:= stud_sch[j+1];
              stud_sch[j+1] := tmp_sch;

              tmp_studname := stud_name[j];                  {Swaping students' name}
              stud_name[j]:= stud_name[j+1];
              stud_name[j+1] := tmp_studname;

               tmp_score := stud_score[j];                      {Swaping students' score}
               stud_score[j]:=stud_score[j+1];
               stud_score[j+1]:=tmp_score;
              end;
              end;
```

```
procedure sort_sch_score;                                    {the procedure for sorting school score}
var
    k,j :integer;
    tmp_schname        : string[45];                         {temporary school name}
    tmp_score : real;                                        {temporary school score}
    begin
    {Bubble Sort}
    for k := 1 to sch_count-1 do
      for j := 1 to sch_count-k do
          if sch_avg[j] < sch_avg[j+1] then            {comparing j th school score with the school's score    behind it}
      begin
            tmp_schname := sch_name[j];                      {Swaping school name}
            sch_name[j]:= sch_name[j+1];
            sch_name[j+1] := tmp_schname;

             tmp_score := sch_avg[j];                     {Swaping school score}
             sch_avg[j]:=sch_avg[j+1];
             sch_avg[j+1]:=tmp_score;
       end;
       end;

procedure cal_passing_rate;
var i: integer;
    begin
       stud_pass :=0;
       i:=0;
       for i := 1 to stud_count do
          if stud_score[i] >= passing_mark    then
          begin
              stud_pass := stud_pass+1;
```

```
        end;

        passing_rate := (stud_pass/stud_count)*100 ;

    end;


     procedure show_top_five;                    {procedure for showing top five students}

     var

     i : integer;

     begin

       clrscr;                                   {clear screen}

       textcolor(13);

       writeln;

       writeln('                              Top Five Students ');

       writeln('           ————————————————————');

       writeln;

       textcolor(14);

       writeln('Rank','School name':16,'Student''s name':51,'Score':8);

       writeln('————————————————————————————————');

       for i := 1 to 5 do

       writeln(i:3,stud_sch[i]:50, stud_name[i]:20, stud_score[i]:3);

       textcolor(13);

       writeln;

       writeln;

writeln('***************************************************************************
**');

       textcolor(18);

       writeln('Please press <Enter> to continue');

       readln

     end;
```

```
procedure show_bottom_five;                    {procedure showing bottom five students}

var

i : integer;

begin

    clrscr;

    textcolor(13);

    writeln;

    writeln('                                    Bottom Five Results ');

    writeln('            ——————————————————');

    writeln;

    textcolor(14);

    writeln('Rank','School name':16,'Student''s name':51,'Score':8);

    writeln('————————————————————————————');

    for i := stud_count-4 to stud_count do

    writeln(i:3,stud_sch[i]:50, stud_name[i]:20, stud_score[i]:3);

    writeln;

    textcolor(13);

writeln('*****************************************************************************');

    textcolor(18);

    writeln;

    writeln('Please press <Enter> to continue');

    readln

end;




procedure show_sch_average;                    {procedure showing schools average score}

var
```

```
    i : integer;
    begin
    clrscr;
        textcolor(13);
        writeln;
        writeln('                                   School Average');
        writeln('             ——————————————————————');
        writeln;
        textcolor(14);
        writeln('School name':10,'No. of participants ':45,'Average score':20);
        writeln('——————————————————————————————————');
        for i := 1 to sch_count do
        begin
        writeln(sch_name[i],sch_size[i]:5,sch_avg[i]:25:2) ;
        end;
        writeln;
        textcolor(13);
writeln('*****************************************************************************');
        writeln;
        textcolor(18);
        writeln('Please press <Enter> to continue');
        readln;
    end;




procedure stud_result;                                   {procedure showing students' result}
    var i: integer;
    begin
        clrscr;
        textcolor(13);
        writeln;
        writeln('Student Results : ');
        writeln;
        textcolor(14);
        writeln('Total number of students',stud_count);
        writeln;
        writeln( '                    Scores of students in descending order');
        writeln('           ______________________');
        writeln;
        writeln('Rank','School Name':15,'Student Name':43,'Score':8);
        writeln('________________________________________');
                 for i:= 1 to stud_count do
                  writeln(i:3,'.     ',stud_sch[i]:45, stud_name[i]:15,stud_score[i]);
        writeln;
        textcolor(13);

writeln('***************************************************************************
**');
        textcolor(18);
        writeln;
        writeln('Please press <Enter> to continue');
       readln
    end;




procedure sch_result;                                       {procedure show school results}

var    i : integer;
```

```
   begin
   clrscr;
  textcolor(13);
  writeln;
  writeln('School Results:');
  writeln;
  textcolor(14);
  writeln('Total number of Schools: ',sch_count);
  writeln;
  writeln( '                        Average score of schools in descending order ');
  writeln('                     ——————————————————————');
  writeln;
  writeln( 'Rank','School Name':15,'Size':39,'Average Score':21);
  writeln('——————————————————————————————————');
  for i := 1 to sch_count do
        writeln(i:3,'.      ',sch_name[i]:45,sch_size[i]:6,sch_avg[i]:20:2);
        writeln;
        textcolor(13);

writeln('**********************************************************************************');
        writeln;
        textcolor(18);
        writeln('Please press <Enter> to continue');
        readln
  end;



procedure question_analysis;                              {procedure showing correct rate for each question}
  var i:integer;
```

```
   begin
   clrscr;
   textcolor(13);
   writeln;
   writeln('                              Question Analysis');
   writeln('            ————————————————————');
   writeln;
   textcolor(14);
   writeln('Percentage correct for each question');
   writeln;
   writeln('——————————————————————————————');
   for i := 1 to 9 do
     begin
       {calculating the correct rate for the i th question}
       write('    Q',i:3,'.',quest_corr[i]/stud_count*100:6:2, ' %');
       if i mod 5=0 then
   writeln
     end;
   for i := 10 to questno do
    begin
       write('    Q',i:3,'.',quest_corr[i]/stud_count*100:6:2,' %');
       if i mod 5 =0 then
       writeln
       end;
   textcolor(13);
   writeln;
writeln('****************************************************************************');
   writeln;
   textcolor(18);
```

```
writeln('Please press <Enter> to continue');
readln
end;

procedure sd;                                          {procedure showing standard deviation}
var
stud_score_mean , abs_value_total: real;     {students' score mean, absolute value total}
abs_value : array[1..maxstudno] of real;     {absolute value}
sd: real;                                              {standard deviation}
i: integer;

begin
stud_score_mean :=0;                                {initialize students' score mean}
{Find mean}
stud_score_mean := stud_score_total/stud_count;

{Find absolute value}
i:=0;                                           {initialize counter variable}
abs_value_total :=0;                      {initialize total of absolute value}

for i := 1 to stud_count do                               {from the 1st student to the (student count) th student}
begin
{find out difference of the i th student score and the mean}
abs_value[i] := stud_score[i]- stud_score_mean;
{find out total of absolute value of the square of all students' absolute value}
abs_value_total      := abs_value_total + sqr(abs_value[i]) ;
end;
{extract the total of absolute value over total number of students}
sd      :=    sqrt(abs_value_total/stud_count) ;
```

```
     {Show standard deviation}

     writeln;

     textcolor(14);


writeln('******************************************************************************
**');

     writeln('Standard deviation : ',sd:5:2);                    {Show standard deviation}

     textcolor(13);


writeln('******************************************************************************
**');

     textcolor(18);

     writeln;

     writeln('Please press <Enter> to continue');

     readln

     end;




     procedure variance;                              {procedure showing variance}

     var

     stud_score_mean , abs_value_total: real;

     abs_value : array[1..maxstudno] of real;

     variance :    real;

     i:integer;


       begin

     {Find mean}

     stud_score_mean :=0;

     stud_score_mean := stud_score_total/stud_count;




     {Find absolute value}
```

```
      abs_value_total :=0;

      i:=0;

    for i := 1 to stud_count do

     begin

     abs_value[i] := stud_score[i]- stud_score_mean;

     abs_value_total      := abs_value_total + sqr(abs_value[i]) ;

     variance      := abs_value_total/stud_count ;

     end;

     writeln;

     textcolor(14);

writeln('*****************************************************************************');

     writeln('Variance : ',variance:5:2);                    {Show variance}

     textcolor(13);

writeln('*****************************************************************************');

     textcolor(18);

     writeln;

     writeln('Please press <Enter> to continue');

     readln

     end;




procedure quartile;                                    {procedure showing quartile range}

  begin

  textcolor(14);

     writeln;

writeln('*****************************************************************************');

     {find out and show the 1st quartile}
     writeln('1st Quartile : ',stud_score[trunc(stud_count*0.75)]    );

     writeln;

     {find out and show the 2nd quartile}

     writeln('2nd Quartile : ',stud_score[trunc(stud_count*0.5)]      );

     writeln;

     {find out and show the 3rd quartile}

     writeln('3rd Quartile : ',stud_score[trunc(stud_count*0.25)]    );

     textcolor(13);


writeln('***************************************************************************
**');

textcolor(18);

     writeln;

     writeln('Please press <Enter> to continue');


readln;

end;




procedure mean;                                          {procedure showing mean}

     var

     stud_score_mean : real;

     begin

     stud_score_mean := 0;                                     {Initialize the mean}

     stud_score_mean := stud_score_total/stud_count;      {Find out the mean}

     textcolor(14);


writeln('***************************************************************************
**');

     writeln('Mean:    ',stud_score_mean:5:2);                  {Show mean}

     end;
```

```
procedure median;                                   {procedure showing median}
   var
   median : real;
   begin

   if (stud_count mod 2 =0 )then          {if the total number of students is even number}
                                           {median equals to the sum of the middle two numbers divide
by 2}
       median := (stud_score[round(stud_count/2)]+stud_score[trunc(stud_count/2)])/2

   else                                              {if the total number of students is odd number}
       median := stud_score[round(stud_count/2)];   {the median is equal to the middle student}

   textcolor(14);
   writeln('Median:    ',median:5:2);              {Show median}
   textcolor(13);
writeln('***************************************************************************
**');
   writeln;
   textcolor(18);
   writeln('Please press <Enter> to continue');
   readln
   end;

procedure mode;                                      {procedure showing mode}
   var
   freq : array[0..questno] of integer;        {array storing number of students get a answer correct}
   i ,j,mode: integer;
   begin

   for i := 0 to questno do                    {initialize all the frequency}
      freq[i] := 0;

   for i := 1 to stud_count do                 {calculating the frequency}
       freq[stud_score[i]]:= freq[stud_score[i]]+1;

   mode := 0 ;                                   {initialize mode}
   for j := 0 to questno do
      if freq[j] > freq[mode] then            {find out the highest frequency,mode}
           mode := j;

   textcolor(14);
   write('Mode:    ');                         {show mode}

   for j := 0 to questno do
       if freq[j] = freq[mode] then           {if there are one or more frequencies which are same and the
highest}
         write(j,'       ');                   {show all of them as mode}
         writeln;
   end;




procedure barchart_questcorr;            {procedure showing number of students get the question correct}
var
      i ,j: integer;
      quest_corrbar : array[1..questno] of integer;   {array storing number of '*'s of the i th bar}
```

```
    begin

    clrscr;

    writeln('                                        Question Correct Graph');      {title of the graph}

    writeln('——————————————————————————————');

    i := 0;

    for i := 1 to questno do                                        {from the 1st question to the (questno)th question}

          begin                                                     {calculate  the  corresponding  numbers  of  '*'s  in  its
bar}

               quest_corrbar[i] := trunc((quest_corr[i]/200)*50);

          end;


    for i := 1 to questno do

       begin

                textcolor(13);

                delay(10);                                          {delay 10/100 secound}

                write('Q ',i:2, '    X      ') ;                   {showing the Y-axis}


                        for j := 1 to quest_corrbar[i] do          {showing number of '*'s of the question}

                              begin

                                    textcolor(18);

                                    write('*');

                              end;

               writeln ('(', quest_corr[i], ')') ;            {showing number of students get the question correct}


               end;

    textcolor(14);

    writeln('——————————————————————————————');

    writeln('                          Number of students    get the answer correct                                    ');

    textcolor(13);

writeln('******************************************************************************
**');
    writeln;
    textcolor(18);
    writeln('Please press <Enter> to continue');
    readln;

    end;


procedure barchart_grade;                                   {procedure showing the bar chart of students grading}
    var
                                                                    {array storing numbers of students get a grade}
            Count : array ['A'..'F'] of integer;
                                                            {array storing numbers of students get a grade, using for
making the bar}
            Countbar : array['A'..'F'] of integer;
            i : integer;
            Ch : char;                                  {character of grades}
    begin
    clrscr;
    writeln;
    textcolor(13);
    for Ch := 'A' to 'F' do                         {from grade 'A' to grade 'F'}
            Count[Ch] := 0;                             {Initialize the numbers of students get the grade}
    for i := 1 to stud_count do                     {from the 1st student to the (total number of students)th student}
          case stud_score[i] of                              {find out the total number of students get that grade}
             0..19 : Count['F'] := Count['F'] +1;        { 0 to 19 mark get grade 'F'}
           20..25 : Count['E'] := Count['E'] +1;         {20 to 25 mark get grade 'E'}
           26..30 : Count['D'] := Count['D'] +1;         {26 to 30 mark get grade 'D'}
           31..40 : Count['C'] := Count['C'] +1;         {31 to 40 mark get grade 'C'}
           41..46 : Count['B'] := Count['B'] +1;        {41 to 46 mark get grade 'B'}
           47..50 : Count['A'] := Count['A'] +1;        {47 to 50 mark get grade 'A'}
          end ;
                                                                   {showing the title of graph}
       writeln('                                Grade Distribution Graph');
       writeln('           ——————————————————————');
       writeln;
     for Ch := 'F' downto 'A' do
          begin
             textcolor(14);
{showing the Y axis}
             write('Grade ',Ch, '    XX    ');
{calculate the corresponding numbers of '*'s in its bar}
             Countbar[Ch] :=    trunc((Count[Ch]/200*100))    ;
             textcolor(18);
             for i := 1 to Countbar[Ch] do           {showing the bar}
              write('*');
              writeln ('(', Count[Ch], ')')         {showing the total number of students get that grade}
              end;
              writeln;
              textcolor(14);
              writeln('——————————————————————————————');
              writeln;
              textcolor(18);
              writeln('Please press <Enter> to continue');
              readln;
      end;


procedure mark_distribution_graph;               {procedure showing the graph of mark distribution}
```

```
var
      i ,j: integer;
      freq : array[0..questno] of integer; {array storing number of students get the mark,frequency}

   begin
   clrscr;                                       {clear screen}
   i := 0;                                        {initialize counter variable}
   for i := 0 to questno do
      freq[i] := 0;                              {initialize frequencies}

   for i := 1 to stud_count do             {from the 1st student to the (total number of students) th student}
       freq[stud_score[i]]:= freq[stud_score[i]]+1;     {calculating the corresponding frequency}

   writeln('                                      Mark distribution Graph');     {show the title}
   writeln('————————————————————————————————————————');
   writeln('Mark');
   for i := 0 to questno do                                 {from the 0 mark to 50 mark }
       begin
          textcolor(13);
          delay(10);
          write(i:2, '    XX    ');                      {showing question number and the Y-axis}
          textcolor(18);
             for j := 1 to freq[i] do              {showing number of '*' of the question bar}
             write('*');
              writeln ('(', freq[i], ')')       {showing the frequency of the question}
       end;
    textcolor(14);
   writeln('————————————————————————————————————————');
   writeln('                     No. of students    get this mark                                      ');
   writeln;
   textcolor(13);


writeln('****************************************************************************
**');

   writeln;

   textcolor(18);

   writeln('Please press <Enter> to continue');

   readln;

   end;






procedure stud_searching;                        {procedure for searching student}

var

     Target : string;                           {the student name need to be searched}

     found : boolean;

     i :integer;

     found_index: integer;                       {the position of the student found}


  Function RTrim (Var S : String) : String ;     {function for deleting space in a student name string}

       {

           RTrim – remove trailing blanks

       }

       Var

           i : Byte ;

       begin { RTrim }

           for i := Length(S) downto 1 do

               if S[i] > ' ' then begin

                   S       := Copy(S,1,i) ;

                   RTrim := S ;

                   Exit
```

```
                end ;

            {

                    if we reach this point then S contains only BLANKS

                so we return a null string

            }

            S       := '' ;

            RTrim := S

        end ; { RTrim }



    begin

        writeln;

        textcolor(13);

        write('Enter the student name to searched:    ');      {ask the user to enter the student name need to
be searched}

        textcolor(14);

        readln(Target);

             textcolor(10);

             write('Data seacrhing ');

             delay(500);

             write('.');

             delay(500);

             write('.');

             delay(500);

             writeln('.');


        Found := FALSE;                 {initialize found boolean variable}

        i := 0;                        {initialize counter variable}

        found_index := 0;              {initialize position of the student found}
```

```
   for i := 1 to stud_count do             {from the 1st student to the (total number of students) th student}

     if RTrim(stud_name[i])  = Target then   {compare the student name list with the name the uesr inputted}

       begin                               {if they are equal}

         found_index:=i;                {the position where we found the student name is equal to the i th student}

         found := true;                {the student is found}

       end;

   if found                              {if the student is found}

       then

       begin

       textcolor(10);

       writeln;

       writeln('The data is in the list!') ;   {tell the user that the student is found}

       writeln;

       delay(100);

       textcolor(13);

       writeln ;

       writeln('Here is his/her rank:');    {show the student's rank,school name,name,score}

       writeln;

       textcolor(14);

       writeln('Rank','Student''s school name':25,'Student name': 35,'Score':12);

       writeln('————————————————————————————————————————');

writeln(found_index,stud_sch[found_index]:50,stud_name[found_index],stud_score[found_index]:15);

       end

       else                              {if the student is not found}

       begin

       textcolor(10);                    {apologize to and tell the user that the student is not found}

       writeln('Sorry. The data is not in the list.');

       end;
```

```
          textcolor(13);

writeln('****************************************************************************
**');

          writeln;

          textcolor(18);

           writeln('Please press <Enter> to continue');

               readln;


     end;


procedure sch_searching;                    {procedure for searching school}

var

    Target : string;                         {the school name need to be searched}

    found : boolean;

    i ,found_index: integer;             {the position of the school found}


  Function RTrim (Var S : String) : String ;    {function for deleting space in a school name string}

      {

         RTrim – remove trailing blanks

      }

      Var

         i : Byte ;

      begin { RTrim }

         for i := Length(S) downto 1 do

            if S[i] > ' ' then begin

               S         := Copy(S,1,i) ;

               RTrim := S ;

               Exit

            end ;

         {
               if we reach this point then S contains only BLANKS
            so we return a null string
         }
         S     := '' ;
         RTrim := S
      end ; { RTrim }



   begin
      textcolor(13);
      writeln;                      {ask the user to enter the school name need to be searched}
      write('Enter the school name to be searched:      ');
      textcolor(14);
      readln(Target);
          textcolor(10);
          write('Data seacrhing');
          delay(200);
          write('.');
          delay(200);
          write('.');
          delay(200);
          writeln('.');

      Found := FALSE;                  {initialize found boolean variable}
      i := 0;                          {initialize counter variable}
      found_index := 0;                 {initialize position of the school found}
      for i := 1 to sch_count do   {from the 1st school to the (total number of schools) th school}
        if RTrim(sch_name[i]) = Target then   {compare the school name list with the name the uesr inputted}
          begin                              {if they are equal}
            found_index:=i;                 {the position where we found the school name is equal to the i
```

```
th school}
              found := true;                    {the school is found}
            end;
       if found                                 {if the school is found}
            then
            begin
            textcolor(10);
            writeln;
            writeln(' The data is in the list!') ;    {tell the user that the school is found}
            writeln;
            delay(100);
            textcolor(13);
            writeln;
            writeln('Here is the school rank:');      {show the school's rank,name,score}
            writeln;
            textcolor(14);
            writeln('Rank':4,'School name': 20,'School score':44);
            writeln('——————————————————————————');
            writeln(found_index:3,sch_name[found_index]:40,sch_avg[found_index]:22:2);
            end
            else                                {if the school is not found}
            begin
            textcolor(10);                        {apologize to and tell the user that the school is not found}
            writeln('Sorry. The data is not in the list.');
            end;
            textcolor(13);

writeln('***************************************************************************
**');
            writeln;
            textcolor(18);
```

```
          writeln('Please press <Enter> to continue');
               readln;

     end;

procedure stud_rank_searching;           {procedure for searching student ranking}
var
    Target : integer;              {the student rank need to be searched}
    found : boolean;
    i ,found_index: integer;       {the position of the school found}

begin
      writeln;                            {ask the user to enter the school name need to be searched}
   repeat
      textcolor(13);
      write('Enter the student rank need to be searched:    ');
      textcolor(14);
      readln(Target);

      if Target<=0 then
        begin
            writeln('A rank must be larger than 0');
        end;

      if Target>stud_count then
          begin
          textcolor(10);
          writeln('There is only ',stud_count,' schools');
          writeln('Please input again!');
          end;
   until (target>0) and (target<stud_count) ;


      begin

         textcolor(10);

         write('Data seacrhing');

         delay(200);

         write('.');

         delay(200);

         write('.');

         delay(200);

         writeln('.');


      i := 0;                              {initialize counter variable}

      found_index := 0;                     {initialize position of the school found}

      Found := FALSE;                      {initialize found boolean variable}

         for i := 1 to stud_count do    {from the 1st school to the (total number of schools) th school}

           if i = Target then   {compare the school name list with the name the uesr inputted}

             begin                              {if they are equal}

                found_index:=i;                  {the position where we found the school name is equal to
the i th school}

                 found := true;                 {the school is found}

             end;

      if found      then                        {if the school is found}

         begin

           textcolor(10);

           writeln;

            writeln(' The data is in the list!') ;   {tell the user that the school is found}

           writeln;

           delay(100);
           textcolor(13);

           writeln;

           writeln('Here is the detail of the target:');        {show the school's rank,name,score}

           writeln;

           textcolor(14);

           writeln('Rank','Student''s school name':25,'Student name': 35,'Score':10);

           writeln('——————————————————————————————');

writeln(found_index,stud_sch[found_index]:50,stud_name[found_index],stud_score[found_index]:10);


        end


      else                                           {if the school is not found}

        begin

        textcolor(10);                                  {apologize to and tell the user that the school is not found}

        writeln('Sorry. The data is not in the list.');

        end;

        end;

        textcolor(13);

writeln('***************************************************************************
**');

        writeln;

        textcolor(18);

        writeln('Please press <Enter> to continue');

            readln;

    end;


procedure sch_rank_searching;                   {procedure for searching student ranking}

var

   Target : integer;                            {the student rank need to be searched}
```

```
    found : boolean;

    i ,found_index: integer;            {the position of the school found}


begin

      writeln;                                    {ask the user to enter the school name need to be searched}

      repeat

      textcolor(13);

      write('Enter the school rank need to be searched:      ');

      textcolor(14);

      readln(Target);


      if Target<=0 then

         begin

               writeln('A rank must be larger than 0');

         end;

      if Target>sch_count then

            begin

            textcolor(10);

            writeln('There is only ',sch_count,' schools');

            writeln('Please input again!');

            end;


      until (target>0) and (target<sch_count) ;

      begin

            textcolor(10);

            write('Data seacrhing');

            delay(200);

            write('.');

            delay(200);

            write('.');
```

```
        delay(200);
        writeln('.');

    Found := FALSE;                    {initialize found boolean variable}
    i := 0;                            {initialize counter variable}
    found_index := 0;                   {initialize position of the school found}
    for i := 1 to sch_count do     {from the 1st school to the (total number of schools) th school}
      if i = Target then    {compare the school name list with the name the uesr inputted}
        begin                                  {if they are equal}
          found_index:=i;                  {the position where we found the school name is equal to the i th school}
          found := true;                  {the school is found}
        end;
    if found                                 {if the school is found}
        then
        begin
        textcolor(10);
        writeln;
        writeln(' The data is in the list!') ;     {tell the user that the school is found}
        writeln;
        delay(100);
        textcolor(13);
        writeln;
        writeln('Here is the detail of the target:');        {show the school's rank,name,score}
        writeln;
        textcolor(14);
        writeln('Rank':4,'School name': 20,'School score':44);
        writeln('——————————————————————————————');
        writeln(found_index:3,sch_name[found_index]:55,sch_avg[found_index]:10:2);
        end
```

```
       else                                {if the school is not found}

          begin

            textcolor(10);                       {apologize to and tell the user that the school is not found}

            writeln('Sorry. The data is not in the list.');

          end;

          end;

       textcolor(13);

writeln('***************************************************************************
**');

       writeln;

       textcolor(18);

       writeln('Please press <Enter> to continue');

       readln;


     end;


procedure show_prizes;                           {procedure showing the prizes}

var i : integer;

   tmp_schsize: integer;

   tmp_sch : string;




begin

clrscr;

textcolor(10);

writeln('***************************************************************************
**');

textcolor(27);

writeln;
```

```
writeln('                                        Student Prize');    {title}

writeln('                                      ————————');

writeln;

writeln('Rank','Student School':25,'Student name':30,'Student score':17);

writeln('——————————————————————————————');

textcolor(13);

writeln('Champion');

writeln;

textcolor(14);

writeln(stud_sch[1]:50,stud_name[1],stud_score[1]);

writeln;

textcolor(13);

writeln('1st runner up');

textcolor(14);

writeln(stud_sch[2]:50,stud_name[2],stud_score[2]);

textcolor(13);

writeln;

writeln('2nd runner up');

textcolor(14);

writeln;

writeln(stud_sch[3]:50,stud_name[3],stud_score[3]);

     for i := 4 to 10 do

       begin

         textcolor(13);

         writeln(i,'th place');

         writeln;

         textcolor(14);

         writeln(stud_sch[i]:50,stud_name[i],stud_score[i]);

         writeln;

       end;
```

```
textcolor(10);

writeln('******************************************************************************
**');

textcolor(27);

writeln;

writeln('                                                   School Prize');        {title}

writeln('                                               —————');

writeln;

writeln('Rank','School name':35,'School score':37);

writeln('—————————————————————————');

textcolor(13);

writeln('Champion');

writeln;

textcolor(14);

writeln(sch_name[1]:65,sch_avg[1]:10:2);

writeln;

textcolor(13);

writeln('1st runner up');

writeln;

textcolor(14);

writeln(sch_name[2]:65,sch_avg[2]:10:2);

writeln;

textcolor(13);

writeln('2nd runner up');

writeln;

textcolor(14);

writeln(sch_name[3]:65,sch_avg[3]:10:2);


       for i := 4 to 5 do

          begin
```

```
              textcolor(13);

              writeln(i,'th place');

              writeln;

              textcolor(14);

              writeln(sch_name[i]:65,sch_avg[i]:10:2);

              writeln;

            end;

textcolor(10);

writeln('***************************************************************************
**');

writeln;

textcolor(18);

writeln('Please press <Enter> to continue');

readln

end;



   procedure menu; forward;



   procedure stop;                              {procedure for stopping the program}

   var decision :char;

   begin

        decision := '0' ;

     writeln;

     writeln;

     textcolor(12);                             {ask the user if he really want to leave}

      repeat

      write('                        Do you wish to leave now?(Y/N)');

      readln(decision);

                                                 {read the user's decision}

    if (decision ='Y') or( decision='y') then    {if the user want to leave}
```

```
begin
clrscr;
writeln;
writeln;
writeln;
writeln;
writeln;
writeln;
textcolor(13);                    {thank the user for using the analyzer}
writeln('          Thanks for using this multiple-choice analyzer!GoodBye!');
writeln;
writeln;
delay(100);
clrscr;                                   {Count down}
writeln('                                   5555555555555');
writeln('                                   5555555555555');
writeln('                                   55         5');
writeln('                                   55  555555555');
writeln('                                   55  555555555');
writeln('                                   55       555');
writeln('                                   55  555555  5');
writeln('                                   5555555555  5');
writeln('                                   5555555555  5');
writeln('                                   55  555555  5');
writeln('                                   5555     555');
writeln('                                   5555555555555');
writeln('                                   5555555555555');
delay(1000);
clrscr;
textcolor(10);
```

```
writeln('                                        4444444444444');
writeln('                                        4444444444444');
writeln('                                        44444444  444');
writeln('                                        444444    444');
writeln('                                        444444    444');
writeln('                                        4444  44  444');
writeln('                                        4444  44  444');
writeln('                                        44  4444  444');
writeln('                                        44         4');
writeln('                                        44444444  444');
writeln('                                        44444444  444');
writeln('                                        4444444444444');
writeln('                                        4444444444444');
delay(1000);
clrscr;
textcolor(14);
writeln('                                        3333333333333');
writeln('                                        3333333333333');
writeln('                                        3333     333');
writeln('                                        33  333333 3');
writeln('                                        3333333333  3');
writeln('                                        3333333333  3');
writeln('                                        333333    333');
writeln('                                        3333333333  3');
writeln('                                        3333333333  3');
writeln('                                        33  333333 3');
writeln('                                        3333     333');
writeln('                                        3333333333333');
writeln('                                        3333333333333');
```

```
delay(1000);

clrscr;

textcolor(12);

writeln('                                    2222222222222');

writeln('                                    2222222222222');

writeln('                                    2222      222');

writeln('                                    22  222222  2');

writeln('                                    2222222222  2');

writeln('                                    2222222222  2');

writeln('                                    22222222  222');

writeln('                                    222222  22222');

writeln('                                    2222  2222222');

writeln('                                    22  222222222');

writeln('                                    22          2');

writeln('                                    2222222222222');

writeln('                                    2222222222222');



delay(1000);

clrscr;

textcolor(26);

writeln('                                    1111111111111');

writeln('                                    1111111111111');

writeln('                                    111111  11111');

writeln('                                    11      11111');

writeln('                                    111111  11111');

writeln('                                    111111  11111');

writeln('                                    111111  11111');

writeln('                                    111111  11111');

writeln('                                    111111  11111');
```

```
        writeln('                                    111111  11111');
        writeln('                                    111111  11111');
        writeln('                                    1111111111111');
        writeln('                                    1111111111111');

        delay(1000);
        clrscr;
        textcolor(15);
        writeln('                                    0000000000000');
        writeln('                                    0000000000000');
        writeln('                                    0000        000');
        writeln('                                    00  000000  0');
        writeln('                                    00  000000  0');
        writeln('                                    00  000000  0');
        writeln('                                    00  000000  0');
        writeln('                                    00  000000  0');
        writeln('                                    00  000000  0');
        writeln('                                    00  000000  0');
        writeln('                                    0000        000');
        writeln('                                    0000000000000');
        writeln('                                    0000000000000');

        exit
        end;
  if (decision ='N') or (decision='n') then      {if the user don't want to leave}
         begin
          clrscr;                                {clear screen}
          menu;                                    {resume to the menu}
          end
else                                             {if the deicision read is not 'Y'or'y'or'N'or'n'}
```

```
                    begin
                         writeln('Wrong input');               {show the error message to the user and}
                         writeln('Please input again');       {ask the user to input again}
                    end;



          until (decision='Y') or (decision='y') or (decision='N') or (decision='n');


end;






procedure save_report;                                            {the procedure for saving the result}
var
     report_file_name: string;                               {read the output filename which the user desire}
     i ,j: integer;
     outfile: text;
     Ch : char;
     Count : array ['A'..'F'] of integer;
     Countbar : array['A'..'F'] of integer;
     quest_corrbar : array[1..questno] of integer;
     freq : array[0..questno] of integer;
     stud_score_mean , abs_value_total: real;
     abs_value : array[1..maxstudno] of real;
     median, sd, variance: real;
     mode: integer;
begin
     writeln;
     write('Please enter the filename of the report file: ');
```

```
   readln(report_file_name);

   assign(outfile,report_file_name);

   rewrite(outfile);

   writeln(outfile,'<<Report on Multiple-choice questions>>');

   writeln(outfile);

   writeln(outfile,'Passing mark : ',(questno/2):3:2);

   writeln(outfile,'Passing rate : ',passing_rate:6:2,' %');

   writeln(outfile,'                                   Ranking');

   writeln(outfile,'                  ————————————');

writeln(outfile,'*******************************************************************************');

   writeln(outfile);

   writeln(outfile,'                             Top Five Students ');

   writeln(outfile,'            ——————————————');

   writeln(outfile);

   writeln(outfile,'Rank','School name':16,'Student''s name':51,'Score':8);

   writeln(outfile,'———————————————————————');

     i:=0;

     for i := 1 to 5 do

        writeln(outfile,i:3,stud_sch[i]:50, stud_name[i]:20, stud_score[i]:3);

   writeln(outfile);

   writeln(outfile);

writeln(outfile,'*******************************************************************************');

   writeln(outfile);

   writeln(outfile,'                             Bottom Five Results ');

   writeln(outfile,'            ——————————————');

   writeln(outfile);

   writeln(outfile,'Rank','School name':16,'Student''s name':51,'Score':8);

   writeln(outfile,'———————————————————————');
```

```
            i:=0;

            for i := stud_count-4 to stud_count do

        writeln(outfile,i:3,stud_sch[i]:50, stud_name[i]:20, stud_score[i]:3);

        writeln(outfile);


     writeln(outfile,'**********************************************************************
*******');

        writeln(outfile);

        writeln(outfile,'                                        School Average');

        writeln(outfile,'                ————————————————');

        writeln(outfile);

        writeln(outfile,'School name':10,'No. of participants ':45,'Average score':20);

        writeln(outfile,'————————————————————————————');

            for i := 1 to sch_count do

               begin

                  writeln(outfile,sch_name[i],sch_size[i]:5,sch_avg[i]:25:2) ;

               end;

        writeln(outfile);


     writeln(outfile,'**********************************************************************
*******');

        writeln(outfile);

        writeln(outfile,'                  Scores of students in descending order');

        writeln(outfile,'                ——————————————');

        writeln(outfile);

        writeln(outfile,'Rank','School Name':15,'Student Name':43,'Score':8);

        writeln(outfile,'————————————————————————————');

           i:= 0;

             for i:= 1 to stud_count do

                    writeln(outfile,i:3,'.     ',stud_sch[i]:45, stud_name[i]:15,stud_score[i]);

        writeln(outfile);
   writeln(outfile,'*****************************************************************************
   *******');

        writeln(outfile,'School Results:');

        writeln(outfile);

        writeln(outfile,'Total number of Schools: ',sch_count);

        writeln(outfile);

        writeln(outfile, '                         Average score of schools in descending order ');

        writeln(outfile,'                    ————————————————————');

        writeln(outfile);

        writeln(outfile, 'Rank','School Name':15,'Size':39,'Average Score':21);

        writeln(outfile,'——————————————————————————————');

           i:=0;

           for i := 1 to sch_count do

           writeln(outfile,i:3,'.     ',sch_name[i]:45,sch_size[i]:6,sch_avg[i]:20:2);

        writeln(outfile);

   writeln(outfile,'*****************************************************************************
   *******');

        writeln(outfile,'                                            Analysis Result');

        writeln(outfile,'                    —————————————————');

   writeln(outfile,'*****************************************************************************
   *******');

        writeln(outfile,'                                                Question Analysis');

        writeln(outfile,'                    ————————————————————');

        writeln(outfile);

        writeln(outfile,'Percentage correct for each question');

        writeln(outfile);

        writeln(outfile,'——————————————————————————————');

           i:=0;

             for i := 1 to 9 do

               begin
```

```
                    write(outfile,'    Q',i:3,'.',quest_corr[i]/stud_count*100:6:2, ' %');

                       if i mod 5=0 then

                          writeln(outfile)

                end;


             for i := 10 to questno do

               begin

                    write(outfile,'    Q',i:3,'.',quest_corr[i]/stud_count*100:6:2,' %');

                       if i mod 5 =0 then

                           writeln(outfile)

               end;

         writeln(outfile);


writeln(outfile,'****************************************************************************');

           {Show Standara Deviation}

                 stud_score_mean :=0;

           {Find mean}

                 stud_score_mean := stud_score_total/stud_count;


           {Find absolute value}


                  i:=0;

                  abs_value_total :=0;


                     for i := 1 to stud_count do

                        begin

                          abs_value[i] := stud_score[i]- stud_score_mean;

                          abs_value_total:= abs_value_total + sqr(abs_value[i]) ;

                        end;

                         sd:=    sqrt(abs_value_total/stud_count) ;
```

```
 writeln(outfile,'Standard deviation : ',sd:5:2);
 writeln(outfile);

 {Show Variance}
    stud_score_mean :=0;
    stud_score_mean := stud_score_total/stud_count;
          {Find absolute value}
          abs_value_total :=0;
           i:=0;
              for i := 1 to stud_count do
                 begin
                     abs_value[i] := stud_score[i]- stud_score_mean;
                     abs_value_total      := abs_value_total + sqr(abs_value[i]) ;
                      variance      := abs_value_total/stud_count ;
                 end;
 writeln(outfile,'Variance        : ',variance:5:2);
writeln(outfile);

 {Show Quartile}
 writeln(outfile,'1st Quartile : ',stud_score[trunc(stud_count*0.75)]   );
 writeln(outfile);
 writeln(outfile,'2nd Quartile : ',stud_score[trunc(stud_count*0.5)]    );
 writeln(outfile);
 writeln(outfile,'3rd Quartile : ',stud_score[trunc(stud_count*0.25)]   );
 writeln(outfile);

  {Show mean}
          stud_score_mean := 0;
          stud_score_mean := stud_score_total/stud_count;
```

```
      writeln(outfile,'Mean    :    ',stud_score_mean:5:2);


 {Show mode}

  writeln(outfile);

      for i := 0 to questno do

         freq[i] := 0;


     for i := 1 to stud_count do

         freq[stud_score[i]]:= freq[stud_score[i]]+1;


    mode := 0 ;

     for j := 1 to questno do

        if freq[j] > freq[mode] then

            mode := j;


    write(outfile,'Mode                :    ');


     for j := 0 to questno do

         if freq[j] = freq[mode] then

          write(outfile,j,'        ');

         writeln(outfile);


  {Show median}

  writeln(outfile);

    if (stud_count mod 2 =0 )then

         median := stud_score[round(stud_count/2)]

    else

         median := stud_score[round(stud_count/2)]+stud_score[trunc(stud_count/2)]/2;

writeln(outfile,'Median                        : ',median:5:2);
writeln(outfile,'********************************************************************
*******');

    writeln(outfile,'                              Graphs');

    writeln(outfile,'           —————————————————————');



      for Ch := 'A' to 'F' do

        Count[Ch] := 0;

        i:=0;

      for i := 1 to stud_count do

         case stud_score[i] of

             0..19 : Count['F'] := Count['F'] +1;

            20..25 : Count['E'] := Count['E'] +1;

            26..30 : Count['D'] := Count['D'] +1;

            31..40 : Count['C'] := Count['C'] +1;

            41..46 : Count['B'] := Count['B'] +1;

            47..50 : Count['A'] := Count['A'] +1;

         end ;

     writeln(outfile,'                   Grade Distribution Graph');

     writeln(outfile,'           —————————————————————');

     writeln(outfile);

         for Ch := 'F' downto 'A' do

            begin

               write(outfile,'Grade ',Ch, '    XX    ');

               Countbar[Ch] :=    trunc((Count[Ch]/200*100))    ;

             for i := 1 to Countbar[Ch] do

                 write(outfile,'*');

                  writeln (outfile,'(', Count[Ch], ')')

            end;

     writeln(outfile);
     writeln(outfile,'————————————————————————————');

writeln(outfile,'**********************************************************************
*******');

     writeln(outfile);

     writeln(outfile,'                              Question Correct Graph');

     writeln(outfile,'                       ————————————');

         i:= 0;

         for i := 1 to questno do

           begin

              quest_corrbar[i] := trunc((quest_corr[i]/200)*50);

           end;

         for i := 1 to questno do

            begin

               write(outfile,'Q ',i:2, '    XX    ');

                j:= 0;

                   for j := 1 to quest_corrbar[i] do

                      write(outfile,'*');

                      writeln (outfile,'(', quest_corr[i], ')')

            end;

     writeln(outfile,'————————————————————————————');

     writeln(outfile,'                 No. of students    get the answer correct                    ');

     writeln(outfile);

writeln(outfile,'**********************************************************************
*******');

     writeln(outfile);

     writeln(outfile,'                  Mark Distribution Graph');

     writeln(outfile,'           ————————————————');

         i:=0;

         for i := 0 to questno do

            begin
```

```
                freq[i] := 0;
             end;

        for i := 1 to stud_count do
           freq[stud_score[i]]:= freq[stud_score[i]]+1;
           writeln(outfile,'Mark');

       for i := 0 to questno do
          begin
             write(outfile,i:2, '    XX    ');
             j:=0;
              for j := 1 to freq[i] do
                   write(outfile,'*');
                   writeln (outfile,'(', freq[i], ')')
        end;

    writeln(outfile,'——————————————————————————————');
    writeln(outfile,'                              No. of students    get this mark                              ');
    writeln(outfile);

writeln(outfile,'**********************************************************************
*******');
    writeln(outfile,'                                              The End Of File                                        ');
    writeln(outfile,'                              Thanks again for using this multiple-choice analyzer');

      close(outfile);
      writeln;
      textcolor(14);
      writeln('File saved');
      write('Please press <enter> to continue');
      readln
```

```
        end;



procedure show_results;                              {question analysis menu}

var

   option :char;                                     {user's option}

   begin

   repeat

    TextBackGround(1);

    clrscr;

    TextBackGround(1);

    textcolor(26);

    TextMode(CO40);

    writeln('                      <<Result of Multiple-Choice Questions>>                  ');

    TextMode(CO80);

writeln('***************************************************************************
**');

    textcolor(13);

    writeln('          Number of pass: ',stud_pass,'              Passing Rate : ',passing_rate:6:2,' %');

    writeln;

    textcolor(10);

    writeln('       Show ranking                                  Analysis Result');

    writeln('     ————                              ————');

    writeln('         A. Show top five stuents                  F. Question Analysis ');

    writeln('         B. Show bottom five students               G. Standard deviation');

    writeln('         C. Show school average scores              H. Variance');

    writeln('         D. Show school ranking                      I. Quartile');

    writeln('         E. Show student ranking                     J. Mean/Mode/Median');

    writeln;

    writeln;
```

```
textcolor(14);
writeln('          Graphs                                    Searching');
writeln('         ——                                   ————');
writeln('           K. Question correct Graph                 N. Student searching');
writeln('           L. Grade Distribution Graph              O. School searching');
writeln('           M. Mark Distribtution Graph              P. Student rank searching');
writeln('                                                       Q. School rank searching');
writeln;
textcolor(11);
writeln('                               R. Show Prizes');
textcolor(13);
writeln('                               #. Quit / Back to menu');
textcolor(12);
writeln;
   option := '0';
write('                Please enter your choice(A-P/#) :    ');
textcolor(10);
readln(option);

 case option of
 {Ranking Display}
'A','a': show_top_five;
'B','b' : show_bottom_five;
'C','c' : show_sch_average;
'D','d' : sch_result;
'E' ,'e': stud_result;

 {Analysis Result}
'F','f' : question_analysis;
'G','g' : sd;
```

```
'H','h' : variance;

'I','i' : quartile;

'J','j' : begin

          mean;

          mode;

          median;

          end;

{Graphs Display}

'K','k' : begin

           textcolor(14);

           barchart_questcorr;

           end;

'L','l' : barchart_grade;

'M','m' : mark_distribution_graph;


{Searching function}

'N','n' : stud_searching;

'O','o' : sch_searching;

'P','p' : stud_rank_searching;

'Q','q' : sch_rank_searching;


{Show prizes}

'R','r' :show_prizes;




end ;

option := upcase(option);

   if (option <>'#') and ((option<'A')or(option>'R')) then


             begin
```

```
                        writeln('Wrong input');              {show the error message to the user and}

                        writeln('Please input again');       {ask the user to input again}

                        writeln;

                        textcolor(18);

                        write('Please press <enter> to continue');

                        readln(option) ;

                     end;

         {Back to menu}

         until (option ='#') ;

         exit;

         end;


procedure menu;

var

choice, decision :char;

begin

repeat

TextBackGround(1);

clrscr;

TextBackGround(1);

writeln;                                          {main menu}

textcolor(27);

writeln('                              Multiple-Choice Analyzer                        ');

writeln('***************************************************************************
**');

writeln;

writeln('                 1.Change answer key file name');

writeln('                 2.Change participant''s information file name');

writeln('                 3.Analysis Report');

writeln('                 4.Save report');
writeln('                              5.Quit');

writeln;


choice := '0';


write('Please choose one of the 5 options by typing in 1/2/3/4/5 :    ');

readln(choice);




case choice of

'1':

begin

reading_ans_keys;

calculate_stud_scores;

calculate_sch_score;

sort_stud_score;

sort_sch_score;

cal_passing_rate;

end;

'2':begin

reading_stud_record;

calculate_stud_scores;

calculate_sch_score;

sort_stud_score;

sort_sch_score;

cal_passing_rate;


end;

'3':begin

show_results;
```

```
end;

'4':begin

save_report;

end;

end;

until choice='5' ;

        stop;

end;




begin    {main body}

TextBackGround(1);

clrscr;

TextBackGround(1);

textcolor(13);

delay(100);                              {welcoming screen}

writeln('XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X');

delay(100);

writeln('X                                                                                   X');

delay(100);

writeln('X               MM               MM               CCCCCCCC                          X');

delay(100);

writeln('X               MMMM           MMMM             CC          CC                        X');

delay(100);

writeln('X               MMMM           MMMM           CC                                      X');

delay(100);

writeln('X               MM    MM      MM    MM        CC                                      X');

delay(100);
```

```
writeln('X         MM   MM       MM    MM            CC                                  X');
delay(100);
writeln('X         MM     MM   MM      MM            CC                                  X');
delay(100);
writeln('X         MM     MM   MM      MM            CC                                  X');
delay(100);
writeln('X         MM       MM       MM               CC        CC                      X');
delay(100);
writeln('X         MM               MM                CCCCCCCC                          X');
delay(100);
writeln('X                                                                          X');
delay(100);
writeln('X                                                                          X');
delay(100);
writeln('X      A      N     N      A       L     Y     Y ZZZZZZ  EEEEEE RRRRR        X');
delay(100);
writeln('X     A A     N     N    A A      L      Y   Y       Z   E      R    R      X');
delay(100);
writeln('X     A A     N     N    A A      L      Y   Y      Z    E      R    R      X');
delay(100);
writeln('X    A   A    N      N   A   A     L       Y Y      Z    E      R    R       X');
delay(100);
writeln('X    A   A    NN     N   A   A      L        Y      Z     EEEEE  RRRRR         X');
delay(100);
writeln('X    AAAAA     N N   N   AAAAA      L        Y      Z      E      R  R        X');
delay(100);
writeln('X   A     A   N N   N   A     A    L        Y     Z      E      R    R       X');
delay(100);
writeln('X   A     A   N   N  N  A      A    L        Y    Z       E      R    R      X');
delay(100);
```

```
writeln('X       A            A    N      N N A            A     LLLLLL     Y       ZZZZZZ    EEEEEE R         R         X');

write('X                                                    ');

textcolor(26);

write('                  By Baron Fung Kin Kok        ');

textcolor(13);

writeln('     X');

delay(100);

writeln('XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
X');

textcolor(14);

write('Please enter your name:');

readln(username);

textcolor(12);

write('Welcome ');              {welcome the user}

textcolor(14);

write(username);

textcolor(12);

writeln(' to use this Multiple-Choice Analyzer!');

textcolor(18);

writeln('Please press <Enter> to continue');

readln;

clrscr; {clear screen}

{call procedure}

instructions;

reading_ans_keys;

reading_stud_record;

calculate_stud_scores;

{writeln('student total score :    ',stud_score_total);       testing if total student score can be calculated

            readln;}

calculate_sch_score;
```

```
sort_stud_score;

sort_sch_score;

cal_passing_rate;

clrscr;

textcolor(11);

menu;

end.
```

Appendix2- User Guide

<Multiple-choice analyzer user-guide>

Please read the following instructions before using this program.

Steps of using the program

1) Run the exe file'PROGRAM.EXE' to start the program

2) File name of the answer key are('ANSKEY.txt','ANSKEY2.txt','ANSKEY3.txt')

3) File name of the participants' answers and information are 'MCDATA.txt','MCDATA2.txt')

then

You would come to a menu:

1.Change answer key file name(ANSKEY.txt,ANSKEY2.txt,ANSKEY3.txt)

2.Change participant's information file name(MCDATA.txt,MCDATA2.txt)

3.Analysis report(It is a sub-menu,there are a list of anaylyzing result for you to select,from A to P)

4.Save report

(You can enter any file name that you want,but please be reminded that you should add '.txt' after the output file name.

Analysis report

if you use the searching function of the program in the analysis report, please be reminded that you should use

capital letter when typing a student name of a school name,any punctuations in the names are also required to type in too.

Appendix 3 - Working schedule

Date	Event
24/12/2008	Flow chart
7/1/2009	Cover page of the program
9/1/2009	Chapter1 and 2 of the report
10/1/2009	Chapter3 of the report
14/1/2009	Program procedure(reading data)
16/1/2009	Program procedure(calculate scores)
20/1/2009	Program procedure(sorting)
25/1/2009	Chapter 4 of the report
26-29/1/2009	Chapter6 of the report
30/1/2009	Program procedure(graphs)
5/2/2009	Program procedure(Searching)
10/2/2009	Program Testing
12/2/2009	Chapter 5 of the report
13/2/2009	Change the font color and regulate the format of the report, Finish the report!