Hong Kong Certificate of Education Examination 2009

Computer and Information Technology Paper 3 (Coursework)

Module A: Algorithm and Programming

Title: Multiple-Choice Analysis Report

Candidate ID No:

Contents

Chapter 1 Introduction

1.1 Background

In this project, there is a inter-school mathematics competition in the form of multiple-choice questions, has been organized. The answer sheets for participants will be read by using an Optical Mark Recognition (OMR) system, and the options selected were converted into a text file.

I am a programmer, I need to develop a computer program to let the machine execute to read the answers in the MC-answers sheet, and write several reports. The reports should include the ability to give marks to candidates, average mark of each school, the highest and lowest mark can be get out of many candidates, the passing rate, the total number of participants, the total number of participating schools, the total number of participant(s) from each participating school, comparisons of individual awards and schools, the average mark of students in schools and all individuals ,the passing rate of schools and questions, the average mark of each questions, number and percentage of levels of mathematics presenting in the results, description of the results, comparison of results to the last few years standard deviation of all students, including all students and students in school and individual. The quartile of the result.

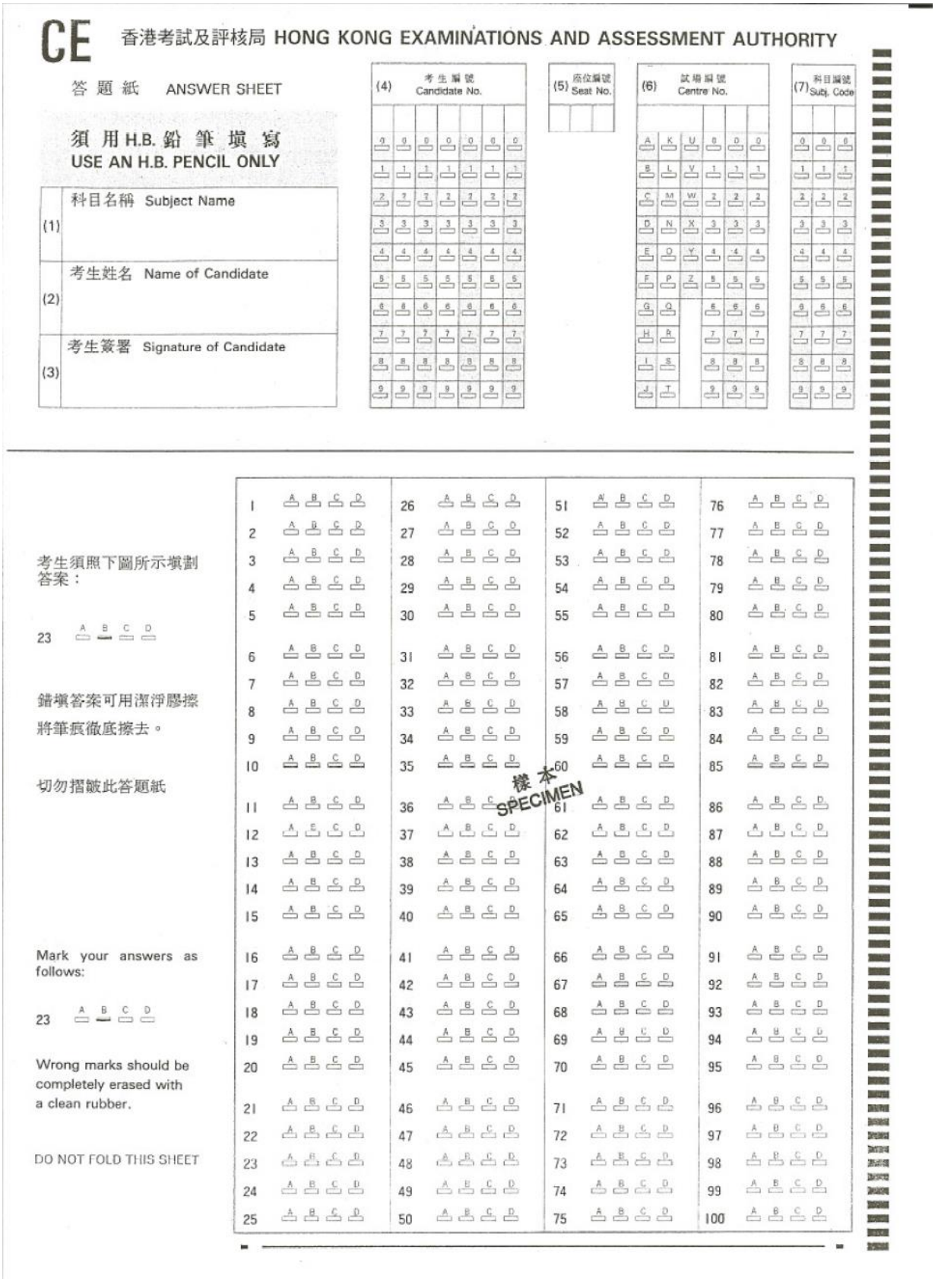
As more different sorts of report I can produce for reflecting the results, more tidy is needed, more complex the program is needed. In the results, clear, accurate and reasonable description of the program and the situation is needed.

About the MC-answers sheets, it should be made smoothly. As the machine detect the answers by optics, smooth papers are needed. It is because rough papers can’t reflect light to the machine. In case the paper is folded, machine can’t read it also.

One sample of the MC-answer sheet is shown below.

Although there is no problem in the program either the machine, the

candidates are using different pencils with different intensity in writing. If printing colour is not sharp, is not deep enough, the questions may not be marked, or error is found from the marking. And the program should ignore and fail the questions automatically in case there is nothing marked or more than 1 box is marked. To ensure the identity of the candidate, some boxes should be given to candidates to mark down their unique code by printing boxes.



As there are many candidates, each candidate has 4 choices each question. For example, there are 100 candidates and there are 50 questions in the competition, 20000 choices is needed to process by the program. As a result, the program needs to process a huge amount of objects. These objects is needed to be saved during processing. It is necessary to group the output values in form of tables, texts or even graphs

And I need to keep it reusable.

1.2 Objectives

In this project, there is a inter-school mathematics competition, I am a programmer, I need to develop a computer program to let the machine execute to read the answers in the MC-answers sheet, and write several reports. The reports should include the ability to give marks to candidates, average mark of each school, the highest and lowest mark can be get out of many candidates, S.D. of the results and the passing rate.

After the program is created, the organizer of the mathematics competition or the examiners employed to mark the paper will use the program to mark the paper and output the results.

As the program will be written by Pascal, some function and phases is needed to learn. For example, Reserved Words,

And	End	Not	Then
Array	File	Of	To
Begin	For	Packed	Or
Case	Function	Procedure	Type
Const	Goto	Program	Until
Div	If	Label	var
Do	In	record	While
Downto	Mod	repeat	with

else	nil	set	

other characteristic symbols,

+	-	*	/	=	<
>	[	]	.	,	:
;	^	(	)	'	<>
>=	<=	:=	..		

And

Constant,

false true maxint

style,

boolean char integer real text

text,

input output

functions,

abs arctan chr cos eof eoln exp

ln odd ord pred round sin sqr

sqrt succ trunc

and processing.

reset rewrite get put read readln write

writeln page pack unpack new dispose

In the huge amount of function and phases, Boolean and repeat terns should be used on checking if the answers are valid or not. Procedure is used in formation of main program and calculates the data in different ways and the output in different needs. Use array to save the result and process the data in procedures. Round function is used to calculate the average marks.

In the aim of produce a detailed analysis report on the mathematics competition. The analysis report should include :

- the total number of participants

- the total number of participating schools
- the total number of participant(s) from each participating school
- comparisons of individual awards and schools
- the average mark of students in schools and all individuals
- the passing rate of schools and questions
- the average mark of each questions
- number and percentage of levels of mathematics presenting in the results
- description of the results
- comparison of results to the last few years
- standard deviation of all students, including all students, students in school and individual.
- The quartile of the result.

1.3 Project Plan

For increasing the efficiency of the program, that means to make small changes inside the program, then it can be used in another MC-papers. For example, it can be used in the mathematics competition in the coming year. As a , the program should be grouped into many small parts. So, the program can be changed by deleting and adding parts into the program.

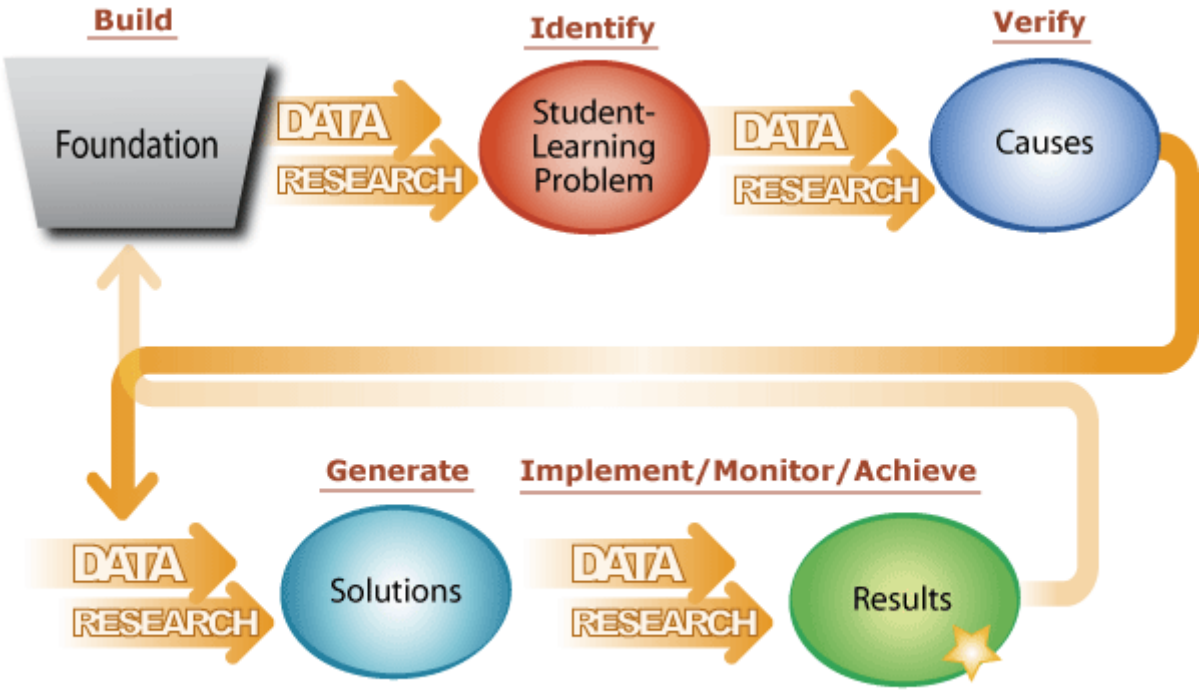
Before typing the program, I need to go through several topics in developing the program. MEIT Chapter 6, Selection of hardware, MEIT Chapter 12, Basic programming concepts, MEIT Chapter 13, Basic programming concepts and MEIT Chapter 14, Programming concepts.

Chapter 6 is used to check again the use of Optical Mark Recognition (OMR) system and the devices for printing the results. After checking, smooth paper is a must, a HB pencil colour writing on the MC-answer sheets also. For the printing device, there are 5 options. Laser printer, lnkjet printer, dot-matrix printer, thermal printer and plotter printer. Since there are many students and schools, and there are both graphs and test inside the outputs. So, laser printing is the best choice since it is high quality output for both text and graphics and it is good for long and multiple printing jobs. But it needs high

cost.

For chapter 12-14, it is used to learn back the basic on making programs. The process is involved during processing, the use of compiler, both the loop occurred in while-do loop and repeat-until loop, the ways of testing, compiling, selection, iteration in programs. And the errors will be remained if there are mistakes in typing, thinking and logic.

.



From *A Data Coach's Guide to Improving Learning for All Students: Unleashing the Power of Collaborative Inquiry* © Corwin Press, 2008.

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,

2. Design

- Design the overall structure of the program
- Design the formats of the input files
- Design the layout of the analysis report

3. Implementation

- Decide the data structures that will be used in the program.
- 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 favourable features and shortcomings of the program
- Suggestion on further development/improvements on the program.

Chapter 2 Analysis

2.1 Competition Regulations

As the competition is serious, some regulations should be built. In the aim to give advice to participants. The form of questions, the limits and rules will be shown below.

The competition is divided into two parts, one part is students in schools, one part is those who participate individually. The maximum number of participating schools is set at not more than 100. It might be changed if it is necessary and depend on the situation. The maximum number of participants from each school is set at not more than 50. It might be changed if it is necessary and depend on the situation.

About the questions, all participants will perform at the same set of mathematics paper. It is the matter of equity and hopes they can compete with the same level and questions. There would be 50 questions in a set of paper. All of them are multiple-choice questions. The first 30 questions are section A, which are easier questions. Conversely, The next 20 questions are section B, which are harder questions. Candidates can choice A, B, C or D and write in

1. Which of the following statements about Octopus and credit card is/are correct?
   (1) Credit cards can be used for shopping on the Internet.
   (2) Most credit cards have built-in chips for storing the balance amounts.
   (3) Octopus is a kind of electronic money.
   A. (1) only
   B. (2) only
   C. (1) and (3) only
   D. (1), (2) and (3)

MC-answer sheet. And they may see some questions are asking like this.

So, candidates may see numbers (1), (2), (3) in the questions. And there

is no difference in giving marks between section A and sections B questions. All questions are giving 1 mark for each 1 correct answer.

B. Analysis

The Comparison using different methods to correct and grade compositions:

Ways / Comparison	Using English teachers in the school	Employing staff outside	Using my program
Efficiency	Lower	Lower	Higher
Time Need to be Used	More time is need to correct one composition	Much time is needed to correct one composition. It takes time for the staff to receive and return composition to/from the school	Lesser time is need to correct one composition
Accuracy (Counting)	Lower	Lower	Highest
Accuracy (Correctness)	Higher	Higher	Lower
Human Mistakes	More human mistakes will be made	More human mistakes will be made	Least human mistakes will be made
Grade Standard	More subjective	More subjective	More objective
Cost	Free	Highest. Money is needed to employ the staff	Free
Health conditions of the teachers	Worst. The teachers' pressure increases, so that this threatens their health conditions	Best. Teacher needs not doing anything	Good. Teachers only need to input the compositions
Opportunity Cost	Higher	Highest	Lowest

2.2 Data Collection

About the way of collecting the papers, more convenient is better. The setting plan in the examination center will be well developed. For example, candidates will set in this shape.

ROD / CROSS	1	2	3	4	5	6	7
A	A1	A2	A3	A4	A5	A6	A7
B	B1	B2	B3	B4	B5	B6	B7
C	C1	C2	C3	C4	C5	C6	C7
D	D1	D2	D3	D4	D5	D6	D7
E	E1	E2	E3	E4	E5	E6	E7
F	F1	F2	F3	F4	F5	F6	F7
G	G1	G2	G3	G4	G5	G6	G7
H	H1	H2	H3	H4	**H5**	H6	H7
I	I1	I2	I3	I4	I5	I6	I7

(Each date represents one candidate)

Then, examiners will collect the papers according cross (in numeral sequence) column. Then run through rod (in alphabetical sequence) column. It means first collect numeral column: A1, B1,C1, …, I1. Then alphabetical column: A1 (whole column)□A2 (whole column)□A3 (whole column)□.□A7 (whole column).

Candidates will receive two sorts of paper altogether. One is question paper another one is MC-answer sheet. As a result, in the aim of not to collect the papers for two times. Clever examiners will use right hand to collect question paper and left hand to collect MC-answer sheet. But there is no problem between the methods from examiners. Time is enough. Collect the different paper separately is the most important thing.

And for easier storing, there will be different file to collect all the date.

- The answer sheets for participants are read and converted into a text file using an Optical Mark Recognition (OMR) system
- Single text file containing all the participants answers

- Text file for each school
- Text file for each participant

2.3 Input, Output and Process

(Each date represents one candidate)

For the input data and output data. The process is totally difference.

About input data, the participants' answers: School names / School codes, participant name / participant codes, participants' answers (A, B, C ,…),… etc. They are input data. For the participants' answers: the answers of one set of questions, or multiple sets of questions. They are also input data. But they are different. One is used to identity candidates another is used in the competition.

For the way to input data, from keyboard or from data file is refer to questions.

The data from filenames of data files will be inputted through keyboard. It is because the program can be used on different answer sets with different filenames, etc.

The data refer to previous information will be inputted from data file. Plain text is a type of data file. Many data files will be inputted, for example, one file for storing all the participants answers and answer keys, one file for all participants answers, one for answer keys, one file for each participating school, one for answer keys, ..., etc.

So, in the result of convenience and tidiness, the data should be consistent with Data Collection method

About output data (reports), in the aim of produce a detailed analysis report on the mathematics competition. The analysis report should include :

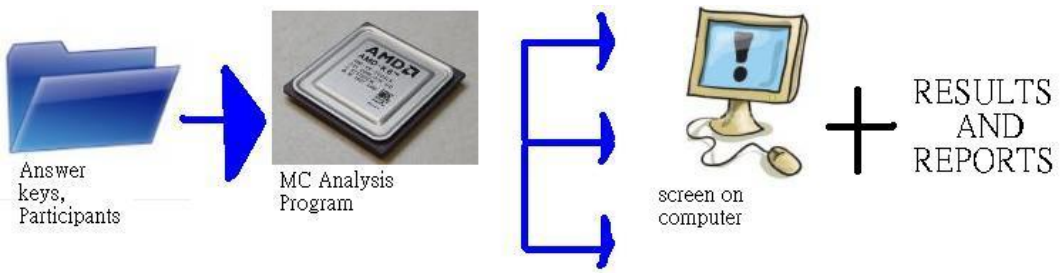
- the total number of participants
- the total number of participating schools
- the total number of participant(s) from each participating school

- comparisons of individual awards and schools
- the average mark of students in schools and all individuals
- the passing rate of schools and questions
- the average mark of each questions
- number and percentage of levels of mathematics presenting in the results
- description of the results
- comparison of results to the last few years
- standard deviation of all students, including all students, students in school and individual.
- The quartile of the result.

These reports will be outputted to report file. And for checking, the results will be posted on screen first. It is because the result is developed for the candidates. There is fixed filename for report file. It is because fixed name can reduce opportunity of the errors occurred. The type of report file will in image with text and graph form. It is the clearest method.

There are many kinds of data processing are mainly involved. For example, simple/complicated calculations, comparison/logical operations, data file handling, etc. Image is a good way of presentation.

The diagram is illustrating the data flow.



2.4 Choice of IT Tools

For the choice of suitable IT tools (hardware and software) for solving the problem. Mouse, keyboard, Pascal, …, etc, are the must. What type of printer is needed to choose? Laser printing is chosen in 1.3 in the report.

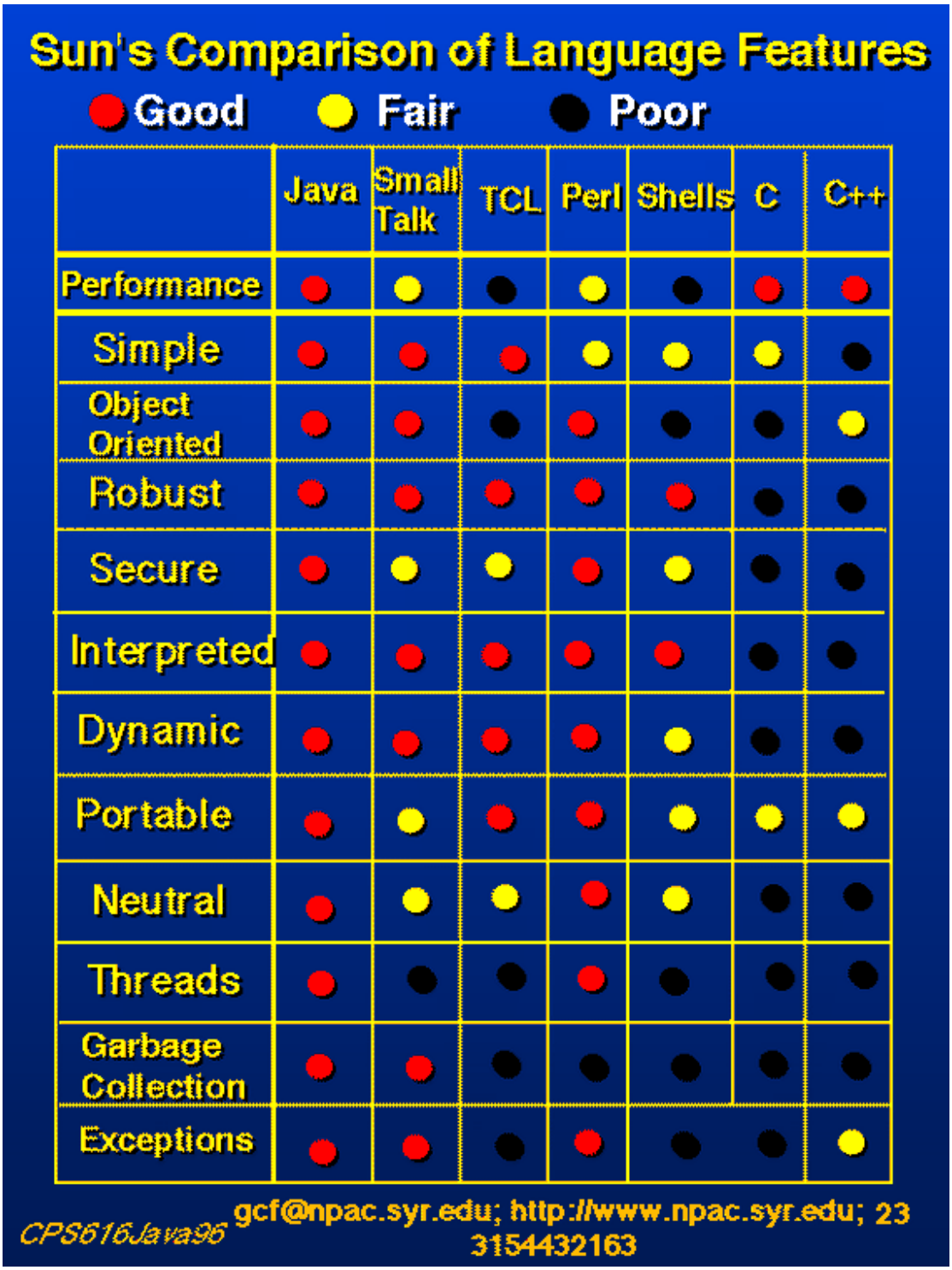
About the software, the program writer: Pascal, C and Visual Basic. Lets show the pros and cons. The points needed to consider is :

- Choice of programming language for solving the problem
- Compare different programming languages
  - e.g. GUI or text interface, web-based / executable file, compiler / interpreter, running on which platforms
- Which programming language will be chosen? (e.g. Pascal) Explain why you choose such language..
  - e.g. availability of resources in school / at home, etc.

A table will be shown below. And I would choose Pascal. It is available of resources in everywhere. Use Dos to run, text to write, use readme to write is suitable. The structure is very simple for a MC-solving. And of course it is very easy to learn. Although Java is best in the table, it is very hard. So the second choice would be Pascal.

Also, C and C++ are not strongly-typed languages. In Pascal, mixing types often led to an error. In C/C++, nothing would happen. So, using Pascal is a better way for learning program.

Use table to show. (Pascal is very like Perl)
Refer to
http://www.npac.syr.edu/users/gcf/cps616java96/foilsepimagedir/023IMAGE.html



Comparison	Pascal's Advantages	Pascal's Disadvantages
C/C++	Pascal's syntaxes are simple, so that programmers can learn and write it more easily. (User friendly) 2. Pascal has a relatively strong type system.(Pascal can often give programmers a meaningful error message, which results in more user friendly)	3. Pascal has run time checking, but C doesn't have.
1. C/C++ has faster run-time speed than Pascal.	Java	. Pascal has faster run-time speed (In Java, some of the codes are interpreted, so execution time is longer)
3. Although Java can run on many different operating systems, a JAVA platform is needed to	Java is more portable than Pascal. (Java can run on many operating systems)	

There is many types of Pascal, QPascal, Dev-Pascal. But they are the same. The main different is QPascal runs in Dos, Dev-Pascal runs in windows. And Dev-Pascal will produce a (.exe) file for easier running programs. So, I will type in QPascal (easier for finding error) but run in Dev-Pascal (will not have the runtime error produced by wrong address of file). And copy and paste function can be used in Dev-Pascal but not in Qpascal.

About OS platform: Microsoft Windows, Linux, etc. It is no need to discuss as most of people are using Microsoft Windows, and there is no problem of using it.

Then, about the hardware. Standard PC is ok as the requirement of using Pascal is very low.

Using Pascal is very convenient because it can be typed everywhere even in readme.

2.5 Conclusion of Study

In conclusion, using Qpascal and Dev-Pascal to write and run program. As exe file will be produced, the best way for learning and making structure. Using laser printer to print results because it is the fast, the best and about the price. The price can be included in the cost of taking part in the competition.

Graph and text consist the results. Making rules and let participants to know. Making sitting plan for more convenient.

Chapter 3 Design of Solution

3.1 Brief Description

In this Chapter, I will design the program based on the functions I proposed in Chapter 1, and the input, process and output I studied in Chapter 2

In the program, add the modal answers and the participants' answers first. Then, calculate the marks of participant. And follow the list in 1.2.

- the total number of participants
- the total number of participating schools
- the total number of participant(s) from each participating school
- comparisons of individual awards and schools
- the average mark of students in schools and all individuals

- the passing rate of schools and questions
- the average mark of each questions
- number and percentage of levels of mathematics presenting in the results
- description of the results
- comparison of results to the last few years
- standard deviation of all students, including all students, students in school and individual.

And finally, output the results.

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 format of the report file for storing the analysis report

The format of the participants' data is better in this format:

sch005s05003ABDCEDEEEBAEDAAEDEAABABDBCADBEABCDEADCDEECDEBBCDCC

sch008s08003CBBCCECDEABBECCADCABEACACEECEDBBCBBCEECADEABCEACCE

sch010s10010EBDDCAADEABDBACABCAEBDDECCDEDCCBEEAADCCDCEBEAAEBAA

sch005s05008DBCDDBEEACDAEADADDDBCCCECEBCBDBDCEBCEBEBDADBCECACD

sch001s01006DAECBCDCCEDADCEDECEAADABDDBBEECDEEDCBEEDACAACBEDEA

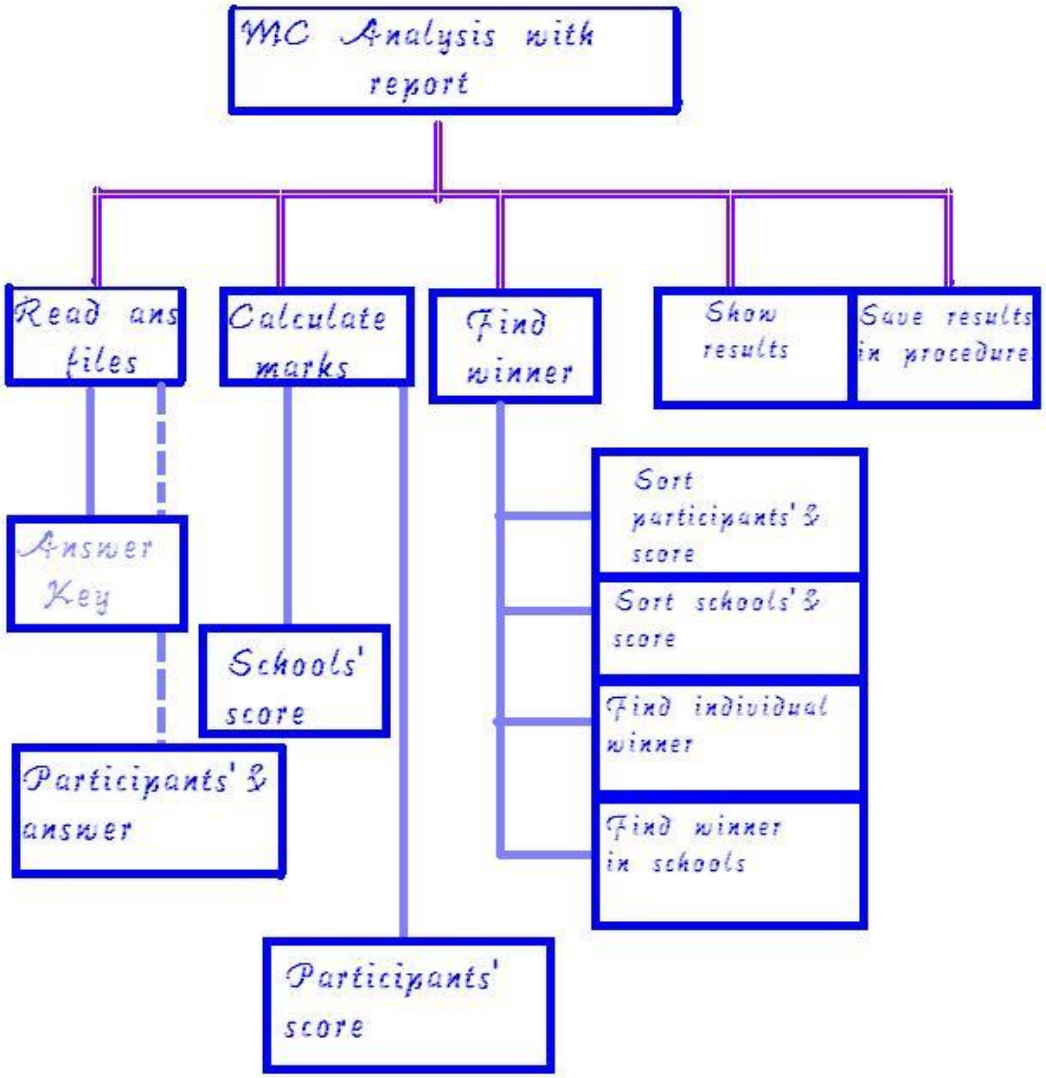
And the modal answer is better in this format.

ABDCCDECAEACCDACBBAECBACDCBAABABADECECDDEDABABACDC

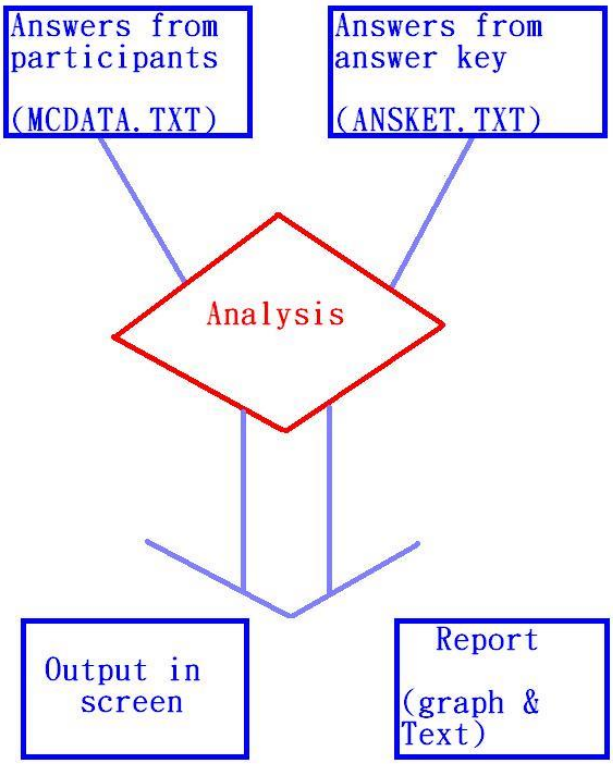
Then use Pascal, copy a few and a few words and read in lines.

3.2 Refinement of Problem

A program consist many procedures and a main program. For the methods of dividing the program into some sub-problems, I need to reder to MEIT ch.12, p.12-12 – 12-13. The result will be shown below with graph.



The structure will be modified in the real program. Anyway, First input the answers, and then calculate, then sorting. Final, output with different results.


Answers from participants
(MCDATA.TXT)
Answers from answer key
(ANSKET.TXT)
Analysis
Output in screen
Report
(graph & Text)

3.3 Input Data File Formats

For the formats of inputted data, the data :

- Should be consistent with the flow of data you described in previous section.
- Describe the formats of the input data files, including the file(s) storing participants' answers and the file of answer key.
- State the naming convention of the data files.
- Show sample data in the files
- Draw the file structures

1. For example, File storing the Participants' Answers:
   - One single file only
   - File name: inputted by user (e.g. MCDATA.TXT) (As discussed in Section 2.3.) Any constraints on filename (e.g. 8.3 filename for program running in DOS mode)
   - File type: plain text file
   - Data stored:

     The data file stores the record of each participant, which includes the following information:
     - School code of the participant (6 characters)
     - Participant code (6 characters)
     - Answers of the 50 questions (altogether 50 characters)
     - Valid answers: 'A', 'B', C', 'D', 'E'
     - Invalid / Null answers: '-'
     - File structure:

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

	School Code (6 characters)	Participant Code (6 characters)	Answers of 50 MC questions 50 characters in 'A', 'B', C', 'D', 'E', '-'								
e.g.	sch039	S02140	A	C	A	C		E	D	A	E

   - Sample file:

MCDATA.TXT

```
sch042S01144AADCCDECAEACCCACBBAECBECDCBAABABADECECDCEDDBABADDC
sch009S04108ACCEACDADAEACEDBBAEBEAEEDCABACBEEEECCCEEEEABDBAAEC
sch024S04033CAABBCCBBDDACEEDCACEACCCCECCCABDBCCAAADACBEAAEACBB
sch025S01135DCABCAAACEAACBDEDEDAEEEEEBABDBCDCEEDECDEEDBCDACBAB
sch026S01136BEBBECDCDCCCBADBAACCAADAEDDCBBCDACBEAAADDDBEDEAABD
sch009S02081AEAAEBCEABBADEEEBEEECACBDCBBBABCDAEDDCCDAEBBAABDDB
sch014S05173ADAEEAEBACDDCCECEADAACEEEEBACEEEDECEBDEBEEAEDEAABE
sch036S03163BEBEECCEBBEDBAADABCDCEBBBCEDADBAAAACBBCBDBAACAEBEA
sch031S04141DDEEDDECBBBDDDABDABCDDCDDACDADBABECDCBEDAACCDEBAAD
```

Remark:

Other possible structures of MCDATA.TXT file:

```
sch033
S02083
D
B
A
C
.
.
.
.
E
sch026
S01136
B
C
A
A
.
.

.
```

Record of first participant

Record of first participant

2. File storing Answer Key :
   - One single file only
   - File name: inputted by user (e.g. ANSKEY.TXT) (As discussed in Section 2.3.) Any constraints on filename (e.g. 8.3 filename for program running in DOS mode)
   - File type: plain text file
   - Data stored (for one question set only):
     The data file stores one set of answer keys 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:

ANSKEY.TXT

```
ABDCCDECAEACCDACBBAECBACDCBAABABADECECDDEDABABACDC
```

3. Sample input screen on running the program
   - E.g.

```
Enter the file name of the Answer Keys: ANSKEY.TXT

Enter the file name of the Participants' Answers: MCDATA.TXT
```

3.4 Output Report Format

About the formats of the outputted data :

- Should be consistent with the flow of data you described in previous section.
- Should be consistent with the output results you suggest in Chapter 2
- Note the basic requirements of the questions (e.g. the 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)).
- What results will be output on screen? Why? **(Note: the display on screen is of limited size, not too much information can be displayed on one screen)**
- What results will be output to report file?
- Design the layout of the output on screen.
- Design the layout of the report in file

For example,

1. Sample output results on screen
    - Results displayed:
        - Individual awards (with scores):
            1. Champion (participant code, school code)
            2. 1st Runner-up (participant code, school code)
            3. 2nd Runner-up (participant code, school code)
        - School awards (with school average scores):
            1. Champion (school code)
            2. 1st Runner-up (school code)
            3. 2nd Runner-up (school code)
        - Total number of participants
        - Total number of participating schools
        - Overall School Results:
            1. school code,
            2. no. of participants from each school,
            3. school's average score
        - Percentage correct for each question

<< Inter-School Mathematics Competition Results >>
Here are the details of the competitions

1, The number of participants 200
2, The number of participated school 51
3, The number of questions in the MC 50
4, Planned number of prize = 5

Champion gets 44 marks S01144
1st runner-up gets 17 marks , S00015S03169 , S02055 ,
2nd runner-up gets 16 marks , S00017S03120 , S00031 , S04131 ,
S02109 , S00036 ,
The forth place gets 15 marks , S01101 , S01062 , S01186 , S04108 ,
S04181 , S00046 , S02118 , S00013 , S02159 , S03030 , S05058
The fifth place gets 14 marks , S05195
, S03122 , S04054 , S02183 , S03193 , S00042 ,

ALL PARTICIPANTS USE THE CODE'Sch000' ARE TAKE PART INDIVIDUALLY
The result in individual part

The Champian in individual part is S00015 who gets 17
The first runner-up in individual part is S00017 who gets 16
The second runner-up in individual part is S00031 who gets 16
The forth place in individual part is S00036 who gets 16
The fifth place in individual part is S00046 who gets 15

The others are representing to their school
The result in school part

The Champian in school part is S01144 who gets 44
The first runner-up in school part is S03169 who gets 17
The second runner-up in school part is S02055 who gets 17
The forth place in school part is S03120 who gets 16
The fifth place in school part is S04131 who gets 16

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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.) Any constraints on filename (e.g. 8.3 filename for program running in DOS)
    - File type: plain text file
    - Results stored:
        - Individual awards (with scores):
        - Champion (participant code, school code)
            1. 1st Runner-up (participant code, school code)
            2. 2nd Runner-up (participant code, school code)
        - School awards (with school average scores):
            1. Champion (school code)
            2. 1st Runner-up (school code)
            3. 2nd Runner-up (school code)
        - Total number of participants
        - Total number of participating schools
        - Overall School Results:
            1. school code,
            2. no. of participants from each school,
            3. school's average score
        - Percentage correct for each question

    - Sample layout: (next page)

<< Inter-School Mathematics Competition Results >>
Here are the details of the competitions

1, The number of participants 200
2, The number of participated school 51
3, The number of questions in the MC 50
4, Planned number of prize = 5

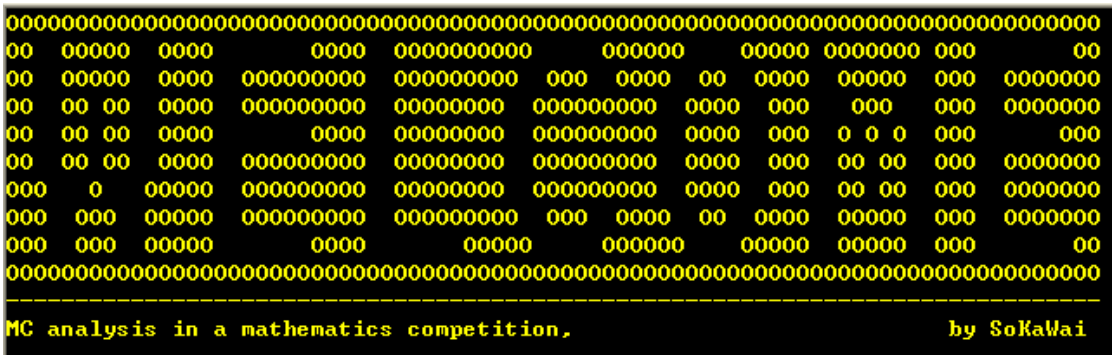
Champion gets 44 marks S01144
1st runner-up gets 17 marks , S00015S03169 , S02055 ,
2nd runner-up gets 16 marks , S00017S03120 , S00031 , S04131 ,
S02109 , S00036 ,
The forth place gets 15 marks , S01101 , S01062 , S01186 , S04108 ,
S04181 , S00046 , S02118 , S00013 , S02159 , S03030 , S05058
The fifth place gets 14 marks , S05195
, S03122 , S04054 , S02183 , S03193 , S00042 ,

school code&student id	score	percentage	full mark
sch000S00000	9	18%	50
sch000S00001	8	16%	50
sch000S00002	9	18%	50
sch000S00003	12	24%	50
sch000S00004	7	14%	50
sch000S00005	14	28%	50
sch000S00006	6	12%	50
sch000S00007	8	16%	50
sch000S00008	11	22%	50
sch000S00009	10	20%	50
sch000S00010	10	20%	50
sch000S00011	8	16%	50
sch000S00012	11	22%	50
sch000S00013	15	30%	50
sch000S00014	10	20%	50
sch000S00015	17	34%	50
sch000S00016	8	16%	50
sch000S00017	16	32%	50
sch000S00018	14	28%	50
sch000S00019	7	14%	50
sch000S00020	12	24%	50
sch000S00021	11	22%	50
sch000S00022	6	12%	50
sch000S00023	12	24%	50
sch000S00024	5	10%	50
sch000S00025	12	24%	50
sch000S00026	12	24%	50
sch000S00027	13	26%	50
sch000S00028	9	18%	50
sch000S00029	7	14%	50
sch000S00030	12	24%	50
sch000S00031	16	32%	50
sch000S00032	10	20%	50
sch000S00033	8	16%	50
sch000S00034	7	14%	50
sch000S00035	7	14%	50
sch000S00036	16	32%	50
sch000S00037	12	24%	50
sch000S00038	12	24%	50
sch000S00039	5	10%	50

sch000S00040	9	18%	50
sch000S00041	7	14%	50
sch000S00042	14	28%	50
sch000S00043	9	18%	50
sch000S00044	9	18%	50
sch000S00045	8	16%	50
sch000S00046	15	30%	50
sch000S00047	6	12%	50
sch000S00048	8	16%	50
sch000S00049	10	20%	50
sch012S04161	11	22%	50
sch004S03169	17	34%	50
sch013S03045	7	14%	50
sch014S04186	9	18%	50
sch027S05051	8	16%	50
sch043S03069	8	16%	50
sch017S02132	13	26%	50
sch025S04158	7	14%	50
sch022S02000	10	20%	50
sch039S02045	4	8%	50
sch004S03120	16	32%	50
sch007S01142	10	20%	50
sch007S01101	15	30%	50
sch006S05053	9	18%	50
sch031S01125	10	20%	50
sch028S04132	6	12%	50
sch048S01000	9	18%	50
sch019S02074	9	18%	50
sch039S01196	6	12%	50
sch017S03195	7	14%	50
sch006S04054	14	28%	50
sch012S01182	8	16%	50
sch025S01054	12	24%	50
sch019S05105	7	14%	50
sch041S02159	15	30%	50
sch017S03138	10	20%	50

Chapter 4 Implementation

4.1 Brief Description



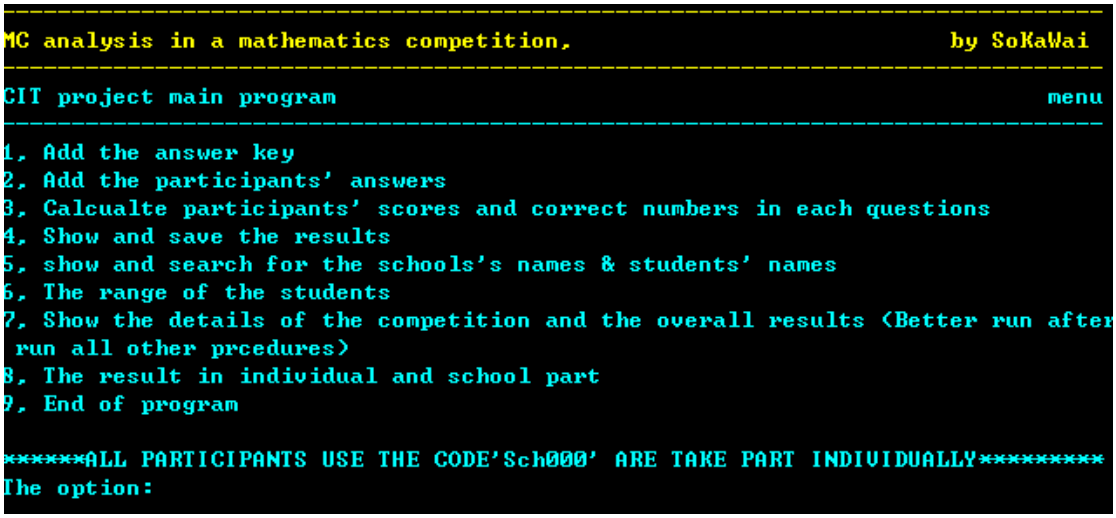
In this Chapter, I will discuss the implementation of the MC Analysis Program. The following things will be considered.

1. Determine the data structures that will be used in the program.
2. Describe the functions that will be performed by each procedure in the program.
3. Explain the main algorithms used in the program
4. Display some of the program codes
5. Display the user interface and analysis report.
6. The reusable of the program.

7. The program should be easy to read.
8. The result should be clear.
9. Assign output of the data.
10. Colour of the background and some effect.
11. Searching for data in the program.
12. Ability on coordination to the data file.
13. The chance of error occur

And the information shown in 1.2,

- the total number of participants
- the total number of participating schools
- the total number of participant(s) from each participating school
- comparisons of individual awards and schools
- the average mark of students in schools and all individuals
- the passing rate of schools and questions
- the average mark of each questions
- number and percentage of levels of mathematics presenting in the results
- description of the results
- comparison of results to the last few years
- standard deviation of all students, including all students, students in school and individual.
- Quartile of the result.



Menu - When the user has entered a file, a menu will be displayed. The user can then choose from the menu whatever they want the program to do.
Results – The results of the composition generated by the program can be saved in a new file for record and further use.

Displaying instructions

Users will be able to read the instructions of using the program in the layout. This can help the user to be able to use the program more easily.

Read in user's input

The program will read the composition in form of a text file so that further results could be generated.

Displaying Menu

A menu will then be displayed for user to choose their options. When an option is chosen, the program will run that particular function.

Showing results

After an option is selected, the program will generate a result of that corresponding function and the results will be
output to the screen.

Saving results

When the users have finished using the procedures, he/she can choose to save the results produced for the composition into a separate new file for further referral or record. In my program, each procedure can save a individual file. Maybe it leads trouble, but I think a specific save file is better in some situation.

Loading a new composition

If the user has finished using a composition, he/she can choose an option to load another composition into the program. In this case, the user does not have to run the program again every time he/she wishes to change a different composition.

4.2 Data Structures

In this chapter, I need to think about 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)? And why? What is/are the data structures for storing the answer keys read from the answer key file (ANSKEY.TXT) Consider the report / results you want to produce. What other data structures / arrays that you will define to store them? How to store the total number of participant(s) from each participating school? How to store the average score of each school? How to store the percentage correct for each question? And etc.

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

Constance: Fix the numbers of participants , schools, and questions.

maxnoques = 50; maxstudno =200; maxschoolno =60; are the constant

defined at the beginning of the program because the number is fixed, as they are maximum.

```
1.1.  studno : array[1..maxstudno] of string[6];
1.2.  real_studans : array[1..maxstudno] of string[maxnoques];
1.3.  stud_score : array[1..maxstudno] of integer;
1.4.  thestudans : array[1..maxstudno] of string[100];
1.5.  ansper_ques : array[1..maxstudno] of integer;
1.6.  studsch : array [1..maxstudno] of string[6];
1.7.  corrper_ques : array[1..maxnoques] of integer;
1.8.  school : array[1..maxschoolno] of string[80];
1.9.  student : array[1..maxstudno] of string[50];
1.10. stud_file, sch_file : text;
1.11. stud_count, sch_count :integer;
1.12. school_name : array[1..maxschoolno] of string[100];
1.13. student_name : array[1..maxstudno] of string[20];
1.14. ques_no : array[1..maxnoques] of integer;
```

thestudans will be inputted firstly as it is used to store the data in mcdata.txt , which consist of participants' numbers , school code and answer of participants.

Real_studans is used to store the mc answer of participants in 'thestudans'. As there is 50 question, so 50 answer and string of 50letters.

Studsch is used to store the school code of participants in the mcdata. It consists code only , so a string of 6 letters is used. 'Sch' is on the front of the code, so string is used.

studno is used to store the student number of the participants. Fix the string is 6 letters is to accommodate with the data file. 'S' is on the front of the code, so string is used.

school_name is used to store the full name of the schools. Name is grouped by Engish letters, so the array form of string is used.

student_name is used to store the full name of the participants. Name is grouped by Engish letters, so the array form of string is used.

Stud_score is used to store the score of each participants. Score is positive integer, so the array form of integer is used.

School is used to store school code and school name together, while student is used to store the student id and participants' name together.

Using code in the process is easier and convenient. Code is usually used in daily life to represent items. So, in the program, students' id represent to participants' name, school code represent to school name. School name and participants' name will be shown only when searching and some reports.

The variable above are using array is because they are all using to store either participants or schools data. As there are many participants and schools, so array is used. And integer is for numbers, string for letters and numbers. Then, real is used in mean.

corrper_ques and ansper_ques are also used to calculate the marks of questions. And ansper_ques is prepared for keeping the data. When corrper_ques gets changes so ansper_ques is created.

Ques_no will be counted in the process of inputting mcdata. Ques_no is used to count and store the number of questions in the MC. And the maximum question number and the question numbers may not be same. So, another array of integer is used.

stud_count will be counted in the process of inputting mcdata. Stud_count is used to count and store the number of questions in the MC. And the maximum number of participants and the numbers of participants may not be same. So, another array of integer is used.

sch_count will be counted in the process of inputting school data. Sch_count is used to count and store the number of questions in the MC. And the maximum number of schools and the numbers of school may not be same. So, another array of integer is used.

stud_file and sch_file are text what are used to locate the data file (MC data and anskey). And then read data .

The difference between real and integer are real is either rational or non-rational number, integer is integer without decimal fraction. And ':2:2' at the behind of real is needed for showing clear numbers but not in integer.

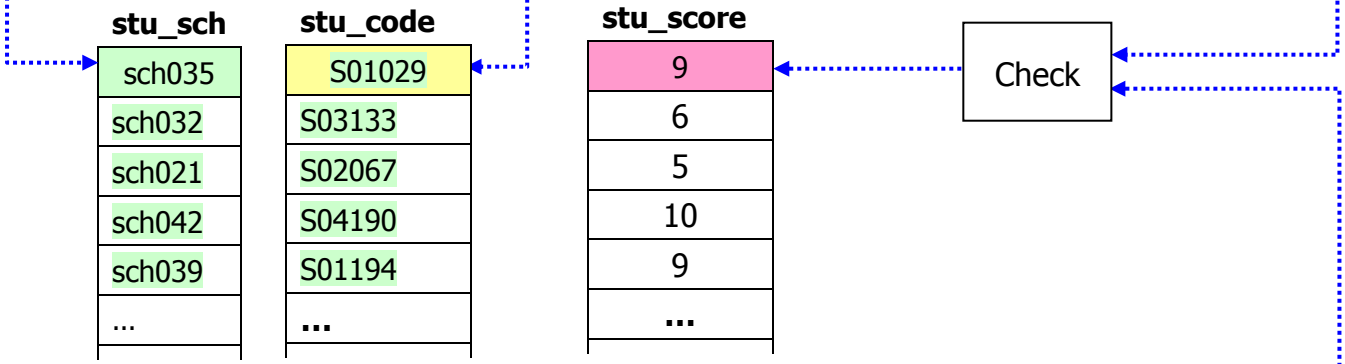
The difference between char and string are char is one letter but string is not more than 255 letters. Char is never been used in my program as there is copy function in Pascal and string is convenient to use.

Array is a function that represent to a lot of same variable. For example, studsch[1], stuno[1] and stud_score[1] will store the corresponding data of the first participant. And, school : array[1..maxschoolno] of string[80]; school is the variable, 1 is the first and maxschoolno (50 in my program) is the last. They group 50

same variable in 1 command . String[80] mean this variable is a string and the maximum number of letter is 80.

MCDATA.TXT

```
sch035S01029BDECEBDBADBDBABCDBDCCECDADEDBBAEEEABCBEEDBBBAECDBA
sch032S03133DEDADCBAAEAEDBCAADBABBEAEDEEDABCBAABCAADDCCAEDDEBE
sch021S02067EEEDCEBBCCDDABADABAADECEBDADCABCDAEBDDABCECACCEDEB
sch042S04190EBAABEEEBECEECEBEBBBCAEACABCDAACECCDACAABDCADCAACA
sch039S01194ACEADECBBAADCEABDDACCECCDBDDBBEECADDDBCCDCBAEEDBAE
sch008s08010EACCDCEACBACAAEBCBEAEECBBEDABAADDCBBBACEADABAEABEA
```



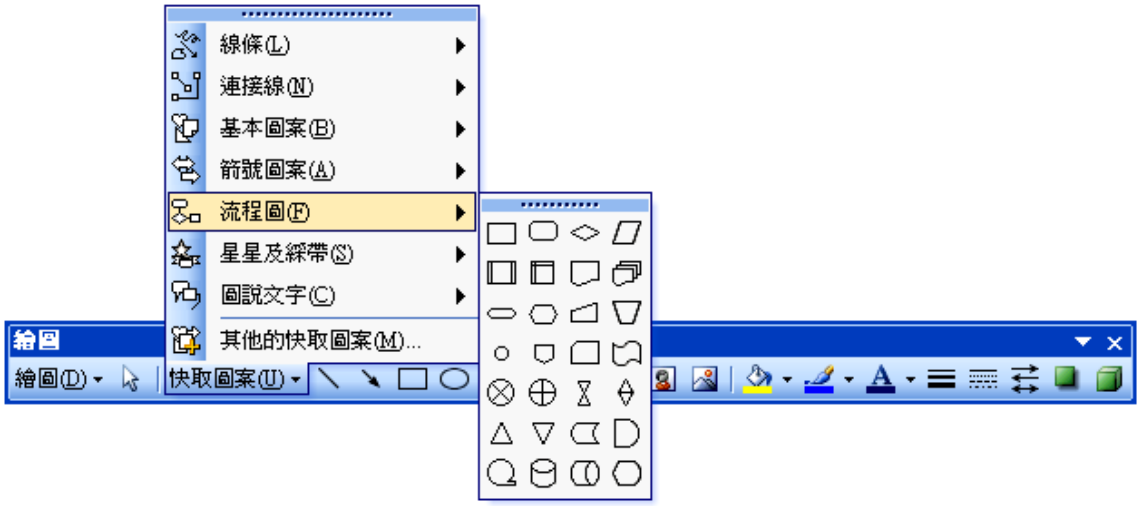
ANSKEY.TXT

```
ABDCCDECAEACCDACBBAECBACDCBAABABADECECDDEDABABACDC
```

4.3 Procedures in the Program

In this chapter, I will list the procedures that using in the program. The procedures should be consistent with the program structure you design in Chapter 3 (Section 3.2). And describe the purposes and uses of each procedure .Then explain the algorithm(s) that you use in the procedure to achieve the purposes. I will display some of the program codes to illustrate and also use flowchart to illustrate.

A flowchart is drawn by using the Drawing Tools in Word:



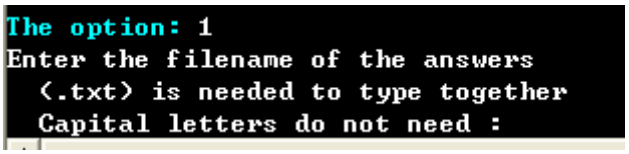
According to the sub-problems in Section 3.2 of Chapter 3, the following procedures will be constructed in the program:

```
1, Add the answer key
2, Add the participants' answers
```

1. **Read_answer_key**

   First, the program will ask the user to type the address of the answer key.

After the user inputted, assign(ansfile, ansfile_name); ansfile_name is the string that the user input. After the user inputted, Pascal will know the ansfile is a text what assigned as the user's input. Then, reset(ansfile); Pascal will know that the user would like to use and read the text file.

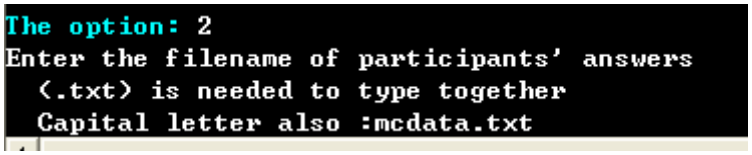


1.1 . **Read_Participants'_Ans**

The process of Read_Participants'_Ans is the sama as Read_answer_key. The difference is there is only 1 line (50 characters) inside the answer key file. There is the numbers of participants lines. In my MCdata, there are 200participants. So, 'while not eof(studans) do ' is used . **As the user don't know the number of participants, and 'eof' doesn't depend on the number of participants, but depend on the lines in the text file.** While the program is running, I add

```
begin
  k:=k+1;
  readln(studans, thestudans[k]);
  end;
  stud_count:=k;
```

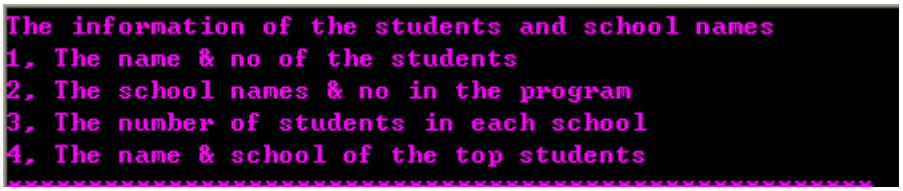
while the program reads the file down the lines, I add k:=k+1; to it then stud_count:=k; , so stud_count can be calculated according to the lines of the text file.

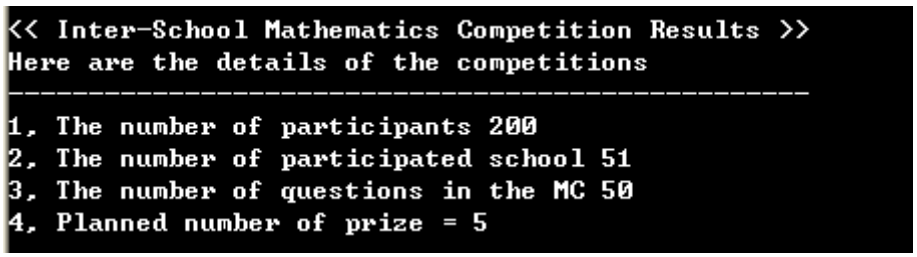


1.2 . **Read_data_file**

As the answer key file and the participants' answer file are not containing all data. So, In the later of the program, school file and student file will be inputted. As the same as Read_Participants'_Ans, 'while not eof' is used and k:=k+1; to calculate numbers of school and numbers of participants respectively.

If you want to load another mcfile, ansfile, just type 1 or 2 in the main project again to read!





2. **Calculate_participant_score**

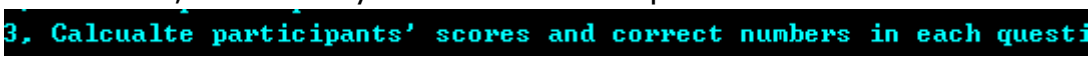
There is many method to calculate the paticipants' score. To me, my program has stored the participants' answer by the array: thestudans, then use

```
studsch[i] := copy(thestudans[i], 1, 6);
      studno[i]   := copy(thestudans[i], 7, 6);
      real_studans[i]:=copy(thestudans[i],13,(maxnoques));
```

to copy all the answers in the array: real_studans, and store the school code of participants' in the array : studsch and their student number in the array : studno. Then

```
for j := 1 to maxnoques do
 begin
 If copy(real_studans[i], j, 1)=copy(anskey, j, 1)then
   begin
     stud_score[i]:=stud_score[i]+1;
     ansper_ques[j]:=ansper_ques[j]+1;
     total:=total+1;
   end; end;
```

maxnoques is the number of questions. **This copy function can get the characters of the strings without using the array of char.** And no space is needed to store the other array to hold the same things. And in the same time, the correctly answered of each question is calculated.



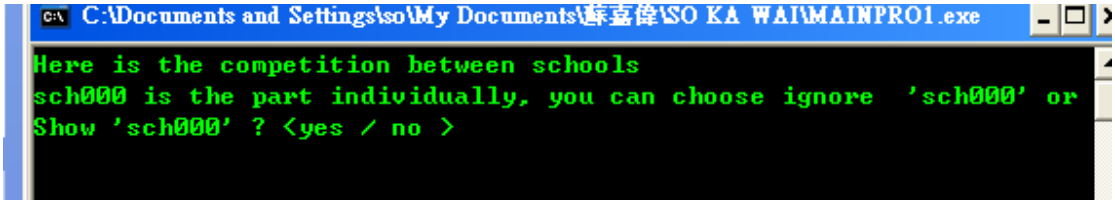
3. **Calculate_school_score**

Initially, this is a very easy job. As I has set some rules in the competition, which needs everyone to obey, including the program. **As there is school part and individual part were set in the rule.** So, I

need to show the difference in the result. The calculating process is very simple.

```
 for n := 1 to sch_count do
    for m := 1 to stud_count do
     if copy(school[n], 1, 6) = studsch[m] then
    begin
    sch_mark[n]:=sch_mark[n]+stud_score[m];
    studper_sch[n]:=studper_sch[n]+1
    end;
```

sch_mark is the sum up of scores from all participants in that school. studper_sch is the sum up of all participants in that school. Then, I can show the results below.

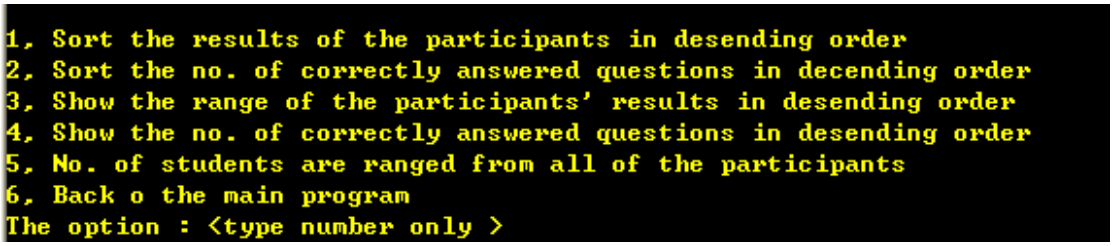


Just below the calculating, a yes/no is supplied to users to try. It is used to ignore the individual participants or not. In my data file and in the program, all individual participants are studies in the same school coded sch000 and given the student id s0000X. If the user wants to ignore the individual participants. Just type yes.

```
for n := 1 to sch_count do
        begin
         write(copy(school[n], 1, 6), sch_mark[n]:10,
studper_sch[n]:10);
         If studper_sch[n]=0 then studper_sch[n]:=-1;
         writeln((sch_mark[n]/studper_sch[n]):10:2);   end;
```

In my data file, some participated schools have not choose any students to do the paper but participated. So, sch_mark[n] and studper_sch[n] both 0. When 0/0 is calculated, error is occurred. So –1 is replaced during calculating and 0 is replaced back as it should be 0 and for reusing the data and program.

4. **Sorting**



4.1 Sort the order of the participants

```
6, The range of the students
```

In order to find the winner, the order of participants should be rearranged. The participant who gets the highest mark should be put on the top or the bottom. However, sort in score is right.

```
if stud_score[y] <= stud_score[y+1] then
                begin
                    tem_stud := stud_score[y];
                    stud_score[y] := stud_score[y+1];
                    stud_score[y+1] := tem_stud;

                    tem_sch := studsch[y];
                    studsch[y] := studsch[y+1];
                    studsch[y+1] := tem_sch;

                    tem_no := studno[y];
                    studno[y] := studno[y+1];
                    studno[y+1] := tem_no;
```

By bubble sort, If student[1] get lower mark than student[2], then their score, student id, school code are changed. About the names, the student name is followed to the student id, school immediately by their[n] are the same when input them.

```
The result sorted into Decending order
The top gets the highest mark
school code, student no,    score,
    sch042    S01144    44
    sch007    S02055    17
    sch000    S00015    17
    sch004    S03169    17
    sch000    S00031    16
```

4.2 Sort the order of the questions

Just for the user or the participants to see which questions have performed well or worse. Use the bubble sort also. Rearrange them.

```
Show the number of corrctly answered in each questions
------------------------------------------------------
Question no.   35      no of correctly answered    56
Question no.   30      no of correctly answered    55
Question no.   47      no of correctly answered    51
Question no.   45      no of correctly answered    51
Question no.   31      no of correctly answered    49
```

5. **Find_Winners**

Initially, this is a very easy job. Just use for m := 1 to 5 do writeln(studno[m]); then the top 5 winner will be shown. But, in the case that there are two or more champions. It will become trouble.

```
curr_score := stud_score[1];
  i := 0;
  write('1, ',   studno[i], '   , ');
  repeat
    i := i + 1;
    if stud_score[i] = curr_score then
        write(studno[i]:5)
  until stud_score[i] <> curr_score;
  write('is the Champion who gets', curr_score, ' marks ');
  writeln;

  curr_score := stud_score[i];

{   if not full then     begin
  If i >= 5   then full:= true;
  repeat          begin
   if stud_score[i] = curr_score then
        write(studno[i]:5, '   , ');
    i := i + 1;                              end
  until stud_score[i] <> curr_score;
  write('is the 1st runner-up who gets', curr_score, ' marks ');
  writeln;          end;}
```

If top 5, the {XXXX} place need to copy more three times. Although it is too long to process, but it can show the result that there are more than one people get the highest marks, second highest mark, third highest mark ,etc. **And it can be stopped at that level that the winner the exceed but show all the winner at the last level.** For example, 3get highest mark, 3get second highest mark, 3get third highest mark,3 forth place and 3 fifth

place. If there are 5 winners , it can show the 3 champions and 3 first runner-up. If there are 10 winners, it can show the 3 champions, 3 first runner-up , 3 second runner-up and 3 forth place.

```
------------------------------------------------
1,   , S01144is the Champion who gets44 marks
S00015  , S03169  , S02055  , is the 1st runner-up who gets17 marks
S00017  , S03120  , S00031  , S04131  , S02109  , S00036  , is the 2nd runner-up
 who gets16 marks
```

6 The statistics

```
Showing of the results of the competition
-----------------------------------------------------

 1, Show the score of the students
 2, Show the correctly answerd in each question
 3, Show the score of the students in graph
 4, Show the correctly answerd in each question in graph
 5, Calculate and show school mark and average
 6, Show the score of schools in graph
 7, Calculate and show the mean of the mark of the participants
 8, Calculate and show the median of the mark of the participants
 9, Calculate and show the mode of the mark of the participants
10, Calculate and show the standard deviation of the mark of the participants
11, Calculate the 1st, 2nd and 3rd quartile of the students
12, Back to main program
The option : <type number only >
```

6.1 Average mark, mean

The information of the variable in calculating average mark has already inputted before.

Eariler" If copy(real_studans[i], j, 1)=copy(anskey, j, 1)then

```
        begin
          stud_score[i]:=stud_score[i]+1;
          ansper_ques[j]:=ansper_ques[j]+1;
          total:=total+1";
" while not eof(studans) do
begin
k:=k+1;
readln(studans, thestudans[k]);
end;
stud_count:=k;"
```

NOW mean:=total/stud_count;

Just use the total score divide by the number of student. Mean is set as real. By the functions of Pascal. (mean):2:2 . Then a number with 2 decimal place will be shown.

```
The mean of the marks is 10.31
```

6.2 Median

Median is just like the method of calculating mean. Use the number of participants divide by 2, the score of him/she is the median.

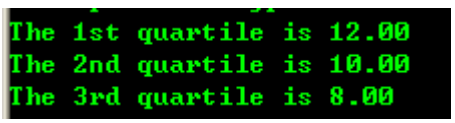
```
If (stud_count / 2) > 0 then
        median := stud_score[round(stud_count/2)]/2
         else if   (stud_count / 2) = 0 then
            median := (stud_score[trunc(stud_count/2)] +
stud_score[round(stud_count/2)])/2;
```

The calculation will be easier when the number of participant is odd number. It is because the half of the participants is one number only. Two number are also median when the number of participant is even number. In **Pascal round function will take the number to the nearest whole number**, for example, let 6.5 become 7. **trunc function will cut the decimal place**, for example 6.5 to 6. So, I can take the more 1 and less 1 number easily.

6.3 Quartile

The method of calculating quartile is the same as median. The difference is only 25%, 50% and 75% is also needed to show.

```
If stud_count mod 2 = 0 then    begin

st:=(stud_score[trunc(stud_count*0.25)]+stud_score[round(stud_coun
t*0.25)])/2;

nd:=(stud_score[trunc(stud_count*0.5)]+stud_score[round(stud_coun
t*0.5)])/2;

rd:=(stud_score[trunc(stud_count*0.75)]+stud_score[round(stud_cou
nt*0.75)])/2 ;end
        else    if stud_count mod 2 > 0 then    begin
            st:=stud_score[round(stud_count*0.25)];
            nd:=stud_score[round(stud_count*0.5)];
            rd:=stud_score[round(stud_count*0.75)];          end;
```



7 Mode

In statistics, the mode is the value that occurs the most frequently in a data set or a probability distribution. In some fields, notably education, sample data are often called scores, and the sample mode is known as the modal score.

Like the statistical mean and the median, the mode is a way of capturing important information about a random variable or a population in a single quantity. The mode is in general different from mean and median, and may be very different for strongly skewed distributions.

The mode is not necessarily unique, since the same maximum frequency may be attained at different values. The most ambiguous case occurs in uniform distributions, wherein all values are equally likely. The method of calculating is complex.

```
Variable: stud_mode : array[0..maxnoques] of integer;
    n, m : integer;
    mode : integer;
  { for n := 1 to stud_count do
        stud_mode[stud_score[n]]:= stud_mode[stud_score[n]]+1;
    mode:=0;
  }

  { for m:= 1 to maxnoques do
        If stud_mode[m] > stud_mode[mode] then
            mode:= m ;
  }
```

As there were some participants get 0 mark, the array begins from 0. Since the highest mark is 50, the range of mode is from 0 to 50. Calculate the number of participants in each score.

The hightest frequency of number of participants become m in the second part of the procdure. Then the highest value (the highest frequency) of the number of participants is the mode. **But It is not the score of participants, is the number of the highest frequency. The highest frequency of participants getting the certain scor is the mode.** To find it out.

```
{ for n := 0 to maxnoques do
    If stud_mode[n] = stud_mode[mode]
    then   write(n, ' ');.
           stud_mode[n]
}
```

Then, the mark of the highest frequency is found.

```
The mode of the students is 8
```

7.1 Standard deviation

Standard deviation is a measure of the dispersion of data about a

mean value. A low standard deviation indicates that the data is clustered around the mean, whereas a high standard deviation indicates that the data is widely spread with significantly higher/lower figures than the mean.

When only a sample of data from a population is available, the population standard deviation can be estimated by a modified standard deviation of the sample.

A useful property of standard deviation is that, unlike variance, it is expressed in the same units as the data.

Mean is needed to find first before calculating standard deviation. Then find the absolute difference, the difference between each data and the mean. Sum up the square of each absolute difference. Finally, divided by the number of (data-1). It is the standard deviation.

```
mean:=total/stud_count;
for n := 1 to stud_count do
begin
absol_diff[n]:=(mean-stud_score[n]);
diff_sum:=(diff_sum)+sqr(absol_diff[n]);
end;
sd := sqrt(diff_sum/(stud_count-1));
```

```
The standard deviation of the participants is  3.75
```

8 Graph

It was used to show the score of participants, correctly answered questions and the score of school.

```
for h := 2 to sch_count+1 do
        begin
        write(copy(school[h], 1, 6)); for   i := 1 to sch_mark[h] do
write('*'); write('[', sch_mark[h],']'); writeln('[', studper_sch[h], ']'); end;

writeln('_____________________________________________________________
_____________________________');
        writeln('0      5       10      15      20      25      30      35
40      45      50');
        writeln('                       [number of schools][students in that
school]');
```

It is no difficult to calculate. **Use the score calculated before then use write function, but not writeln, to write the "*"s**. Then writeln at end.

And Shows the information of x-axis.

In my program, graph in show the result of competition between schools is not simply write"*"s. Since there are individual participants and schools' participants. To separate them, I make a option part to them.

```
Here is the competition between schools
sch000 is the part individually, do you want to show 'sch000' or not
Show 'sch000' ? <yes / no >
```

If the choose is yes, sch000 (represent to the individual participants), will be shown in the graph, else, only schools' participants.

If copy(school[n], 1, 6) <> 'sch000' then begin

```
sch000 is the part individually, do you want to show 'sch000' or not
Show 'sch000' ? <yes / no >yes
Okay, individual participants is going to be shown below
School code    total score number of paricipants  average score
sch000       509        50     10.18
sch001         0         0     -0.00
sch002         0         0     -0.00
sch003         0         0     -0.00
sch004        51         4     12.75
```

And

```
sch000 is the part individually, do you want to show 'sch000' or not
Show 'sch000' ? <yes / no >no
Okay, no individual participants will be shown below
School code    total score number of paricipants  average score
sch001         0         0     -0.00
sch002         0         0     -0.00
sch003         0         0     -0.00
sch004        51         4     12.75
sch005        37         4      9.25
```

9 Searching

Searching is a extra function to make the program becomes convenient when use. When the score, ranking is calculated. A huge amount of results will be shown in the same time. It causes trouble when the user wants to find out the certain participants, schools. He/she can easily find the information they need when using searching.

```
readln(search_no);
iF search_no = '' THEN   search_no:=' ';
for n := 1 to stud_count do
begin If copy(student[n], 1, 6) = search_no then
        begin
        search_name := copy(student[n], 9, 29);
        writeln('Found! Student ', copy(student[n], 1, 6) , ' called ',
copy(student[n], 9, 29), ' and studies in ', studsch[n], ' gets ',
stud_score[n], ' marks');
        found:=true;
```

```
            end;
        end;
        for n := 1 to sch_count do
        begin If copy(school[n], 1, 6) = search_no then
                begin
                search_name := copy(school[n], 9, 109);
                writeln('Found! School ', copy(school[n], 1, 6) , ' called ',
copy(school[n], 9, 109));
                found:=true;
                end;
        end;
        If not found then writeln('Sorry. ', search_no, ' could not be found.
');
```

For easier using, school code and student id can be search at the same time. As there are both string, no needed to separate them by using different variable. It is because the school code and student id is totally difference. Use "If then" to check , If it can be found in the list of student id, then it is a student id represent to the unique student. If it can be found in the list of school code, then it is a school cod represent to the unique school. The name of the student/ school will be shown immediately after found, marks also.

```
Welcome to use this procedure 'search'
Type the school no. or student no. to search for his / its name.
Capital letter for 'S' in student no. and both school no. please
Search no : sch000
Found! School sch000 called Individual participant gets 509 which have 50 studen
ts participated

"0" may occurred If you don't calculate the schools' marks first, otherwise, the
re is no any participants in that school
Search again? <yes / no > ys
Type the school no. or student no. to search for his / its name.
Capital letter for 'S' in student no. and both school no. please
Search no : S00000
Found! Student S00000 called TSANG, YING KAM and studies in sch042 gets 44 marks


"0" may occurred If you don't calculate the schools' marks first, otherwise, the
re is no any participants in that school
Search again? <yes / no >
```

Searching in only codes and id will not be enough when the user has a name but hasn't the codes or id. So, a search in name procedure is made.

```
    readln(search_no);
        iF search_no = '' THEN
           search_no:=' ';
    for n := 1 to stud_count do
    begin If copy(student[n], 9, length(search_no)) = search_no then
             begin
```

```
                search_name := copy(student[n], 9, 29);
                writeln('Found! Student ', search_name, ' is ', copy(student[n],
1, 6) , ' and studies in ', studsch[n], ' gets ', stud_score[n], ' marks which
ranked ', n);
                found:=true;
                end;
        end;
        for n := 1 to sch_count do
        begin If copy(school[n], 9, length(search_no)) = search_no then
                  begin
                  search_name := copy(school[n], 1, 6);
                  writeln('Found! School ', copy(school[n], 9, 109) , ' is ',
search_name, ' gets ', sch_mark[n], ' which have ', studper_sch[n], '
students participated ');
                  found:=true;
                  end;    end;
        If not found then writeln('Sorry. ', search_no, ' could not be found. ');
```

In this search, the variable is also a string. So, there is no difference between the variables. There is a special point in this search in name procedure. If you didn't type the full name, only typed a few words. It can be found also only when the user typed in capital letters and there is no misspelling. As the procedure is used

If copy(school[n], 9, length(search_no)) = search_no then

The area or the length of string it was needed to find is the length of string (the number of characters) that the user typed. For example, the user typed CHAN, then all participants with CHAN is the front of the full name will be shown. And it hasn't not made the same function in the procedure that searching in numbers. It is because there is a huge difference even there is a number typed wrongly.

```
Welcome to use this procedure 'search'
Type the school name or student name to search for his / its name.
Capital letter for all the words
Search name : CHAN
Found! Student CHAN, KWOK LEUNG is S00006 and studies in sch000 gets 16 marks wh
ich ranked 7
Found! Student CHANG, SHUI HUNG is S00007 and studies in sch021 gets 16 marks wh
ich ranked 8
Found! Student CHAN, SHU SUM is S00009 and studies in sch000 gets 16 marks which
 ranked 10
Found! Student CHAN, KAM MING is S00010 and studies in sch007 gets 15 marks whic
h ranked 11
Found! Student CHAN, WAI MAN is S00014 and studies in sch000 gets 15 marks which
 ranked 15
```

```
Search again? <yes / no > yes
Type the school name or student name to search for his / its name.
Capital letter for all the words
Search name : YMCA
Found! School YMCA of Hong Kong Christian College  is sch005 gets 37 which have
4 students participated
"0" may occurred If you don't calculate the schools' marks first, otherwise, the
re is no any participants in that school
Search again? <yes / no >
```

10 Some extra functions

In my program, A top[n] function is added, menu with go and back function, show individual part and school part result, save in many procedures, reset to 0 in each procedure, repeat asking when wrongly input and making data files.

Top[n]

After I saw many classmates made a procedure called top 5, I had an idea and decided to make a top[n] procedure.

```
for m := 1 to no_top do
      writeln(m, ',is ', studsch[m]:8, studno[m]:10,
stud_score[m]:6);
```

Didn't make the function of show both participants have the same score is a mistake. For example, the user wanted to show top 5, but there are 6 champion, I can't show both participants have the same mark in this procedure. It is because I think that it is top[n], there is a unfair situation. So, it will be discussed later.

```
for m := 1 to no_top do
  remember[m]:=studsch[m]+'      '+studno[m];
```

It is run in sorting page as it is really made by sorting, and I has made the same procedure for just showing the result calculated here. It shows detailer, so in the aim of temporary remember. I use this sentence.

However, it is for more convenient, don't need to type too much when run, just the number of participants you want to show. Or, I should put it with searching procedure.

```
The option : <type number only > 5
How many students are ranged from all of the participants would you like to show
? 5
5 of highest mark participants you would like to show
------------------------------------------------------------
school code, student no,    score,
1,is    sch042    S01144    44
2,is    sch004    S03169    17
3,is    sch000    S00015    17
4,is    sch007    S02055    17
5,is    sch004    S03120    16
Want to remember the student no. of the participants above ?
You can use another procdure to find their names after saving it
Need temporary remember ?<yes / no > yes
The data are successfully remembered !
You can find that procdure in '5, show the schools's names & students' names 'in
 the main program
Press <Enter> to continue
```

```
**The name and school of the top participants will be shown below
**school code&student id,  School name,   Student name

1sch042    S01144 is SO, KAR CHEUK studies in Tung Wah Group of Hospitals Chang
Ming Thien College  who gets 44
2sch004    S03169 is WONG, CHOI studies in Tung Chung Catholic School  who gets
17
3sch000    S00015 is WONG, SUM YIN studies in Individual participant who gets 17

4sch007    S02055 is SO, TIM studies in CCC Kei To Secondary School  who gets 17

5sch004    S03120 is TSANG, KWENG FAI studies in Tung Chung Catholic School  who
 gets 16
--------------------------------------------------------------------------------
Press <Enter> to continue
```

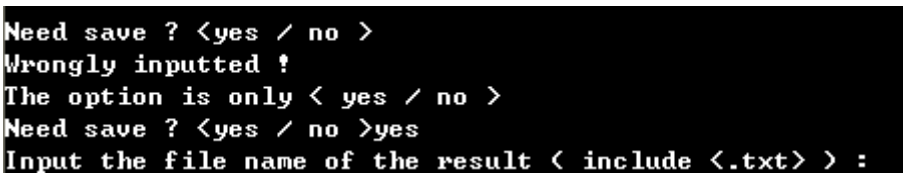
Show individual part and school part result

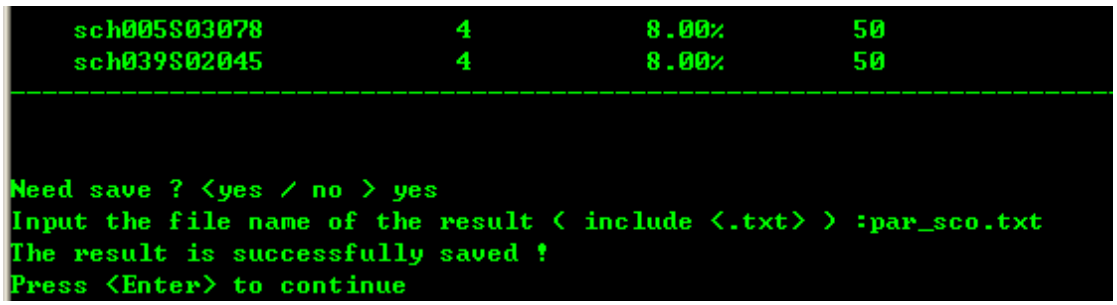
The method of calculating it has been descript above, the process will be shown below. It is just showing top5 there.

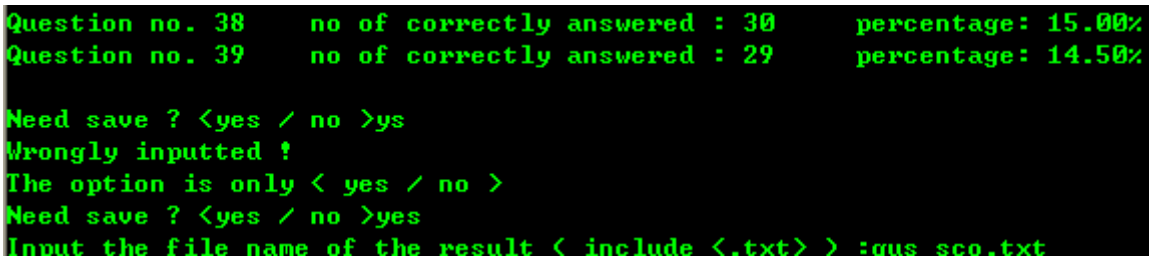
```
ALL PARTICIPANTS USE THE CODE'Sch000' ARE TAKE PART INDIVIDUALLY
The result in individual part
--------------------------------------------------------------------------------

The Champian in individual part is S00015 who gets 17
The first runner-up in individual part is S00017 who gets 16
The second runner-up in individual part is S00036 who gets 16
The forth place in individual part is S00031 who gets 16
The fifth place in individual part is S00013 who gets 15
--------------------------------------------------------------------------------




The others are representing to their school
The result in school part
--------------------------------------------------------------------------------

The Champian in school part is S01144 who gets 44
The first runner-up in school part is S03169 who gets 17
The second runner-up in school part is S02055 who gets 17
The forth place in school part is S03120 who gets 16
The fifth place in school part is S02109 who gets 16
--------------------------------------------------------------------------------
```

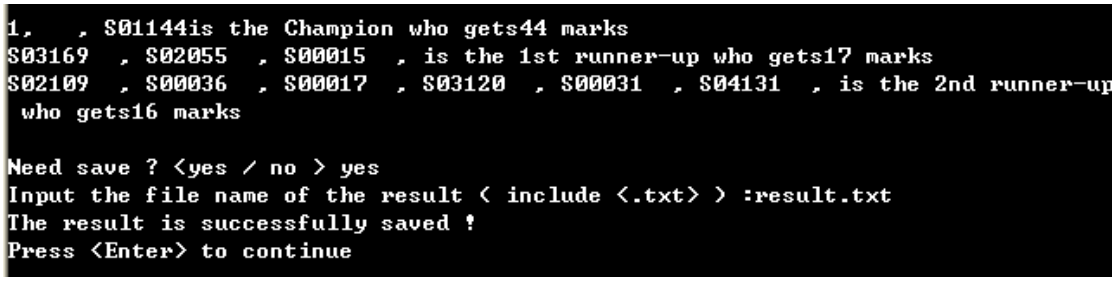
Save in many procedures

In my program, I use many small save procedure to replace a big save at the end. At first, I through that it would be a good idea, but at last, I think that it is too trouble to see all results. At the end, I decided to make a overall result and both run with small saves. As my logic is not suitable to run a overall results, it need too many factors coordinate. So, I didn't make a overall save. Just let it shows in many small parts of saves.









Reset to 0 in each procedure

After testing a few times, I found that the variable is continuous adding numbers in some sentences, for example, b:=b+1, stud_count:=stud_count+1,

As my logic is calculating and show result in the same time in each procedure, the number multiple by 1 time every running.

So, set the variable back to initial is necessary before every running.

```
for n := 0 to maxnoques do
   stud_mode[n]:=0;
n:=0; sch_count:=0;
   for n := 1 to sch_count do
       stud_sch[n]:=0;
```

Although it is a must, it is not necessary to reset the variable to 0 as for n :=1 to stud_count do n is fixed. So, not need to change.

Repeat asking when wrongly input

In some cases, options will be chose, like menu, input data, ask for run 1 more time, etc. As the program is interacting with the users, a little wrongly inputted will occur run-time error.

To prevent avoidable run-time error, we can check the input before process.

```
If (save <> 'yes') and (save <> 'no')  and (save <> 'NO')
and (save <> 'N') and (save <>'YES') and (SAVE <>'Y')then
        repeat
  writeln('Wrongly inputted !');
  writeln('The option is only < yes / no > ');
  write('Need temporary remember ? <yes / no >');
  readln(save);
        until (save = 'yes') or (save = 'no') OR (save = 'NO')OR
(save = 'N') OR (save ='YES') OR (SAVE ='Y');
```

As there are many save function in my program, asking save every time is needed. And check the input also, in this process, If the user don't type yes/no, the error signal occurs until yes/no is typed.

In menu, other way of checking is used.

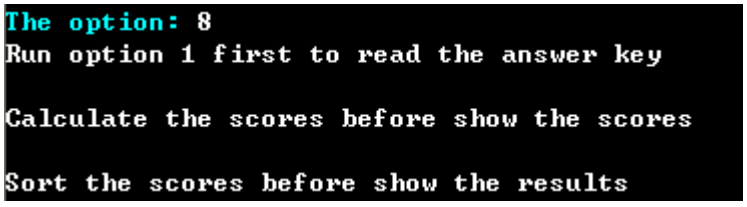
```
readln(no);
check := true;
 If (no <> 1) and (no <> 2) and (no <> 9) then
  begin
    check := false;
     if run[1]=false then
         begin writeln('Run option 1 first to read the answer
key');
         readln; end
     else
         if run[2]=false then
```

```
                    begin writeln('Run option 2 first to read the
participants'' answer ');
                     readln; end
                  else
                     check := true;
            If (no = 4 ) or (no = 6) or (no = 7 ) or (no = 8 )then
               begin check:= false;
                if (run[3] = false) then
                     begin    writeln('Calculate the scores before show the
scores ');    readln;
                     end     else
                    check := true;
            If    (no = 6 ) then if (run[3] = false) then
                  begin check := false; writeln('Calculate the scores
before sort the results');    readln; end end
                        else check := true;
                If    (no = 7 ) or (no = 8 ) then if (run[3] = false) or
(run[6] = false) then
                     begin check := false; writeln('Sort the scores before
show the results');    readln; end end
           else check := true;
         until check;
```

Before using this code, I add

```
 for a := 1 to 12 do
    run[a] := false;
```

At first, and run[a]:=true, in some procedure that must be written first.



Making data files

Coordination between data file and the program is a must.

In my planning, copy term coordinate with the data file clearly, then a clear result is formed.

```
sch000S00000BCEECBEEEDCADDBDEDBCCDDCAAABCBDAAAABBECAEADCBACBDB
sch000S00001CBEEBBEBDAECCDBBADEBECCAACDCEBDABAEDADEBDBBADADABA
sch000S00002DBBAEDEBDEBCDEDEADDCAAACBBACAABCECDECECCDEDADAADCB
sch000S00003ECEEBCACAAACCBECEDBEABBEBBADDEDDDCEADBCECCDDBBACBA
sch000S00004DEBBDCACAADCACBCAEDDBAEEBBCCCDECBADCAECCECCBEDCDAA
sch000S00005CDDACECEDEDCABEBAAAEDBCDEBCCDEADABBDCDDDADADEEEDAC
sch000S00006DEACCAABEBDEBCBECDBDBABEAEDDBACDDAEEDDCBCAECABAAAE
sch000S00007CABACCDBBDEDAABECBAEAACEABEBACBEAEABEACECBBDADBDBA
sch000S00008AECDCACEBDCDADABACBADBAECEBBDBCBDADADDAACEADAACACD
sch000S00009DCCAEDBCCECBDAEDCBCBADAECBCBDEACBDDDCEBDEAEAADDDCE
```

data.txt

```
ABDCCDECAEACCDACBBAECBACDCBAABABADECECDDEDABABACDC
```

anskey.txt

```
sch000  Individual participant
sch001  Ling Liang Church E Wun Secondary School
sch002  NTHYK Southern District Secondary School
sch003  Po Leung Kuk Mrs. Ma Kam Ming-Cheung Fook Sien College
sch004  Tung Chung Catholic School
sch005  YMCA of Hong Kong Christian College
sch006  Carmel Secondary School
sch007  CCC Kei To Secondary School
sch008  Chan Sui Ki (La Salle) College
sch009  Christian Alliance PC Lau Memorial International School
sch010  Diocesan Boys' School
sch011  CCC Yenching College
sch012  China Holiness College
sch013  CNEC Christian College
```

school_list.txt

```
S00000  TSANG, YING KAM
S00001  YIP, WAI CHOI
S00002  NG, YU SO
S00003  LAM, PING TAK
S00004  WONG, CHUNG SANG
S00005  CHENG, KWOK CHIU
S00006  CHAN, KWOK LEUNG
S00007  CHANG, SHUI HUNG
S00008  NG, TIM FU
S00009  CHAN, SHU SUM
S00010  CHAN, KAM MING
```

name_list.txt

```
for i:= 1 to stud_count do
 begin
  stud_score[i]:=0;
  studsch[i] := copy(thestudans[i], 1, 6);
  studno[i]  := copy(thestudans[i], 7, 6);
  real_studans[i]:=copy(thestudans[i],13,(maxnoques));
```

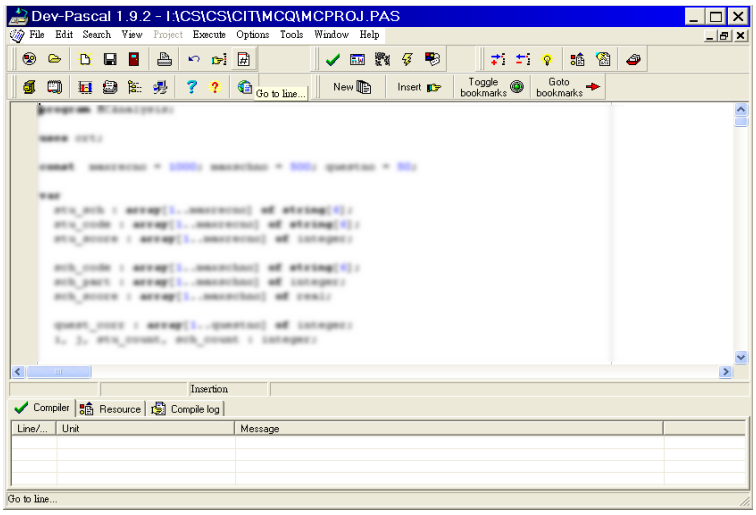
4.4 Program Coding

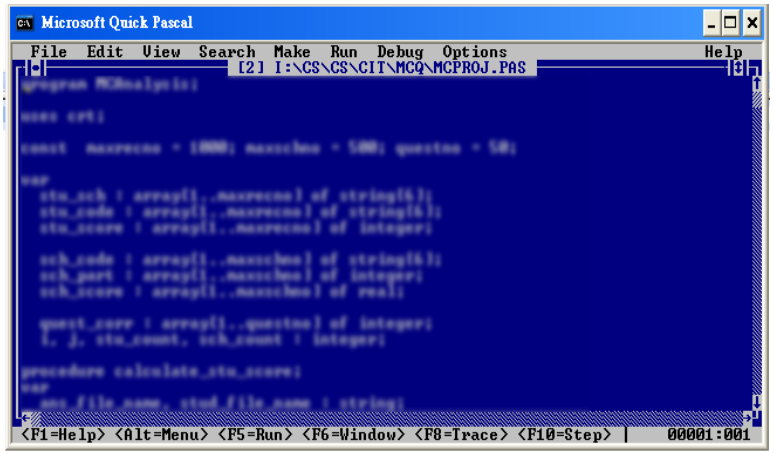
I will describe the process of program coding (writing). By using which programming language and tools (e.g. QPascal, Dev-Pascal, etc.). Writing the source program and then compile it into the object program (the executable program .exe)

- What is the filename of the source program? (e.g. MCPROJ.PAS)
- What is the filename of the object program? (e.g. MCPROJ.EXE)

Screenshots will be shown to illustrate. Complete program code will be placed in the Appendix Section.

And most of the code is discussed in 4.3.





4.5 Program Execution

My program is pretty complex. The user will type most of data and the steps. I will describe the steps in execution of program. First, I will describe the following thing in the text.

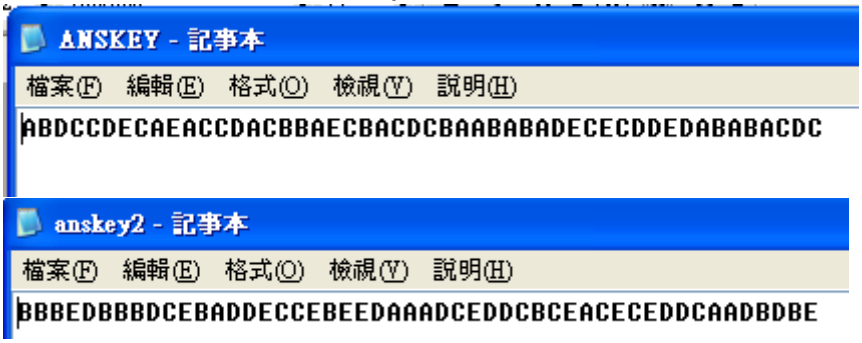
- What data files should be prepared before execution?
  - The text file storing the answer keys (ANSKEY.TXT)
  - The text file storing the Participants' Answers (MCDATA.TXT)
  - Refer to Section 3.3
- What file should be produced? (e.g. the report file REPORT.TXT)
- Capture some screenshots/pictures of the user interface from the program.
- Briefly describe the screenshots.
- The screenshots (with descriptions) should be arranged in proper order so that the flow of operation of your program can be shown.
- Consider this as a simple user guide for the user. You may construct a more detailed user guide in the Appendices of this report.
- etc.

Example

1. Program file: MCPROJ.EXE
2. Data file to be prepare for input:
   - The text file storing the answer keys: ANSKEY.TXT
   - The text file storing the Participants' Answers: MCDATA.TXT
   - Indicate that the program file and data files should be put into the same folder / location before execution.

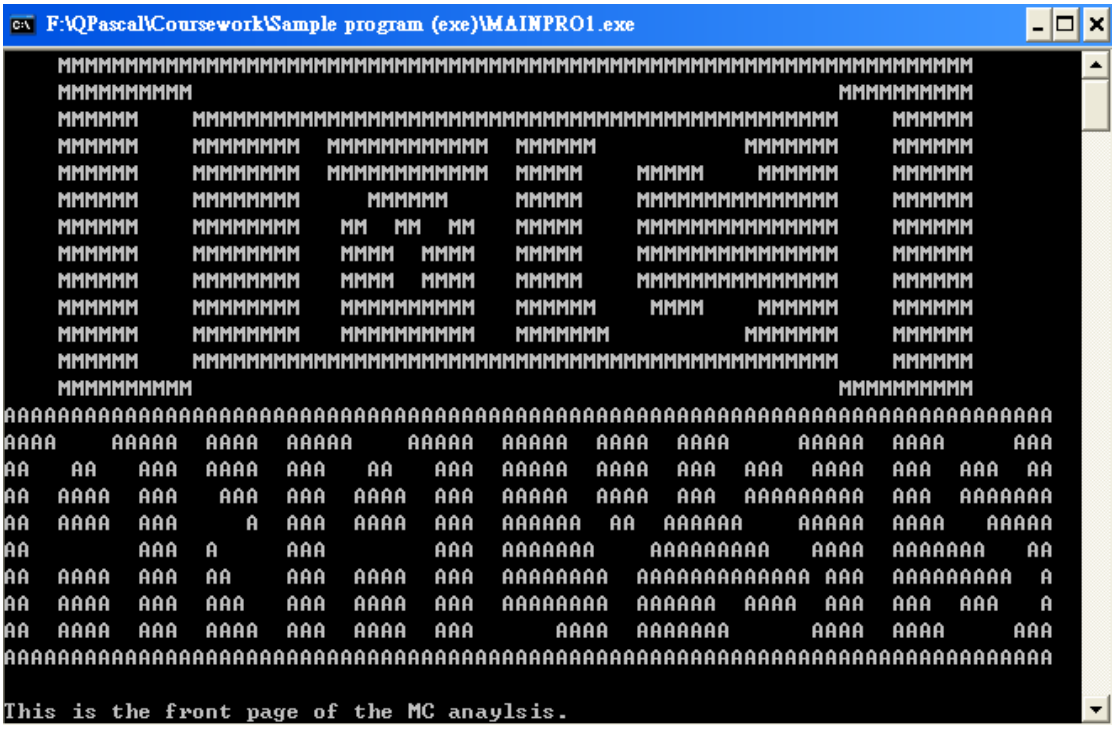
   Briefly explain that the files are prepared by MS Notepad for program testing.

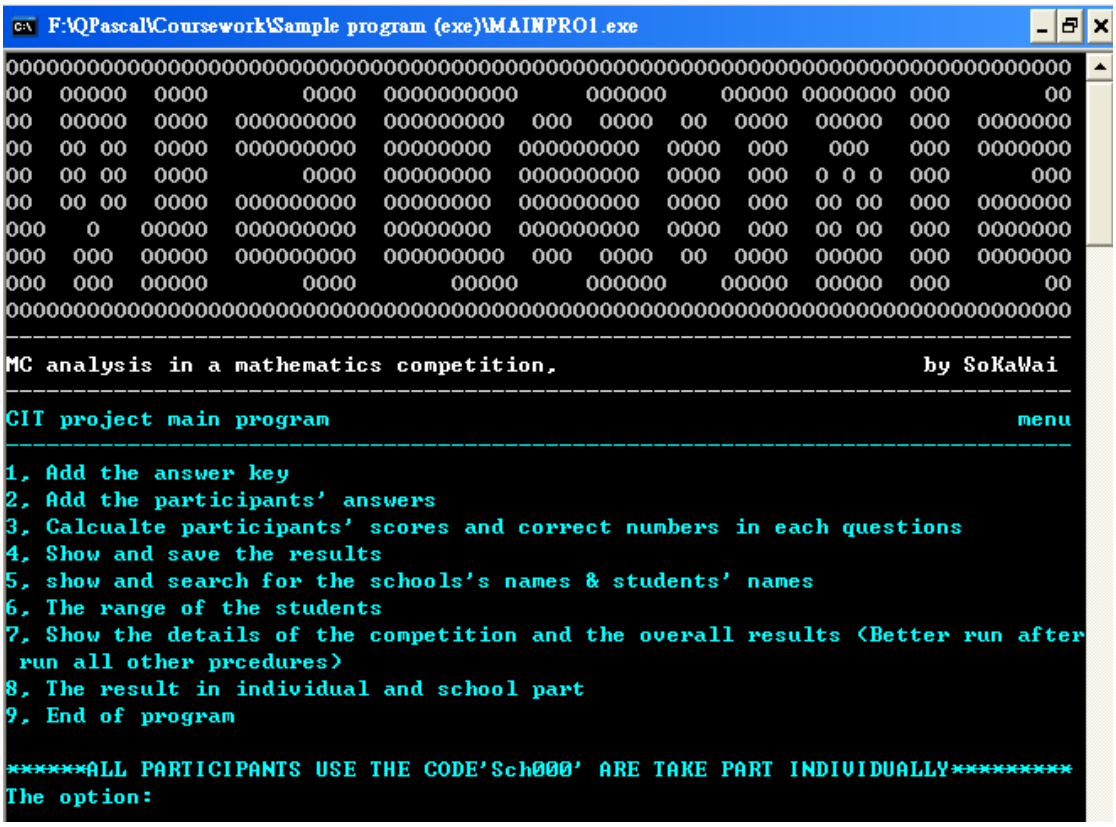
1. Confirm the answer key.txt file.



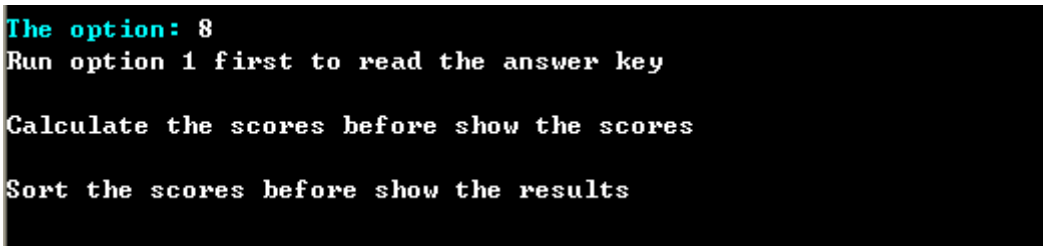
2. Confirm the mcdata.txt file.

3. User interface of the program (The input screen)





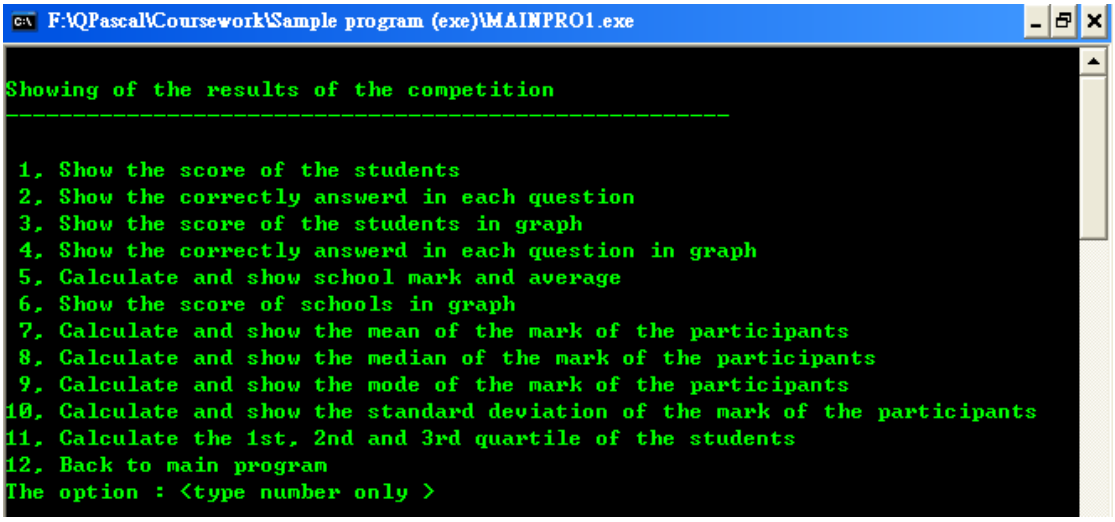
In this page, 1 and 2 is reading data, must be run first. If not, my warning or error is occurred. Then run 3 to calculate the scores.



4. Results displayed on screen

After 4 is run, it is the page of showing the statistics. But 5, 6, 11 must be run later. It is because it needs the sorted result or read the other data first.

The main menu



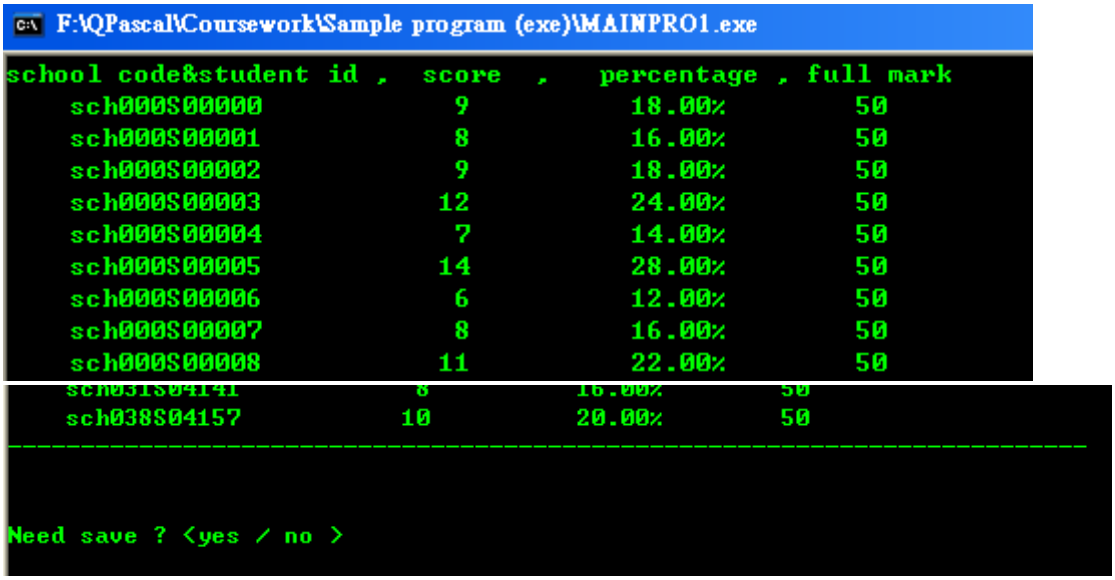
5, 6, 8, 11 is needed to run another procedure first.

5, 6 need to read the data file of schools.

7, 11 need to sort the data first. If not, a wrong result will be shown.

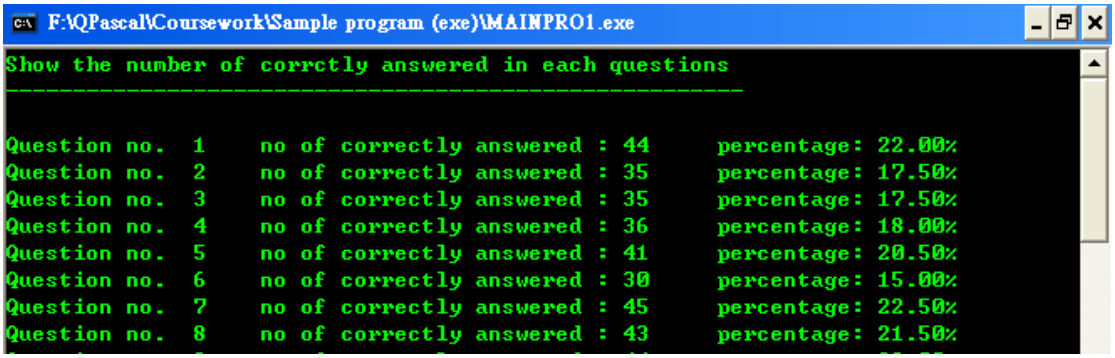
5. **statistics**

1 is showing the score of the participants.



In this procedure, the user may save this page into <.txt> file.

2 is showing the correctly answered in questions.



```
Question no. 50    no of correctly answered : 45     percentage: 22.50%

Need save ? <yes / no >
```

Also, the user may save this page by typing yes into <.txt> file.

3 is showing the score of participants in graph the data are the same with 1.

```
F:\QPascal\Coursework\Sample program (exe)\MAINPRO1.exe
Here is the results of students show in graph
S00000,  **********[9]
S00001,  *********[8]
S00002,  **********[9]
S00003,  ************[12]
S00004,  *******[7]
S00005,  **************[14]
S00006,  ******[6]
```

```
S03163,  ********[8]
S04141,  ********[8]
S04157,  **********[10]
0    5     10    15    20    25    30    35    40    45    50
                    [mark of participants]
Press <Enter> to continue
```

4 is showing the correctly answered of questions in graph, the data are the same with 2.

```
F:\QPascal\Coursework\Sample program (exe)\MAINPRO1.exe
Here is the results of correctly answered questions in graph
 1,  ********************************************[44]
 2,  ***********************************[35]
 3,  ***********************************[35]
 4,  ************************************[36]
 5,  *********************************************[41]
 6,  ******************************[30]
 7,  ***********************************************[45]
```

```
48,  *********************************[32]
49,  ************************************************[46]
50,  ***********************************************[45]
0    5     10    15    20    25    30    35    40    45    50
                    [number of questions]
Press <Enter> to continue
```

5 will be shown later as it needs to school data first.

```
11, Calculate the 1st, 2nd and 3rd quartile of the students
12, Back to main program
The option : <type number only >5
Plaase read the school and student data first
```

6 is the graph of 5, no graph can be made before calculation.

```
11, Calculate the 1st, 2nd and 3rd quartile of the students
12, Back to main program
The option : <type number only >6
Calculate the school mark and average before show the graph
```

7 is showing and calculating the mean of the score of the participants.

```
The option : <type number only >7
The mean of the marks is 10.31
Press <Enter> to continue
```

9 is showing and calculating the mode of the score of the participants.

```
The option : <type number only >9
The mode of the students is 8
Press <Enter> to continue
```

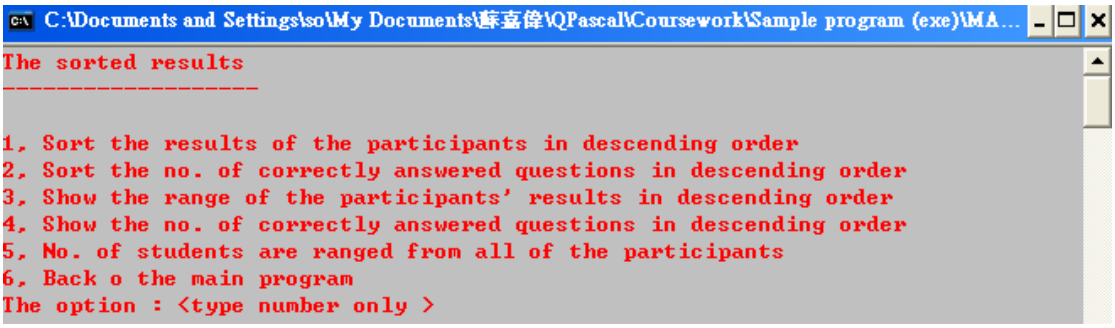
This is the hardest part to calculate. And this part is the easiest part of occurring errors.

10 is showing and calculating the standard deviation of the score of the participants. The larger number means the larger difference between all data.

```
The option : <type number only >10
The standard deviation of the participants is  3.75
Press <Enter> to continue
```

12 is back to the main menu.

6. Sort in the score of the participants



1 is sorting the participants by the score in descending order.

```
5, No. of students are ranged from all of the participants
6, Back o the main program
The option : <type number only > 1
Press <Enter> to continue
```

2 is sorting the questions by the numbers of correctly answered in descending order.

```
5, No. of students are ranged from all of the participants
6, Back o the main program
The option : <type number only > 2
Press <Enter> to continue
```

3 is the showing the ranking of the questions after sorting, show briefly.

```
Show the number of corrctly answered in each questions
-------------------------------------------------------
Question no. 35     no of correctly answered 56   percentage 28.00
Question no. 30     no of correctly answered 55   percentage 27.50
Question no. 45     no of correctly answered 51   percentage 25.50
Question no. 47     no of correctly answered 51   percentage 25.50
Question no. 31     no of correctly answered 49   percentage 24.50
Question no. 20     no of correctly answered 48   percentage 24.00
```

```
Question no. 32     no of correctly answered 32   percentage 16.00
Question no.  6     no of correctly answered 30   percentage 15.00
Question no. 38     no of correctly answered 30   percentage 15.00
Question no. 39     no of correctly answered 29   percentage 14.50

-------------------------------------------------------
If you want to save the result, please go to main program then go to '4, Show an
d save the results '
```

4 is showing the ranking of the participants after sorting, show briefly.

```
6, Back o the main program
The option : <type number only > 4
The result sorted into Decending order
The top gets the highest mark
school code, student no,    score,
    sch042    S01144    44
    sch004    S03169    17
    sch007    S02055    17
    sch000    S00015    17
    sch021    S02109    16
    sch000    S00036    16
    sch000    S00017    16
    sch004    S03120    16
```

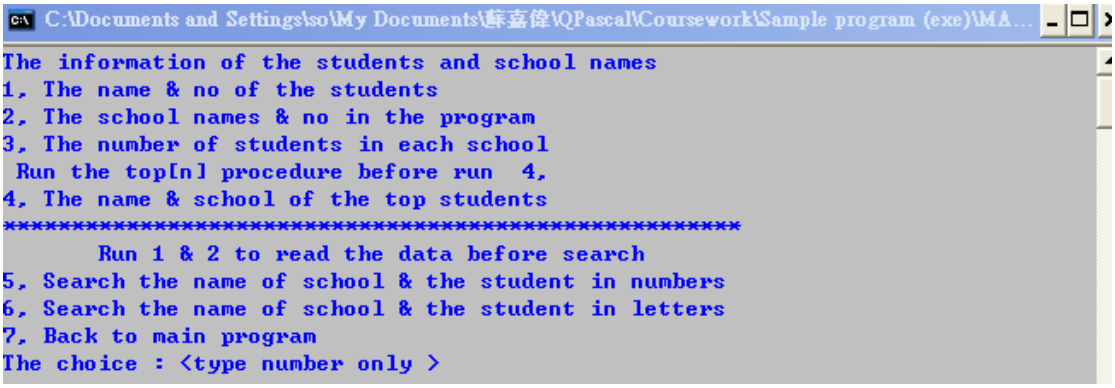
```
    sch000    S00024    5
    sch021    S02067    5
    sch027    S02121    5
    sch039    S02045    4
    sch005    S03078    4
-------------------------------------------------------
If you want to save the result, please go to main program then go to '4, Show an
d save the results '
```

5 is finding top [n], and show briefly

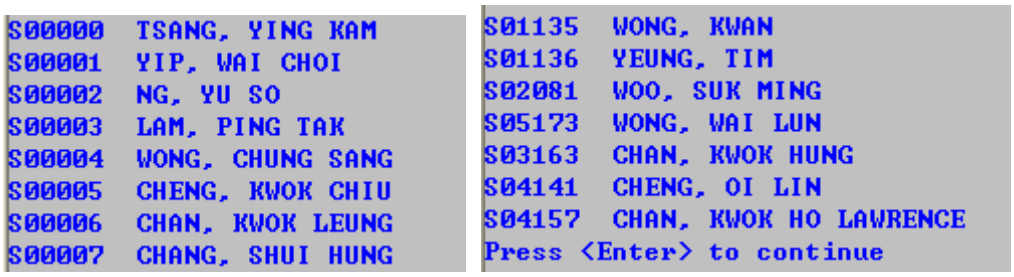
```
6, Back o the main program
The option : <type number only > 5
How many students are ranged from all of the participants would you like to show
? 5
5 of highest mark participants you would like to show
-------------------------------------------------------------
school code, student no,    score,
1,is   sch042    S01144    44
2,is   sch004    S03169    17
3,is   sch007    S02055    17
4,is   sch000    S00015    17
5,is   sch021    S02109    16
Want to remember the student no. of the participants above ?
You can use another procdure to find their names after saving it
Need temporary remember ?<yes / no > yes
The data are successfully remembered !
You can find that procdure in '5, show the schools's names & students' names 'in
 the main program
Press <Enter> to continue
```

6 is back to main menu.

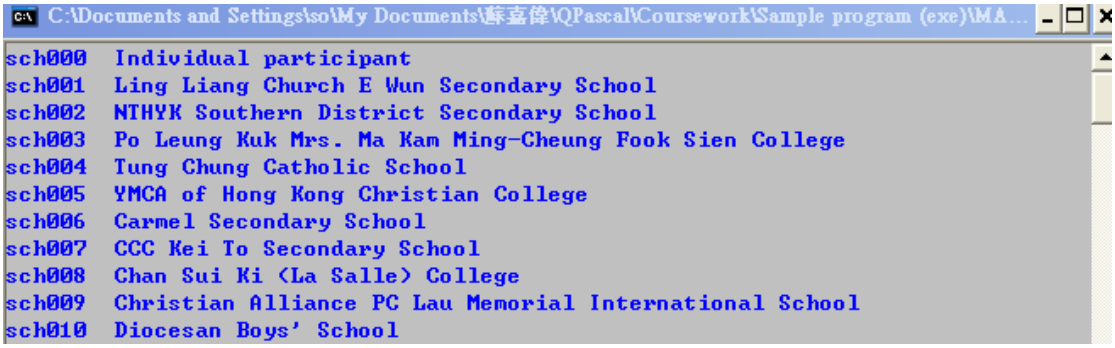
6. Read the school and participant data and searching.



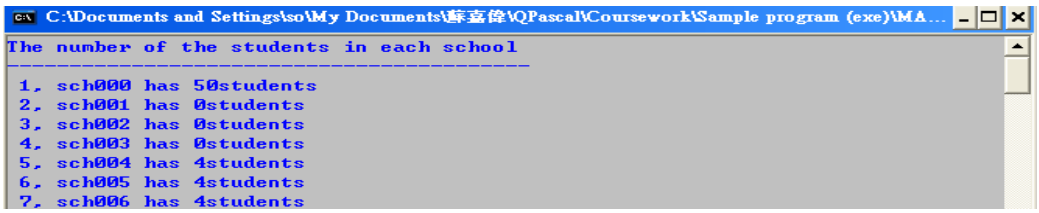
1. is read and show the student data file.



2 is read and show the school data file



3 is show the number of participated student in schools.



```
46, sch045 has 2students
47, sch046 has 3students
48, sch047 has 0students
49, sch048 has 1students
50, sch049 has 2students
51, sch050 has 0students
------------------------------------------------------------
Press <Enter> to continue
```

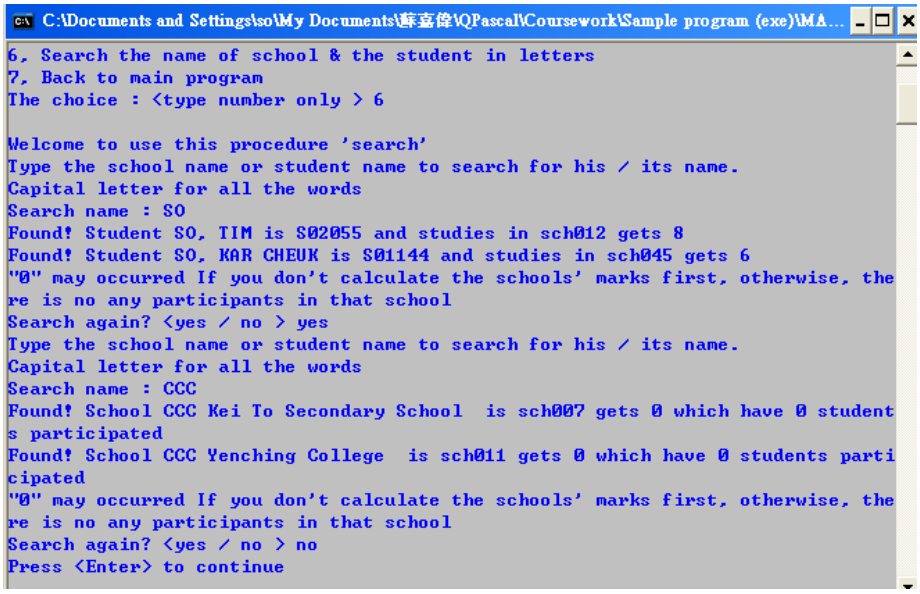
4 is using the temporarily remembered data, show detailed.

```
The choice : <type number only > 4

**The name and school of the top participants will be shown below
**school code&student id,  School name,   Student name

1sch042    S01144 is SO, KAR CHEUK studies in Tung Wah Group of Hospitals Chang
Ming Thien College  who gets 44
2sch004    S03169 is WONG, CHOI studies in Tung Chung Catholic School  who gets
17
3sch007    S02055 is SO, TIM studies in CCC Kei To Secondary School  who gets 17

4sch000    S00015 is WONG, SUM YIN studies in Individual participant who gets 17

5sch021    S02109 is WONG, TAK MING studies in Sha Tau Kok Government Secondary
School  who gets 6
------------------------------------------------------------------------------
Press <Enter> to continue
```

5 is searching for either school or participant by using code.

```
Welcome to use this procedure 'search'
Type the school no. or student no. to search for his / its name.
Capital letter for 'S' in student no. and both school no. please
Search no : sch000
Found! School sch000 called Individual participant gets 0 which have 0 students
participated

"0" may occurred If you don't calculate the schools' marks first, otherwise, the
re is no any participants in that school
Search again? <yes / no > yes
Type the school no. or student no. to search for his / its name.
Capital letter for 'S' in student no. and both school no. please
Search no : S00000
Found! Student S00000 called TSANG, YING KAM and studies in sch042 gets 44 marks


"0" may occurred If you don't calculate the schools' marks first, otherwise, the
re is no any participants in that school
Search again? <yes / no >
```

6 is searching for either school or participant by using name.

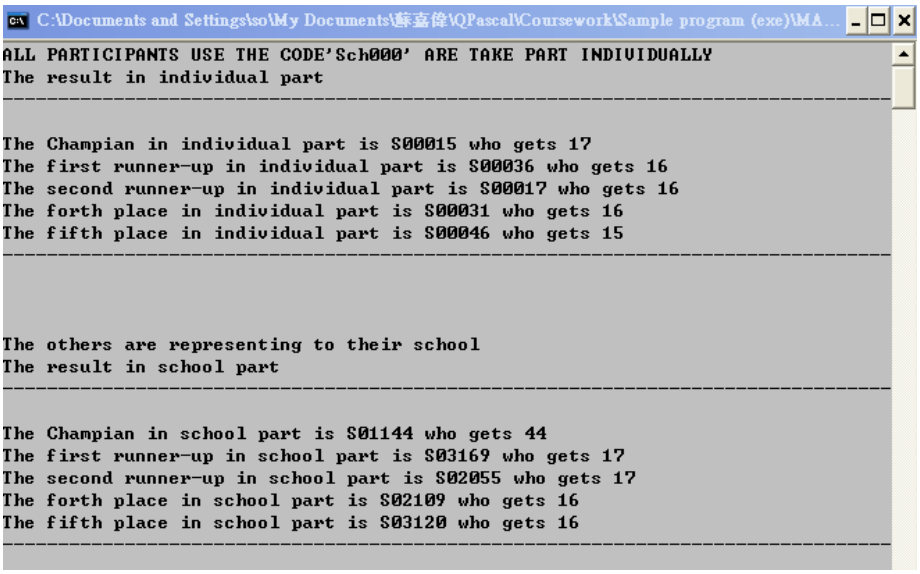


7 is back to main menu.

7. Showing the overall result and the detail in the competition

```
******ALL PARTICIPANTS USE THE CODE'Sch000' ARE TAKE PART INDIVIDUALLY*********
The option: 7

<< Inter-School Mathematics Competition Results >>
Here are the details of the competitions
-------------------------------------------------
1, The number of participants 200
2, The number of participated school 51
3, The number of questions in the MC 50
4, Planned number of prize = 5
-------------------------------------------------
1,   , S01144is the Champion who gets44 marks
S03169  , S02055  , S00015  , is the 1st runner-up who gets17 marks
S02109  , S00036  , S00017  , S03120  , S00031  , S04131  , is the 2nd runner-up
 who gets16 marks

Need save ? <yes / no >
```

8. Showing the result in individual part and school part.



9. **Remind**

During running 4, The statistics part. There are 4 procedure cannot be run because the data haven't sorted or the school and student data haven't inputted.

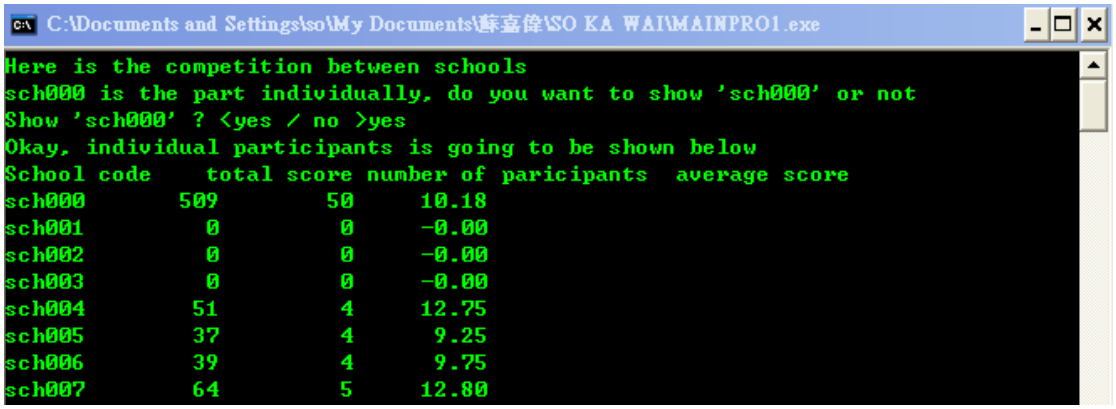
```
5, Calculate and show school mark and average
6, Show the score of schools in graph
```

```
8, Calculate and show the median of the mark of the participants
```

```
11, Calculate the 1st, 2nd and 3rd quartile of the students
```

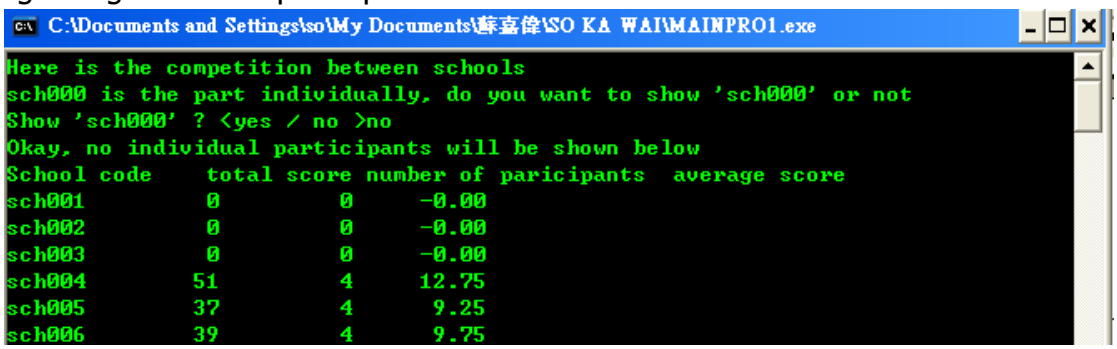
5 is the score of the sum up of all participants represented to their schools.

As I has taken the individual participants are sch000, the user can choose ignore them or not for the accurate result.



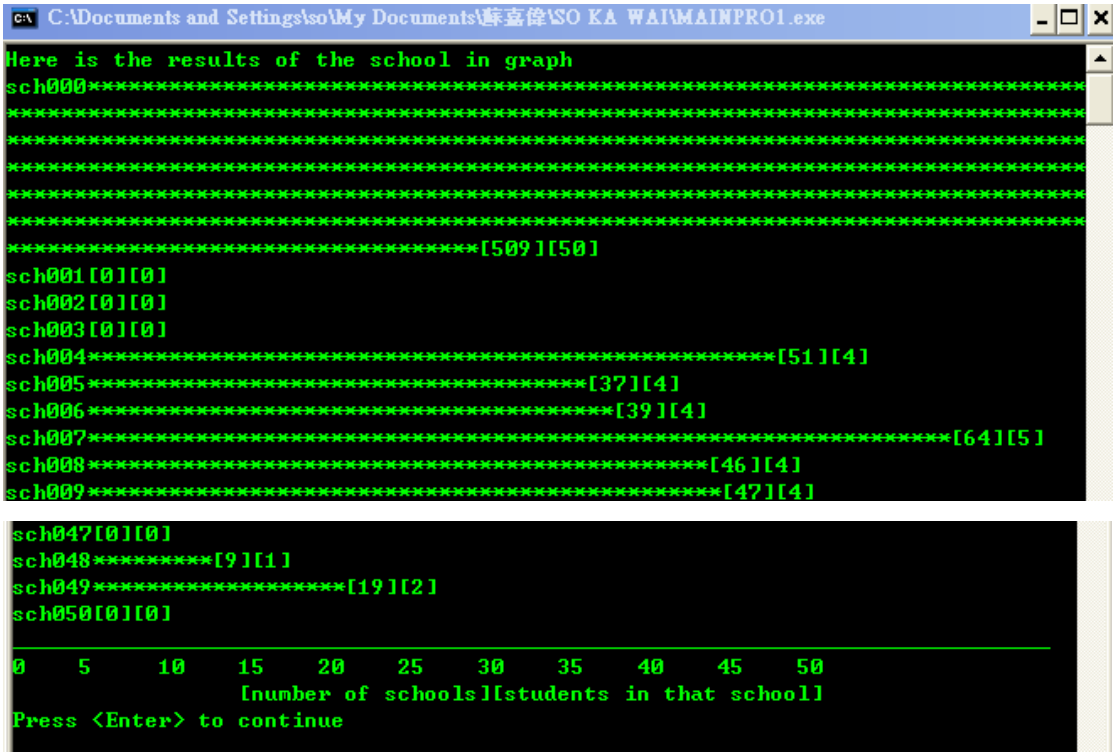

```
sch048          9          1       9.00
sch049         19          2       9.50
sch050          0          0      -0.00
--------------------------------------------------------------------------------

Press <Enter> to continue
```

Ignoring individual participants.

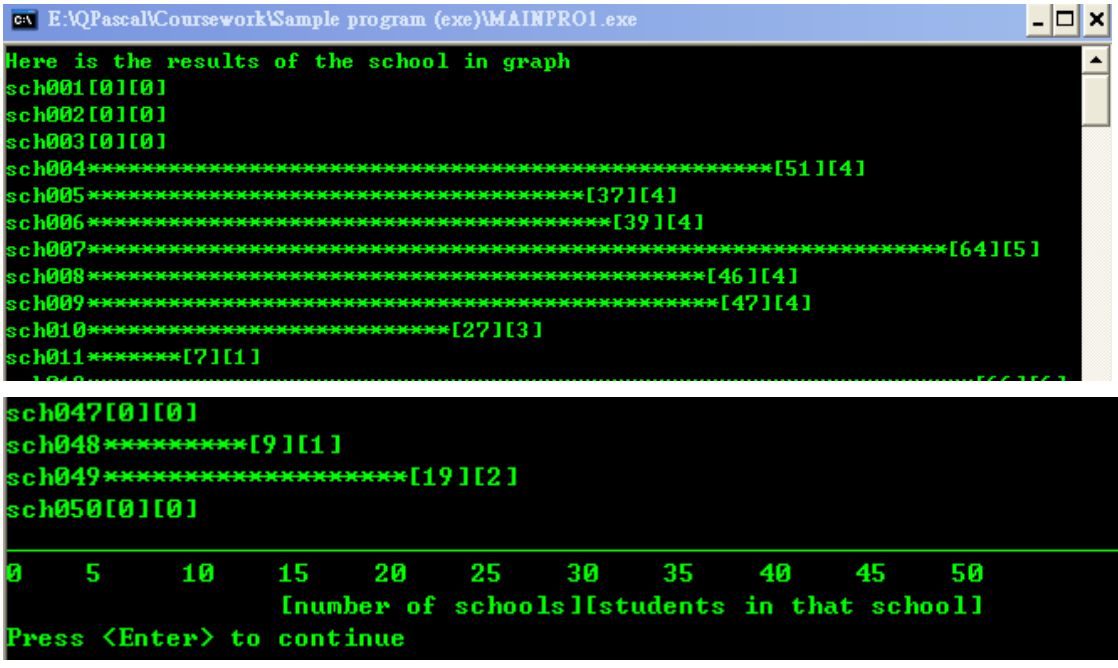



```
sch048          9          1       9.00
sch049         19          2       9.50
sch050          0          0      -0.00
--------------------------------------------------------------------------------

Press <Enter> to continue
```

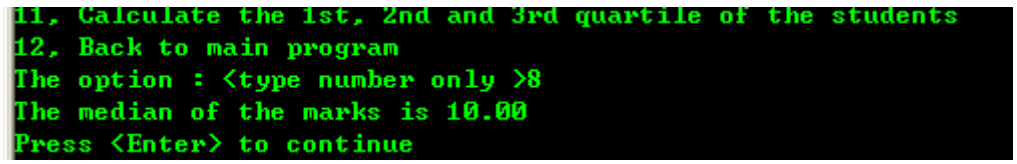
6 is the graph of the score of the sum up of all participants represented to their schools.



Ignoring individual participants.



8 is showing and calculating the median of the score of the participants.



The miscalculating is occurred in calculating median before setting the initial variable.

11 is the quartile of the score of the participants.

```
11, Calculate the 1st, 2nd and 3rd quartile of the students
12, Back to main program
The option : <type number only >11
The 1st quartile is 12.00
The 2nd quartile is 10.00
The 3rd quartile is 8.00
Press <Enter> to continue
```

10. **The end of the program**

```
*******ALL PARTICIPANTS USE THE CODE'Sch000' ARE TAKE PART INDIVIDUALLY*********
The option: 9
Thanks for using this program
```

Chapter 5 Testing & Evaluation

In this chapter, I decide to do 5 testing to evaluate the program. In these 10 tests, I will test things abnormally, because I have debugged for three days. Whatever I do more 5 normal tests, no big effects will be tested.

First test with an abnormal MCDATA

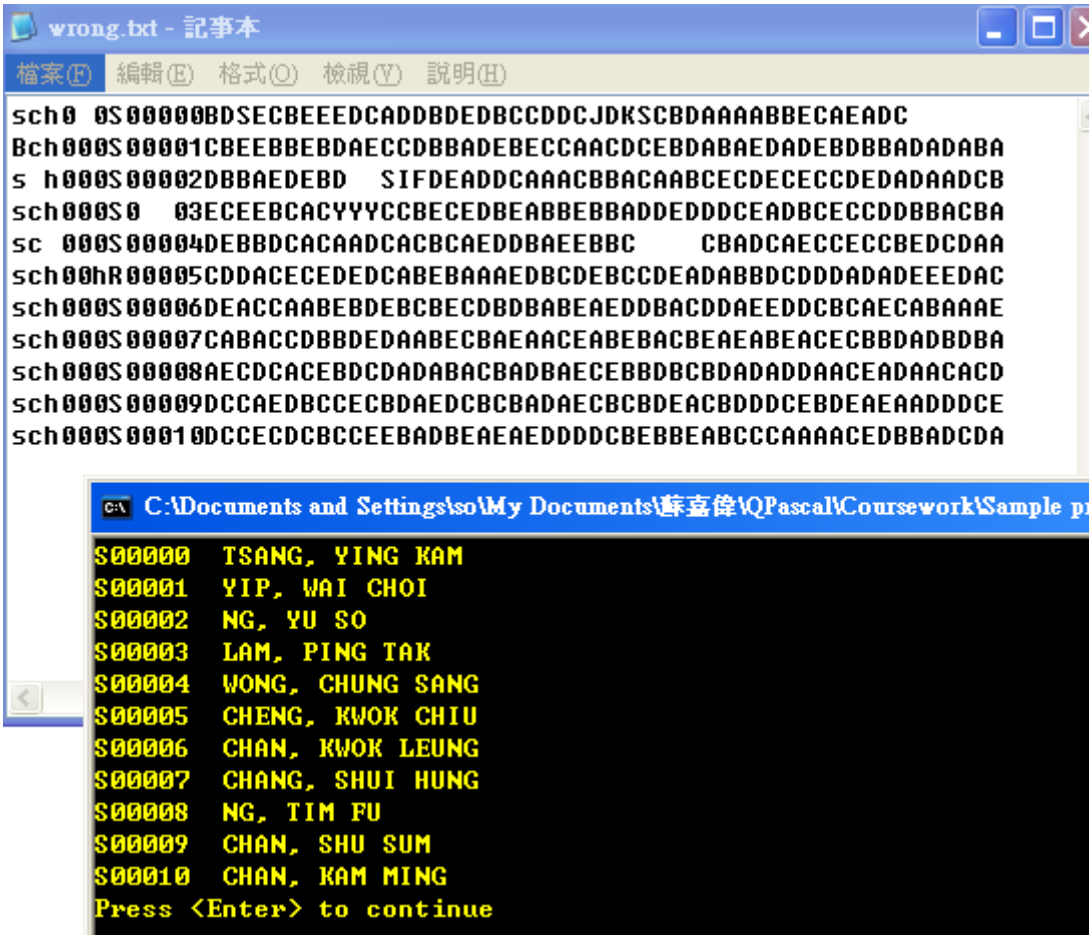
As the answer key must not be wrong, I cannot think any test on answer key.

About the answers answered from participants. If there is any error, that participant is really unlucky, as he/she must be given a wrong. If there is a blank, he/she must not be given any marks for that. If there is the error by the machine, he/she is unlucky, as I don't know what errors will it made, no solution can be taken to test.

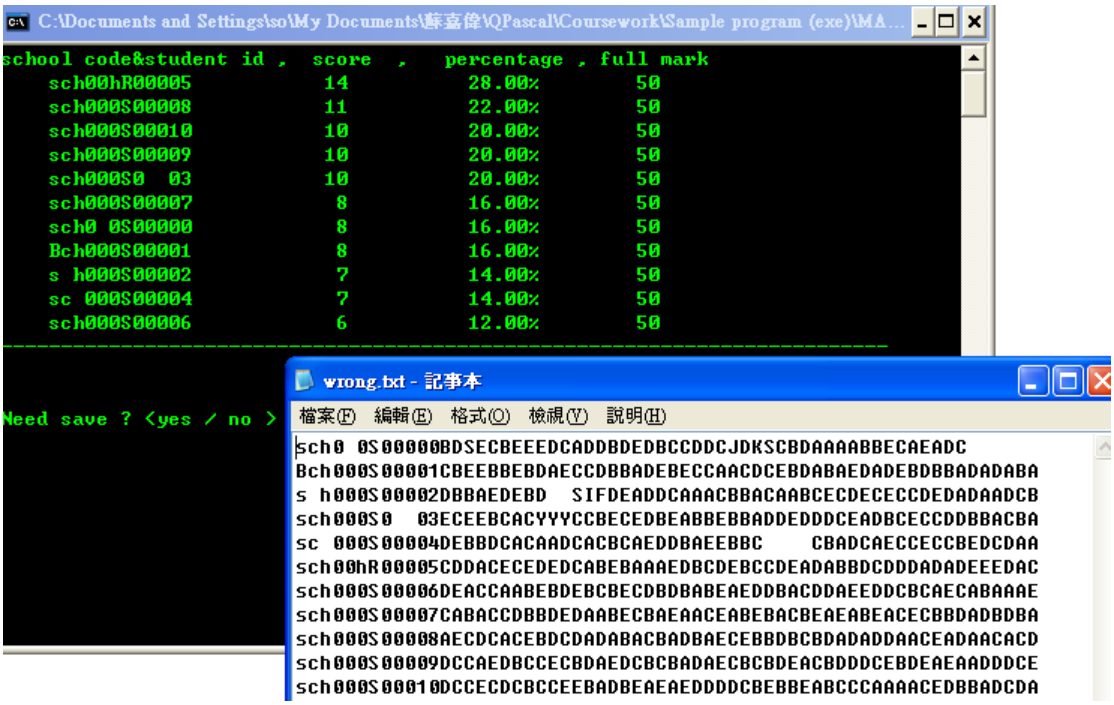
However, I have a aim to test for give a wrong to him/her if he/she don't answer correctly.

5 Data above is changed, 5 below isn't changed.

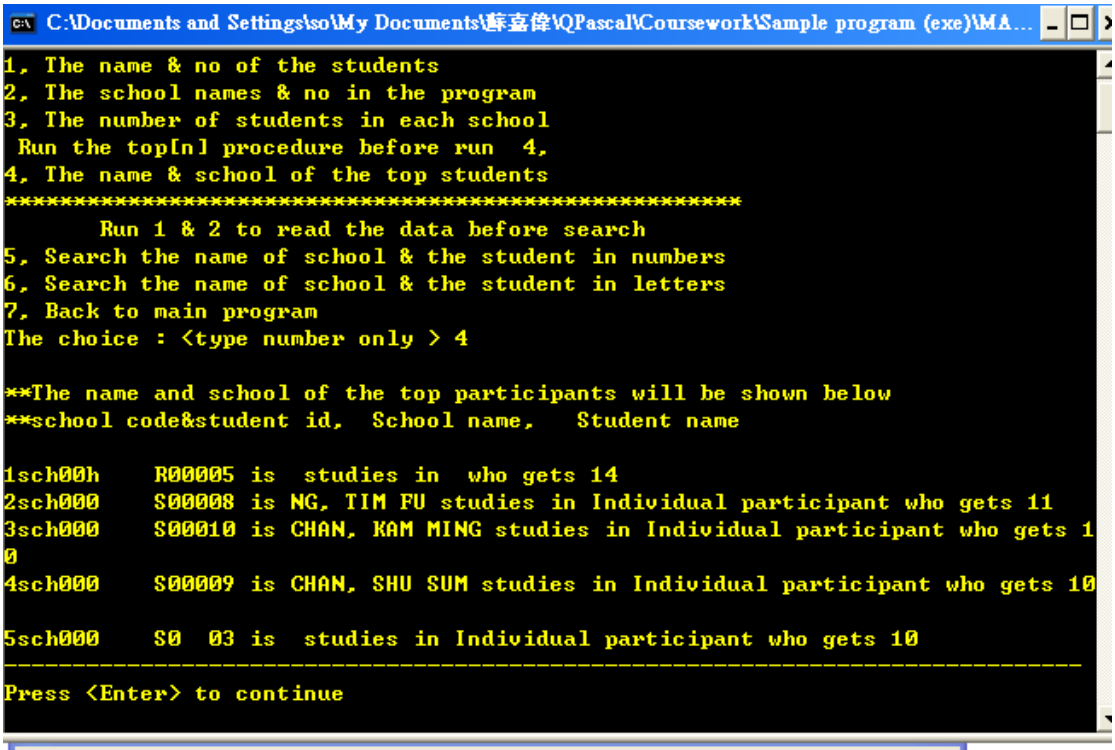
The expected result would be the "bch000"part will be shown. The blank will not be given any mark and the student code changed will be shown directly, with no effect on ranking. But affect the search and showing the responding name.



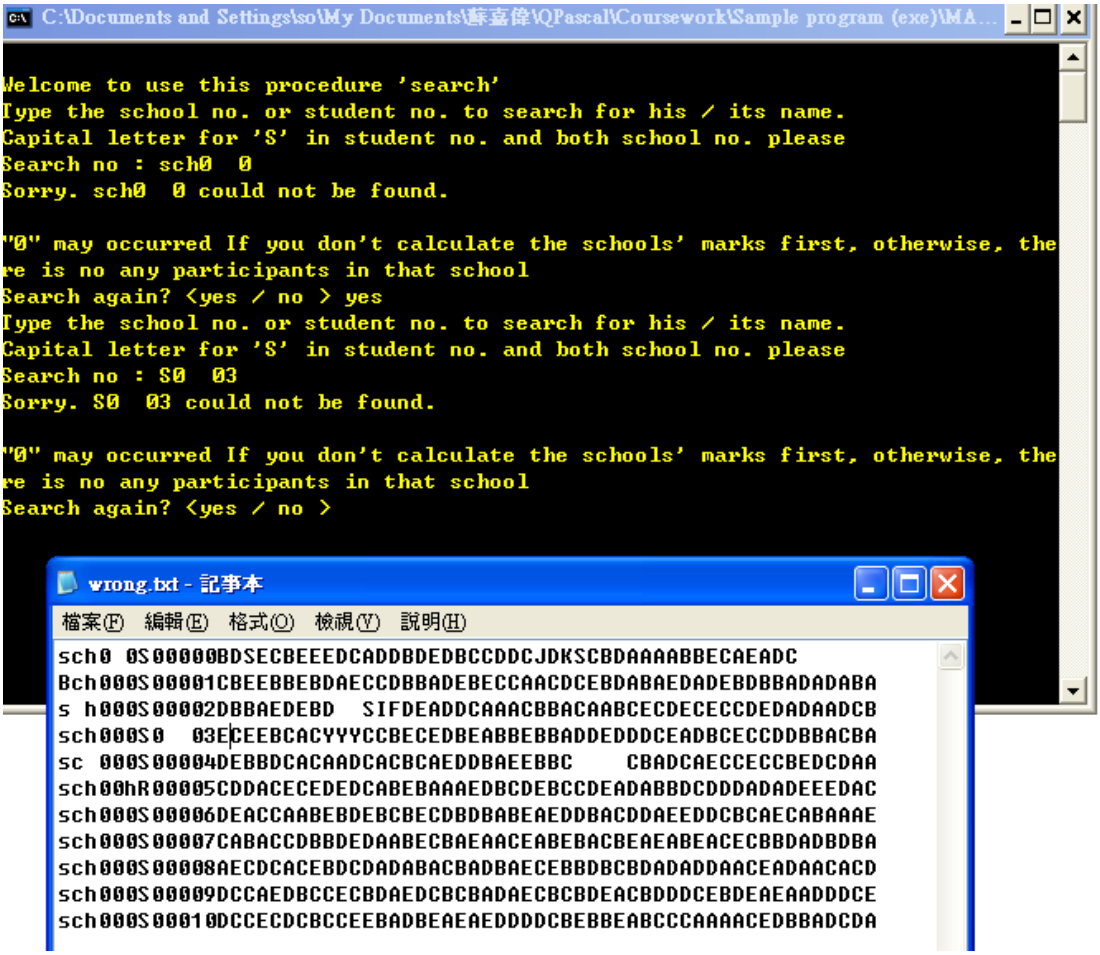
It means that I need to change the reading method of student data, because there should not be any effect.



As the expectation, the score the showing will not be affected.
And not affected the whole statistics part.



The student will affected student id cannot be found his/her real name, this also expected.



Actually, I expect the wrong student id can be found out through searching. The data that cannot be found I expected is school code. The reason of not found is because my search is based on the name_list. Of course a wrongly typed id cannot be found in a correct list.

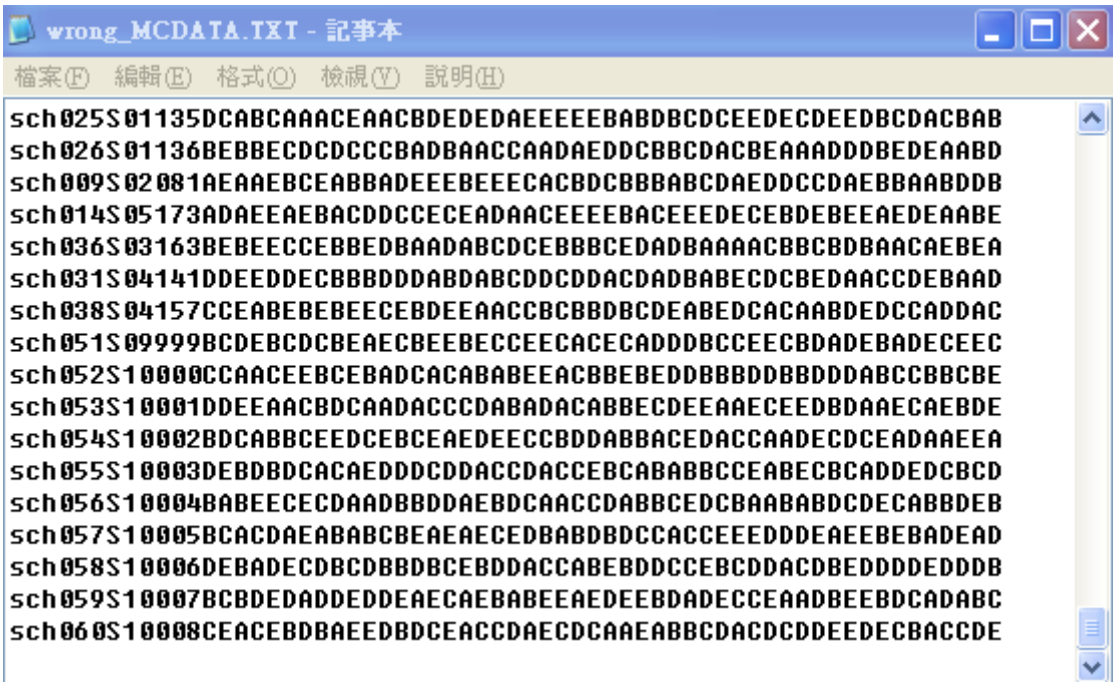
But I think I can modify it to find the wrong name by changing the logic, I will but it in "future improvement".

Overall result : Pass

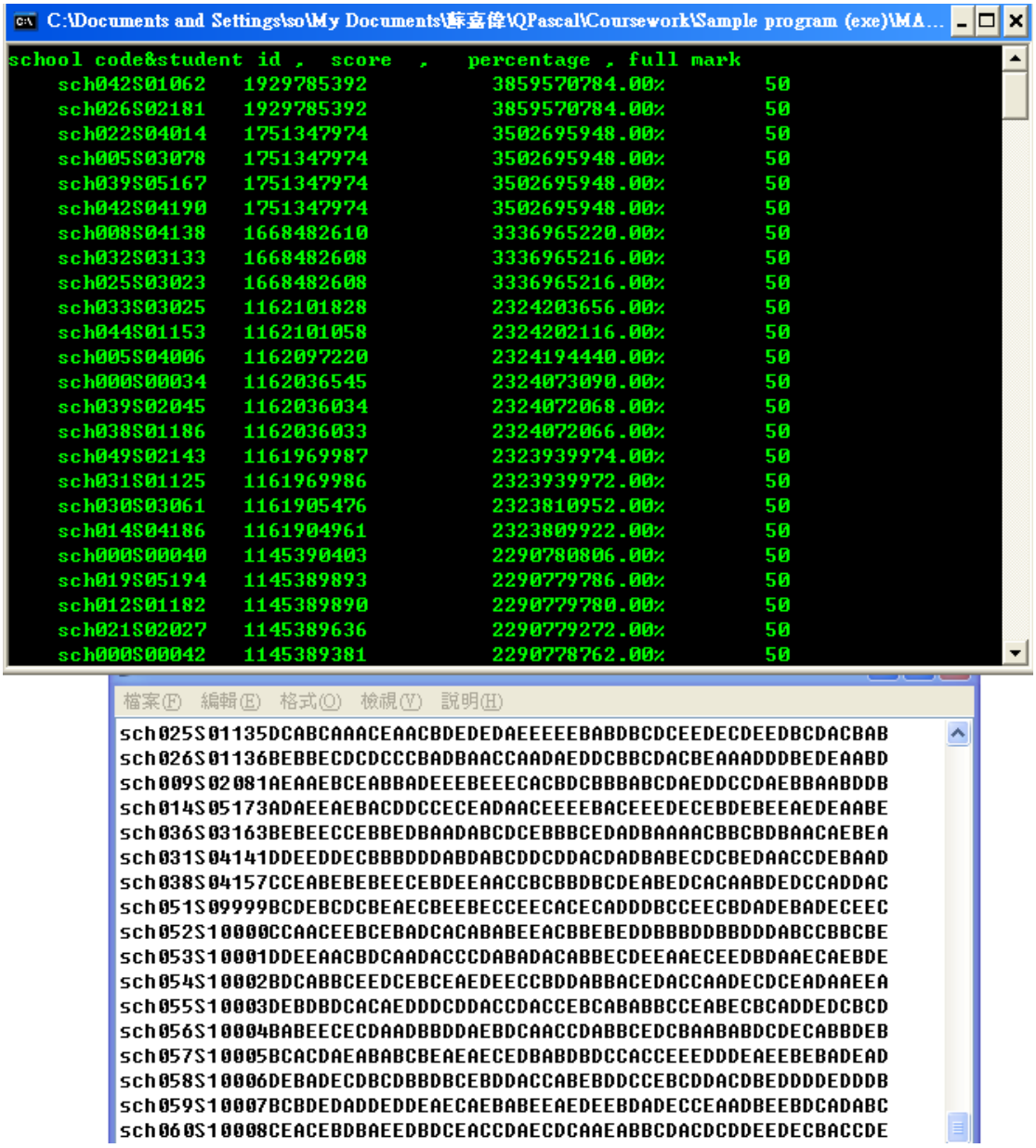
Second test with abnormal input more than 200 participants and more than 50 schools.

In my original setting, the maximum number of participants is 200 only, and maximum number of schools is 50only. So, no need to consider anymore.

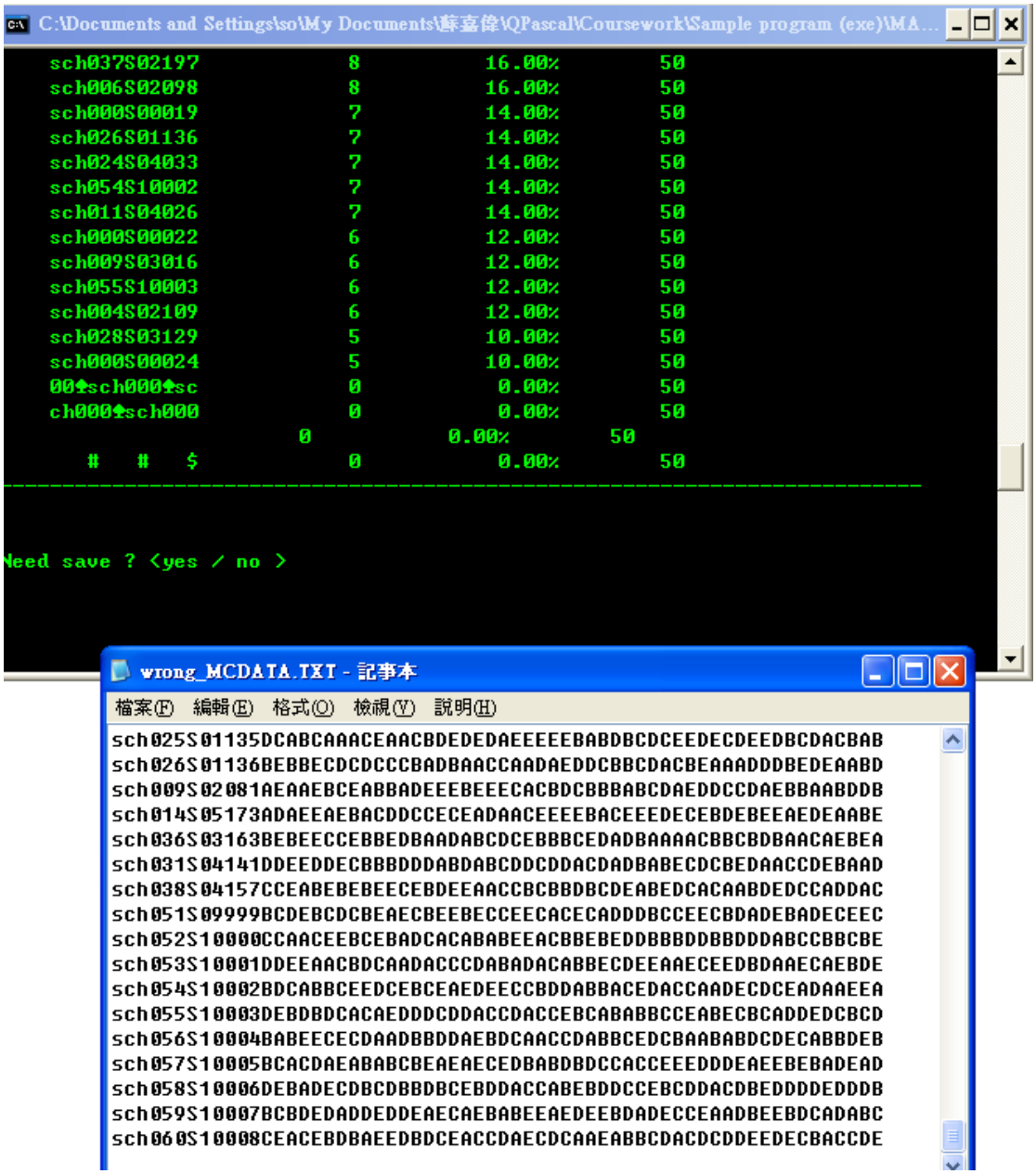
Rum-time error is a must.

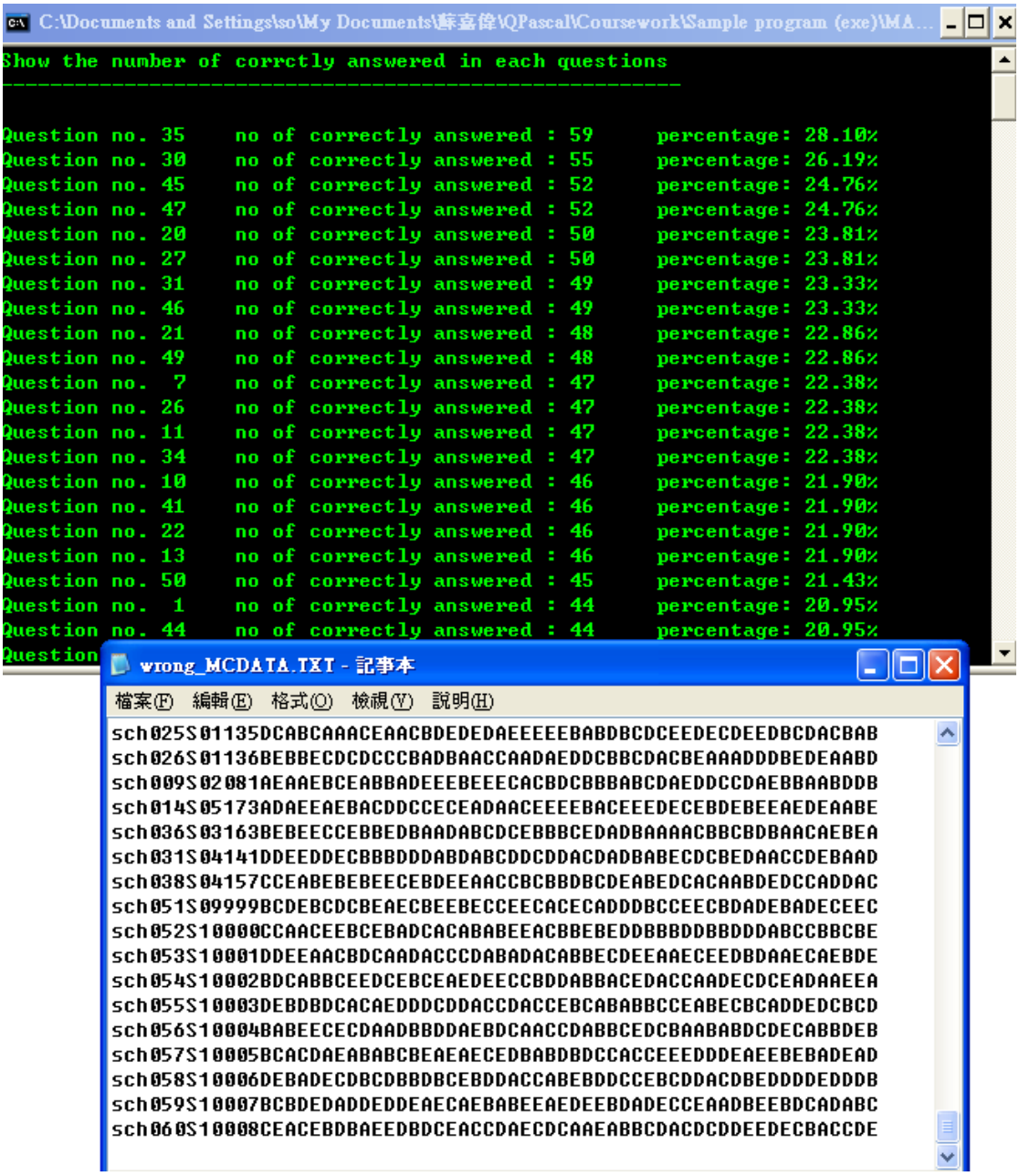


The bottom 10 is the new participants. Sch051-sch060, S09999-S10008

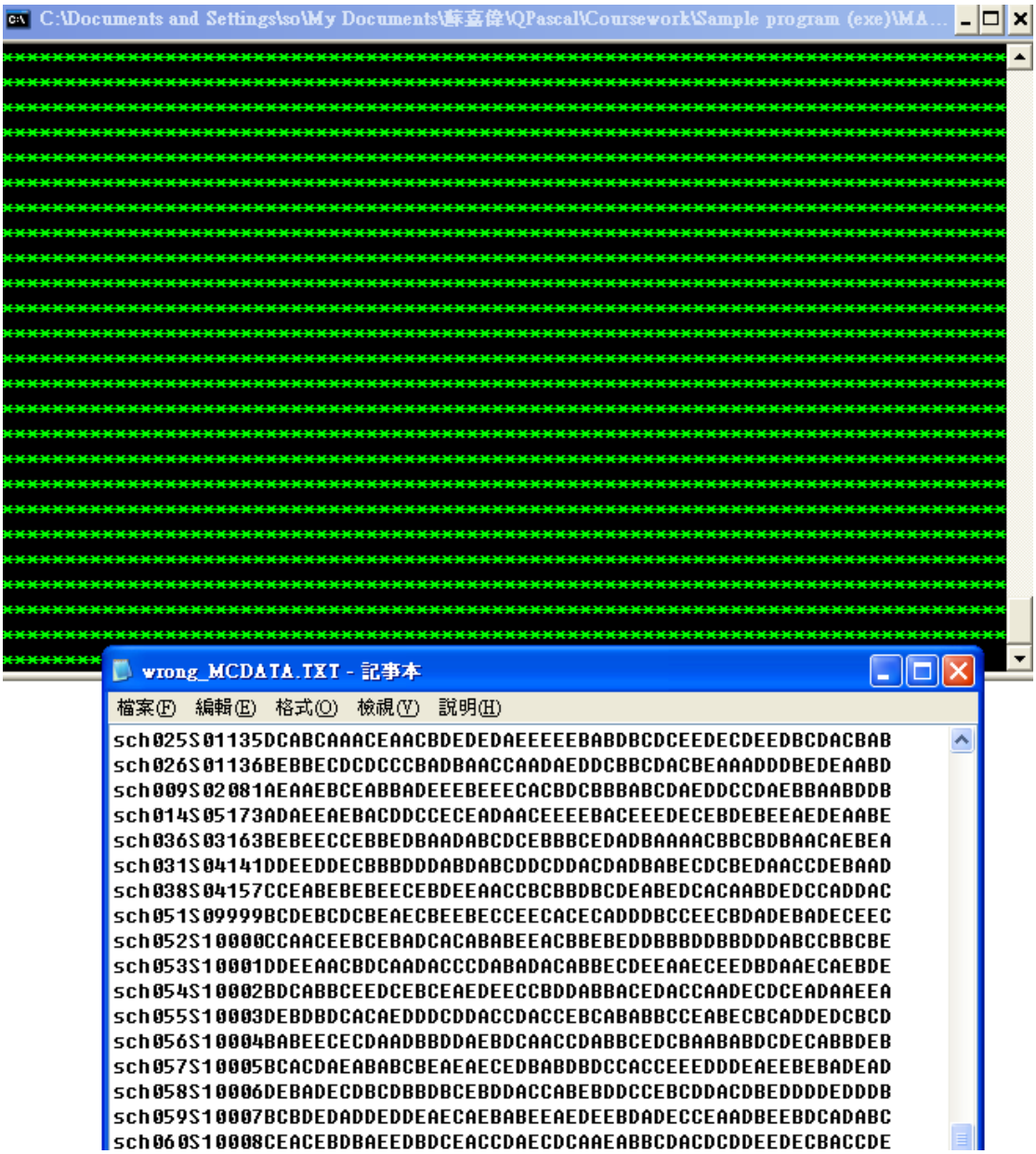


I don’t know how to describe this error, but I am sure it is because the new-added participants. However, I make a wrong guess, it is not a run-time error.


C:\Documents and Settings\so\My Documents\蘇嘉偉\QPascal\Coursework\Sample program (exe)\MA...
sch037S02197 8 16.00% 50
sch006S02098 8 16.00% 50
sch000S00019 7 14.00% 50
sch026S01136 7 14.00% 50
sch024S04033 7 14.00% 50
sch054S10002 7 14.00% 50
sch011S04026 7 14.00% 50
sch000S00022 6 12.00% 50
sch009S03016 6 12.00% 50
sch055S10003 6 12.00% 50
sch004S02109 6 12.00% 50
sch028S03129 5 10.00% 50
sch000S00024 5 10.00% 50
00♠sch000♠sc 0 0.00% 50
ch000♠sch000 0 0.00% 50
0 0.00% 50
$ 0 0.00% 50
Need save ? <yes / no >
wrong_MCDATA.TXT - 記事本
檔案(F) 編輯(E) 格式(O) 檢視(V) 說明(H)
sch025S01135DCABCAAACEAACBDEDEDAEEEEEBABDBCDCEEDECDEEDBCDACBAB
sch026S01136BEBBECDCDCCCBADBAACCAADAEDDCBBCDACBEAAADDDBEDEAABD
sch009S02081AEAAEBCEABBADEEEBEEECACBDCBBBABCDAEDDCCDAEBBAABDDB
sch014S05173ADAEEAEBACDDCCECEADAACEEEEBACEEEDECEBDEBEEAEDEAABE
sch036S03163BEBEECCEBBEDBAADABCDCEBBBCEDADBAAAACBBCBDBAACAEBEA
sch031S04141DDEEDDECBBBDDDABDABCDDCDDACDADBABECDCBEDAACCDEBAAD
sch038S04157CCEABEBEBEECEBDEEAACCBCBBDBCDEABEDCACAABDEDCCADDAC
sch051S09999BCDEBCDCBEAECBEEBECCEECACECADDDBCCEECBDADEBADECEEC
sch052S10000CCAACEEBCEBADCACABABEEACBBEBEDDBBBDDBBDDDABCCBBCBE
sch053S10001DDEEAACBDCAADACCCDABADACABBECDEEAAECEEDBDAAECAEBDE
sch054S10002BDCABBCEEDCEBCEAEDEECCBDDABBACEDACCAADECDCEADAAEEA
sch055S10003DEBDBDCACAEDDDCDDACCDACCEBCABABBCCEABECBCADDEDCBCD
sch056S10004BABEECECDAADBBDDAEBDCAACCDABBCEDCBAABABDCDECABBDEB
sch057S10005BCACDAEABABCBEAEAECEDBABDBDCCACCEEEDDDEAEEBEBADEAD
sch058S10006DEBADECDBCDBBDBCEBDDACCABEBDDCCEBCDDACDBEDDDDEDDDB
sch059S10007BCBDEDADDEDDEAECAEBABEEAEDEEBDADECCEAADBEEBDCADABC
sch060S10008CEACEBDBAEEDBDCEACCDAECDCAAEABBCDACDCDDEEDECBACCDE



But there is no effect in counting questions.



When I see this at first, I realize that it is run-time error. But I doesn't. It is because the result calculated above in millions score. So, this run-time error looked error is occurred.

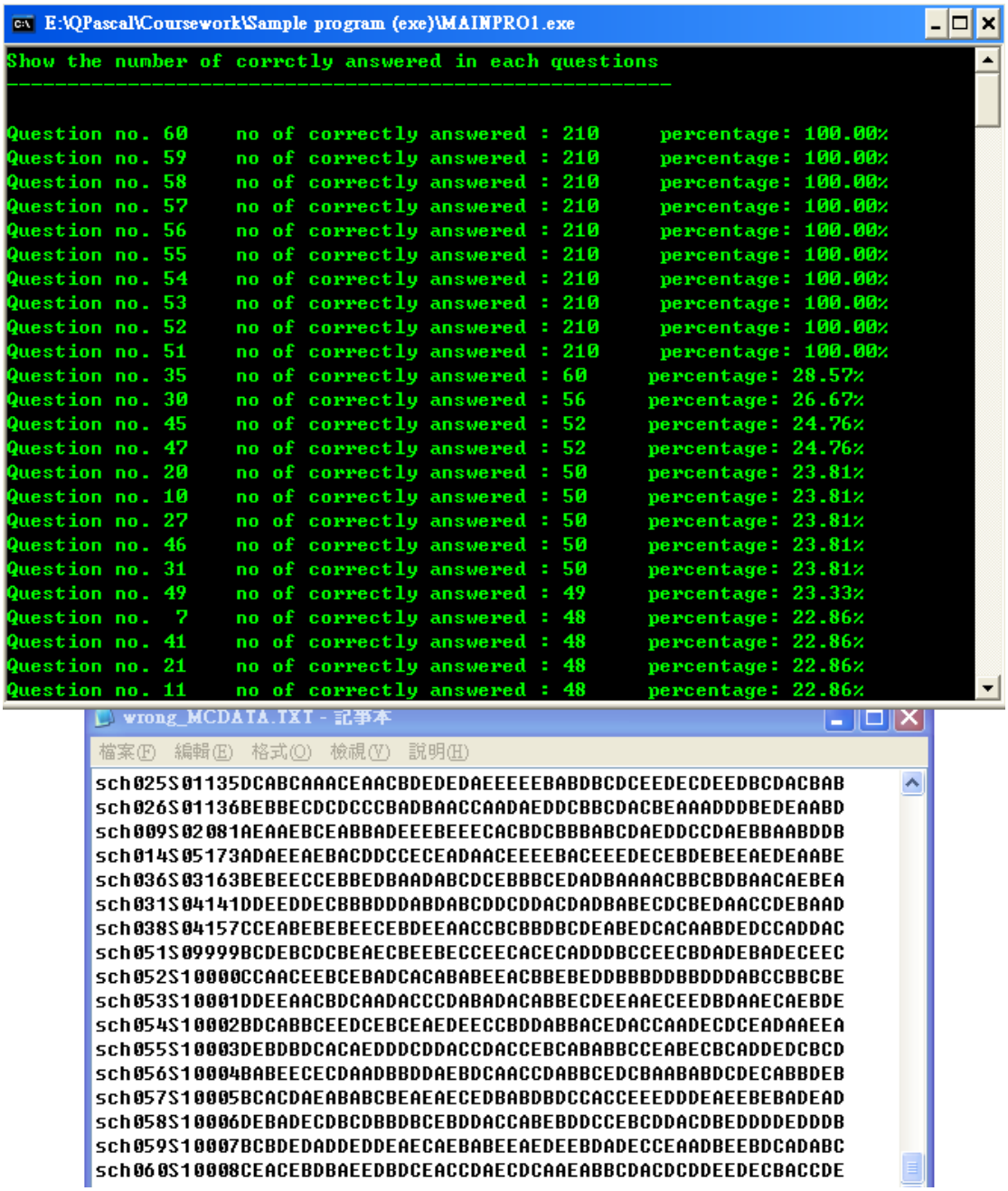
However, error is occurred, but the debug method is just change the number in constance.

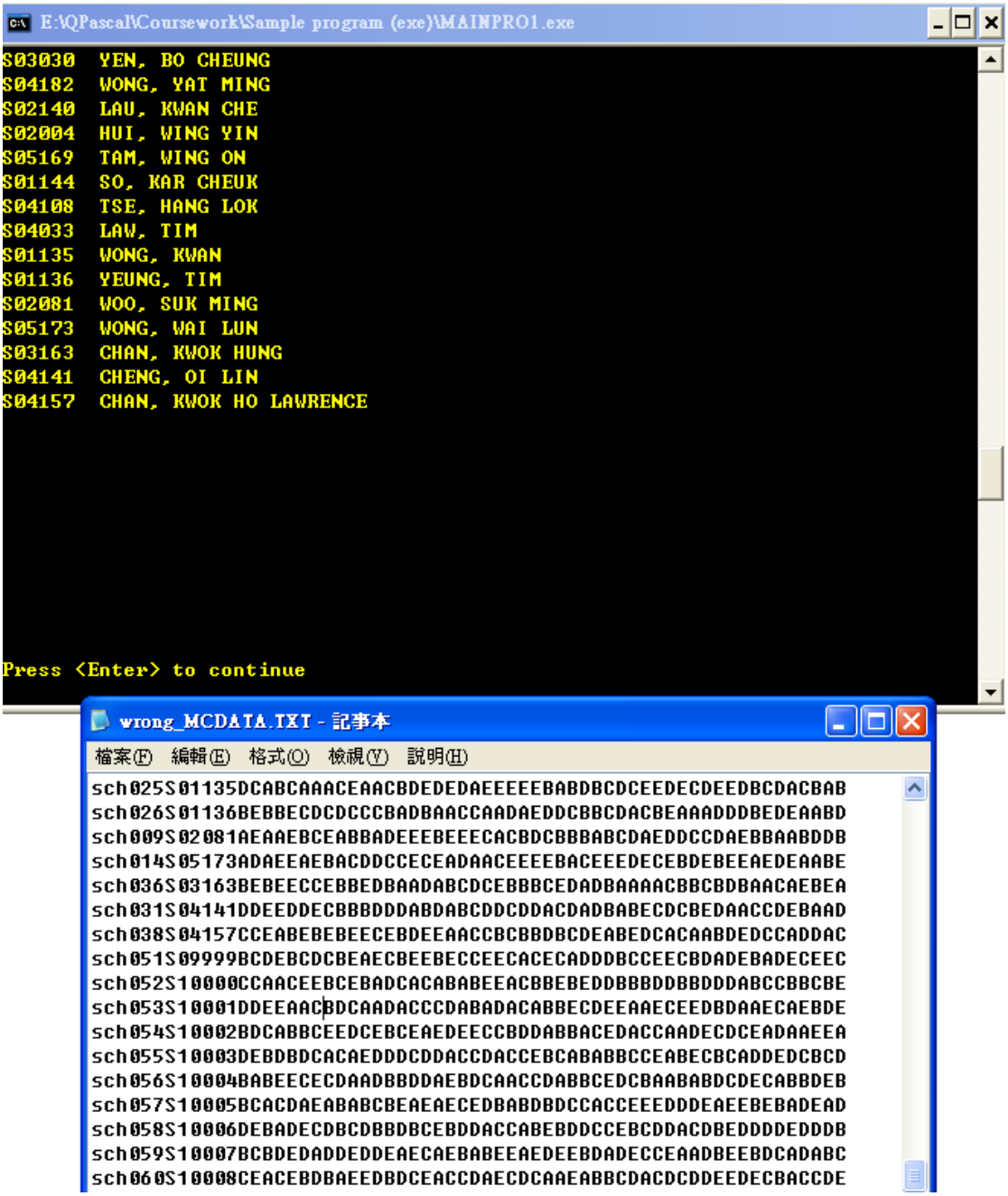
```
program project;
uses crt;                                                    {maxnoqu
const                                                        {maxstuc
   maxnoques = 50;  maxstudno =200;  maxschoolno =60; noprize = 5;
var
   anskey :string;                                           {anskey
   no, total :integer;
   studno : array[1..maxstudno] of string[6];
```

After changing, it can be run.

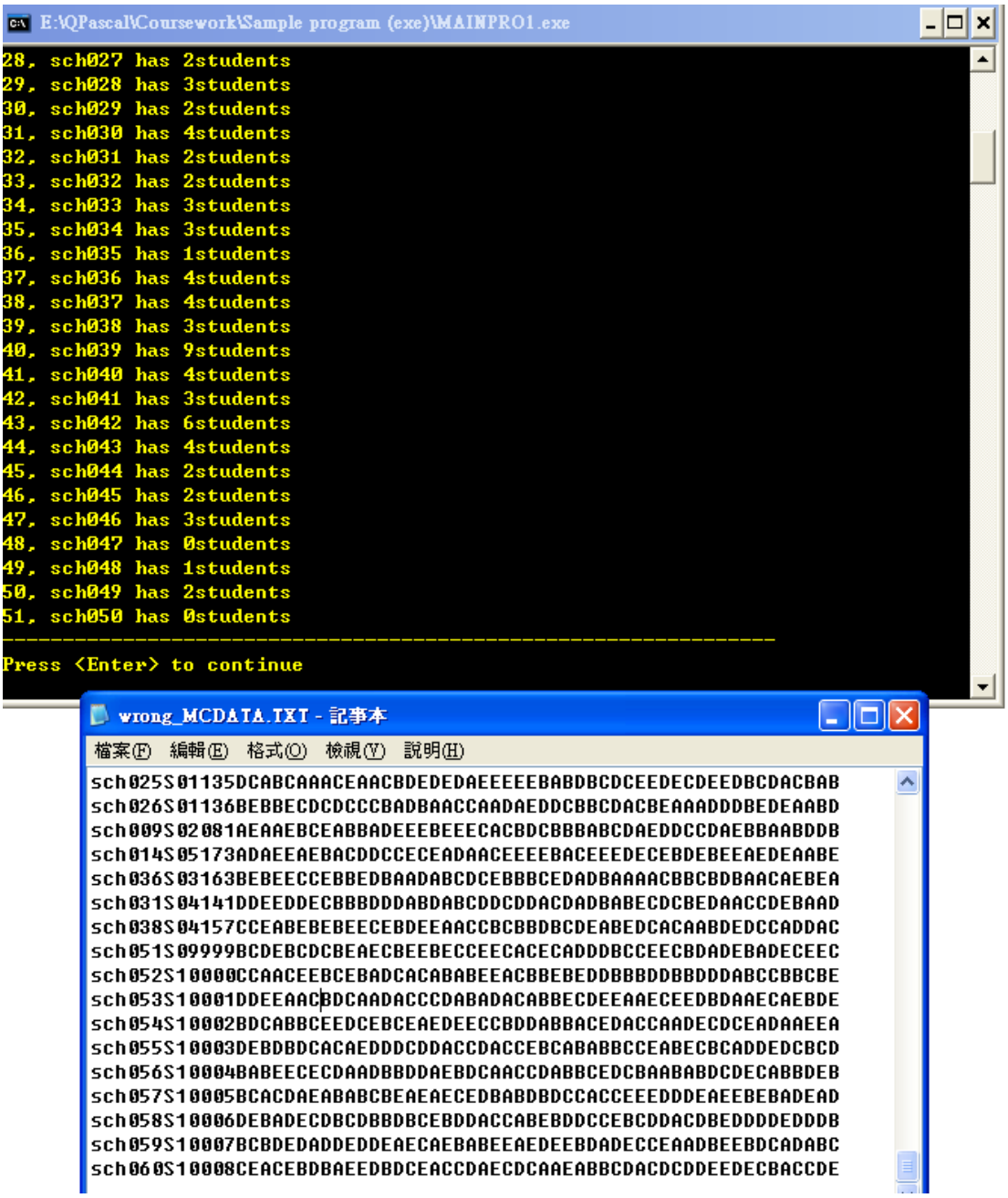
```
program project;
uses crt;                                                    {maxnoqu
const                                                        {maxstud
   maxnoques = 60;  maxstudno =210;  maxschoolno =60; noprize = 5;
var
   anskey :string;                                           {anskey
   no, total :integer;
   studno : array[1..maxstudno] of string[6];
```

The maximum number of questions is changed.

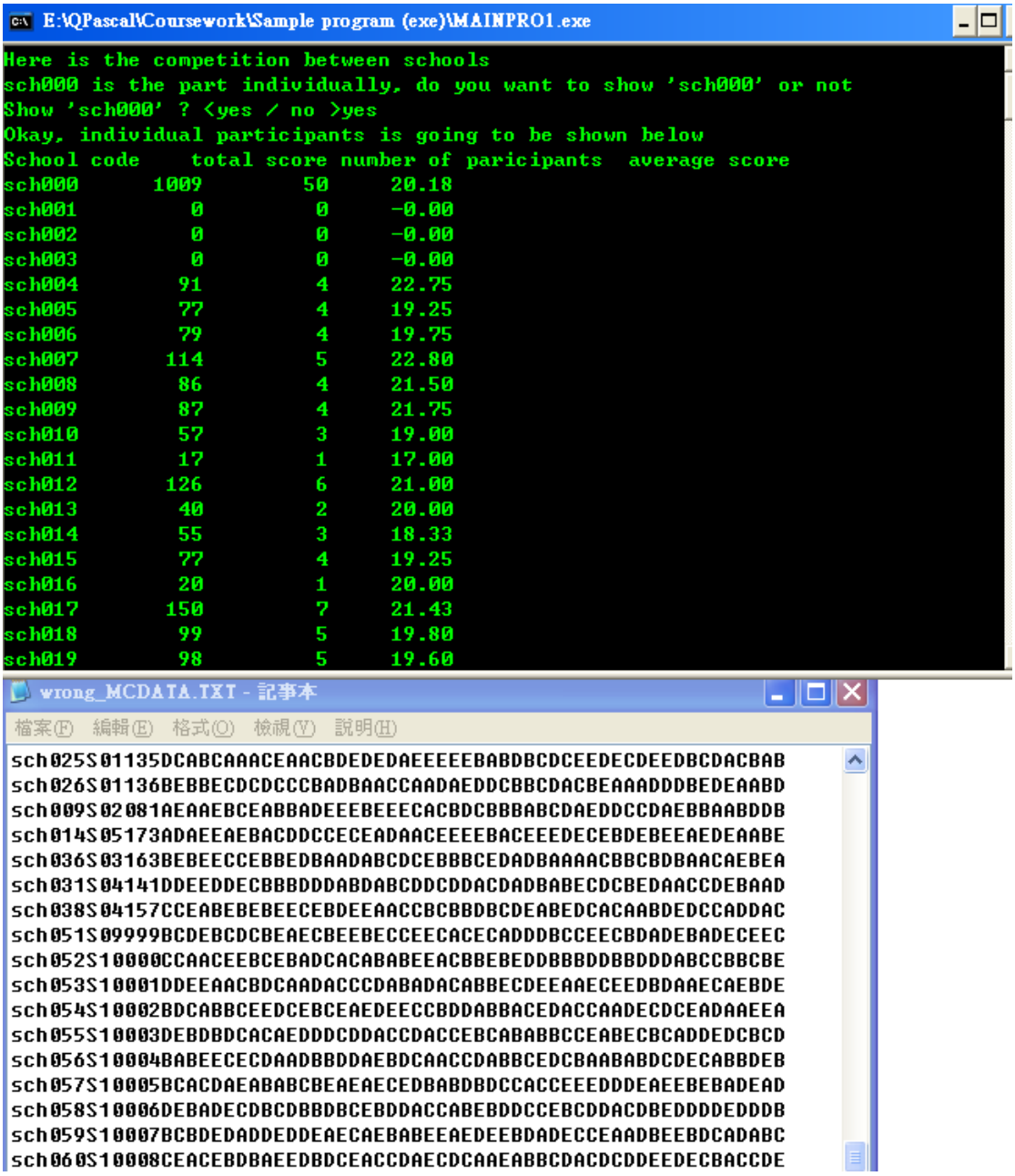

E:\QPascal\Coursework\Sample program (exe)\MAINPRO1.exe
Show the number of corrctly answered in each questions
Question no. 60 no of correctly answered : 210 percentage: 100.00%
Question no. 59 no of correctly answered : 210 percentage: 100.00%
Question no. 58 no of correctly answered : 210 percentage: 100.00%
Question no. 57 no of correctly answered : 210 percentage: 100.00%
Question no. 56 no of correctly answered : 210 percentage: 100.00%
Question no. 55 no of correctly answered : 210 percentage: 100.00%
Question no. 54 no of correctly answered : 210 percentage: 100.00%
Question no. 53 no of correctly answered : 210 percentage: 100.00%
Question no. 52 no of correctly answered : 210 percentage: 100.00%
Question no. 51 no of correctly answered : 210 percentage: 100.00%
Question no. 35 no of correctly answered : 60 percentage: 28.57%
Question no. 30 no of correctly answered : 56 percentage: 26.67%
Question no. 45 no of correctly answered : 52 percentage: 24.76%
Question no. 47 no of correctly answered : 52 percentage: 24.76%
Question no. 20 no of correctly answered : 50 percentage: 23.81%
Question no. 10 no of correctly answered : 50 percentage: 23.81%
Question no. 27 no of correctly answered : 50 percentage: 23.81%
Question no. 46 no of correctly answered : 50 percentage: 23.81%
Question no. 31 no of correctly answered : 50 percentage: 23.81%
Question no. 49 no of correctly answered : 49 percentage: 23.33%
Question no. 7 no of correctly answered : 48 percentage: 22.86%
Question no. 41 no of correctly answered : 48 percentage: 22.86%
Question no. 21 no of correctly answered : 48 percentage: 22.86%
Question no. 11 no of correctly answered : 48 percentage: 22.86%
wrong_MCDATA.TXT - 記事本
檔案(F) 編輯(E) 格式(O) 檢視(V) 說明(H)
sch025S01135DCABCAAACEAACBDEDEDAEEEEEBABDBCDCEEDECDEEDBCDACBAB
sch026S01136BEBBECDCDCCCBADBAACCAADAEDDCBBCDACBEAAADDDBEDEAABD
sch009S02081AEAAEBCEABBADEEEBEEECACBDCBBBABCDAEDDCCDAEBBAABDDB
sch014S05173ADAEEAEBACDDCCECEADAACEEEEBACEEEDECEBDEBEEAEDEAABE
sch036S03163BEBEECCEBBEDBAADABCDCEBBBCEDADBAAAACBBCBDBAACAEBEA
sch031S04141DDEEDDECBBBDDDABDABCDDCDDACDADBABECDCBEDAACCDEBAAD
sch038S04157CCEABEBEBEECEBDEEAACCBCBBDBCDEABEDCACAABDEDCCADDAC
sch051S09999BCDEBCDCBEAECBEEBECCEECACECADDDBCCEECBDADEBADECEEC
sch052S10000CCAACEEBCEBADCACABABEEACBBEBEDDBBBDDBBDDDABCCBBCBE
sch053S10001DDEEAACBDCAADACCCDABADACABBECDEEAAECEEDBDAAECAEBDE
sch054S10002BDCABBCEEDCEBCEAEDEECCBDDABBACEDACCAADECDCEADAAEEA
sch055S10003DEBDBDCACAEDDDCDDACCDACCEBCABABBCCEABECBCADDEDCBCD
sch056S10004BABEECECDAADBBDDAEBDCAACCDABBCEDCBAABABDCDECABBDEB
sch057S10005BCACDAEABABCBEAEAECEDBABDBDCCACCEEEDDDEAEEBEBADEAD
sch058S10006DEBADECDBCDBBDBCEBDDACCABEBDDCCEBCDDACDBEDDDDEDDDB
sch059S10007BCBDEDADDEDDEAECAEBABEEAEDEEBDADECCEAADBEEBDCADABC
sch060S10008CEACEBDBAEEDBDCEACCDAECDCAAEABBCDACDCDDEEDECBACCDE



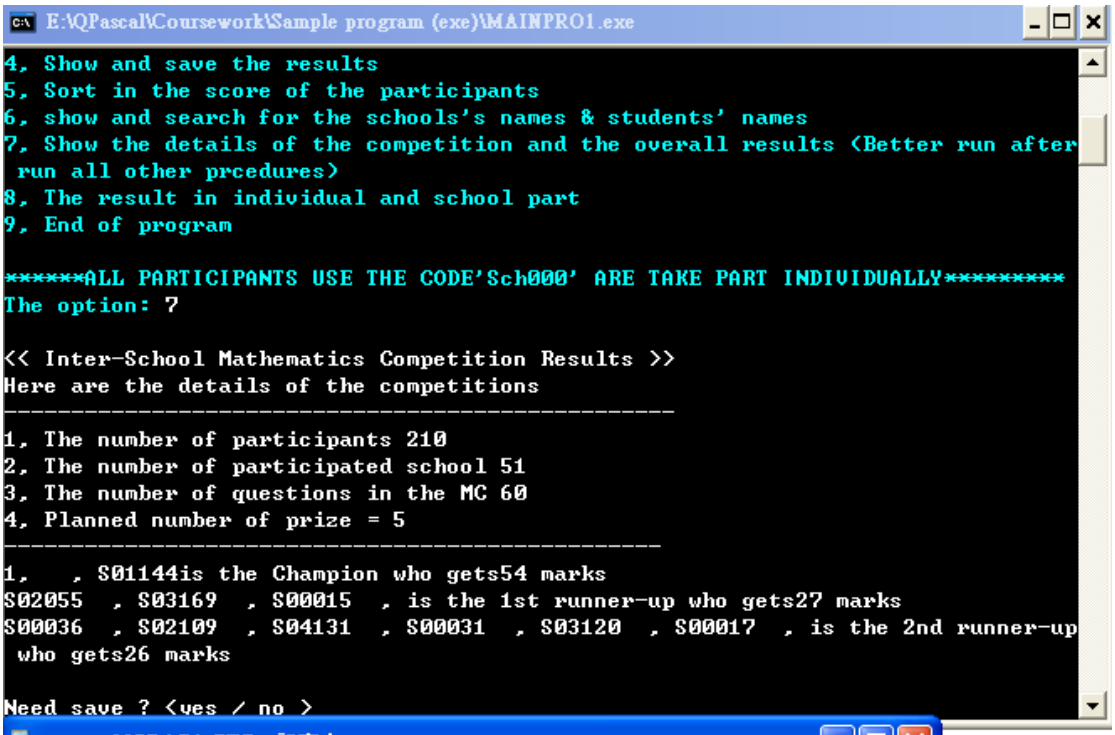
It is the only part which is expected to show. More 10 participants then 10 unknown.

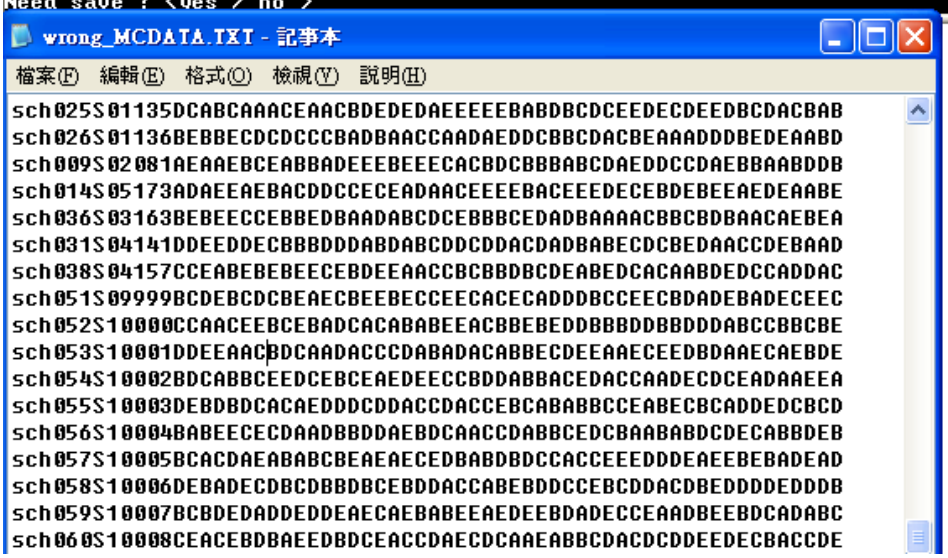


The new schools are ignored, as the school_count is based on the true school file.



The stud_count is normal, the problem must at mark calculating.






```
writeln('1, The number of participants ', stud_count);
writeln('2, The number of participated school ', sch_count);
writeln('3, The number of questions in the MC ', maxnoques);
writeln('4, Planned number of prize = 5 ');
writeln('-------------------------------------------------');
```

This is an unknown. Maxnoques is a constance 50. As I know, a constance must not be changed.

The result is I must do school count, as I used to use the maxnoques occurs a tricky error. As I don't know whether the problem can be solve, I will try again later.

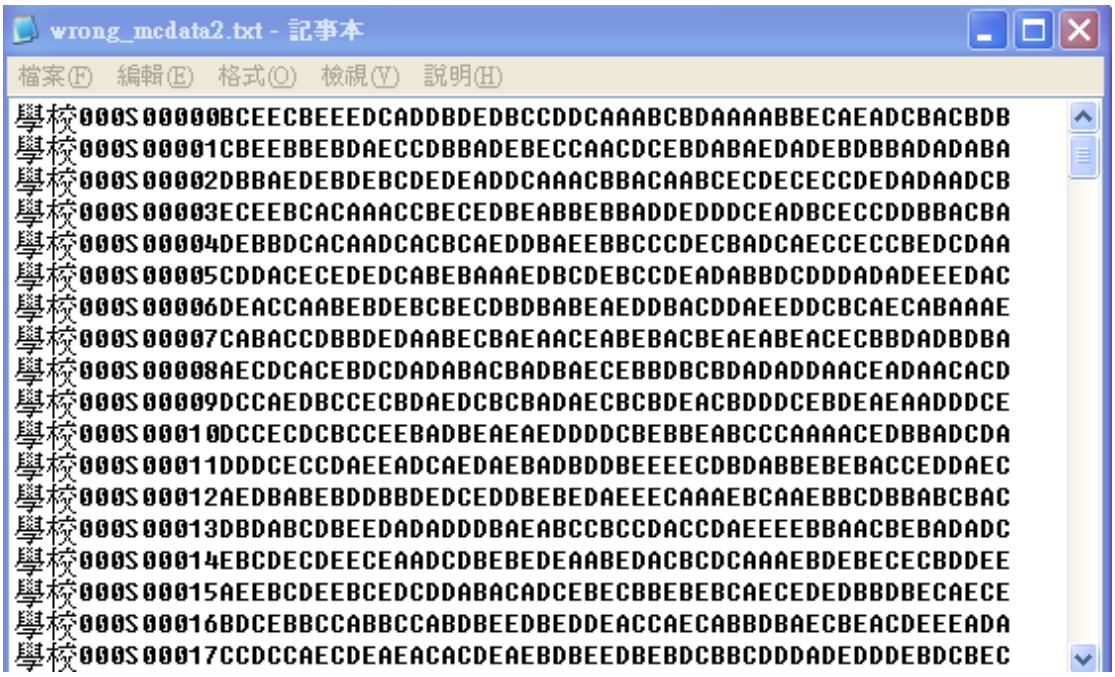
- **Overall result : Failed and unknown**

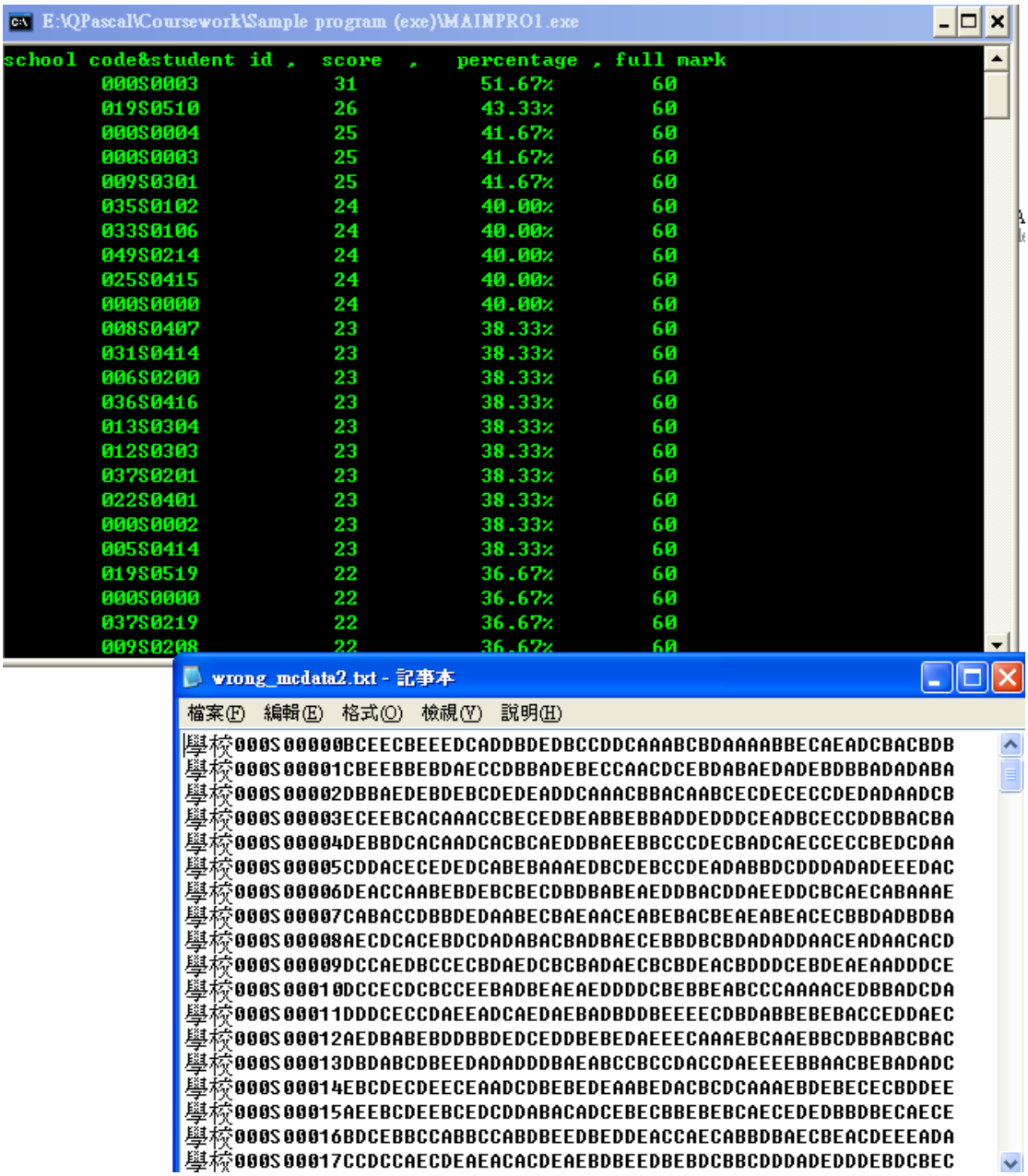
Third test with an abnormal type of words

As I have tried before there was a wider space made by .

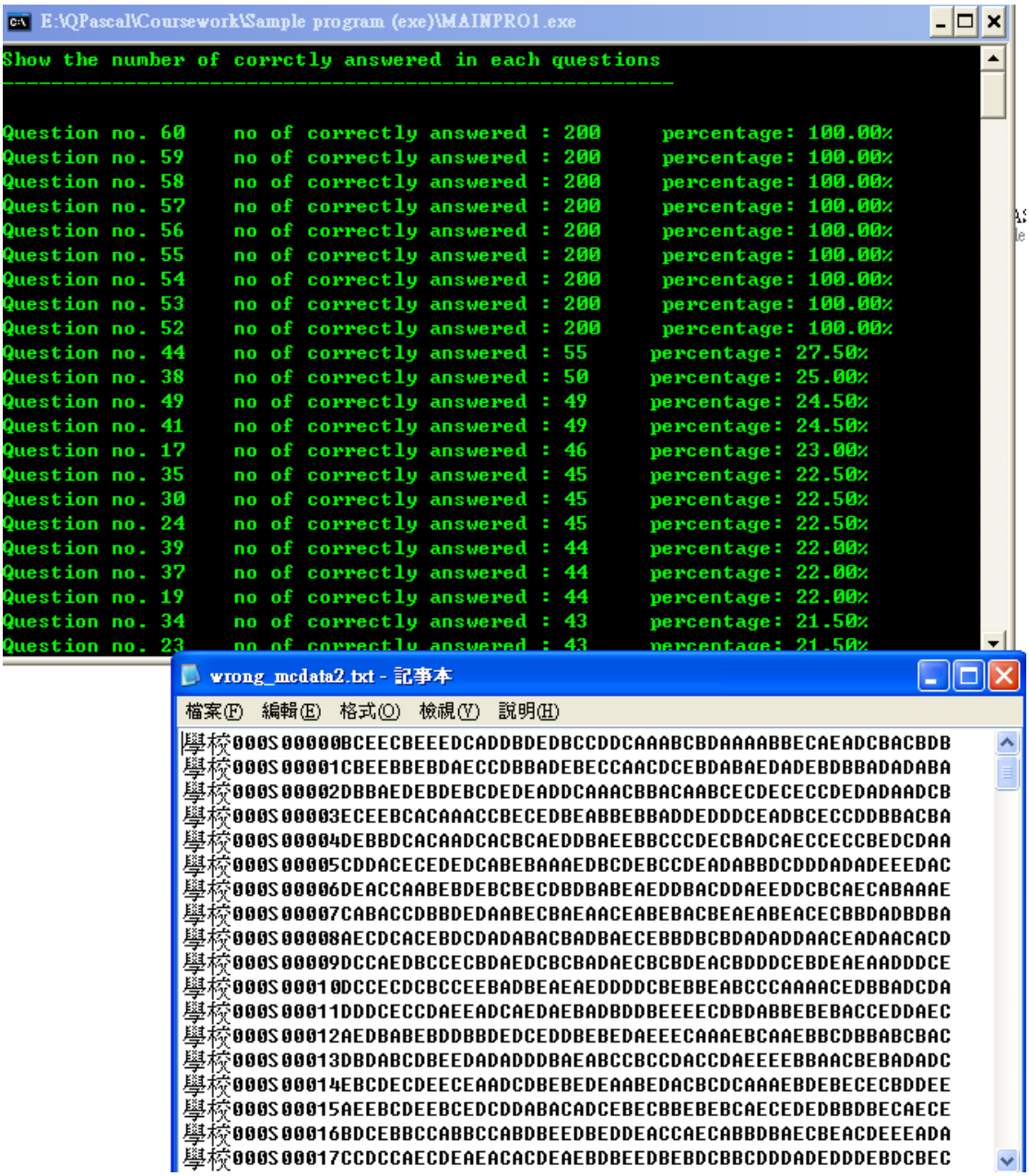
There was a confused code .

I think it will be occurred also though I changed all sch to 學校 in Chinese.





Not expected just space occurred. The other kind of confused code just like the figure in the second testing I expected.

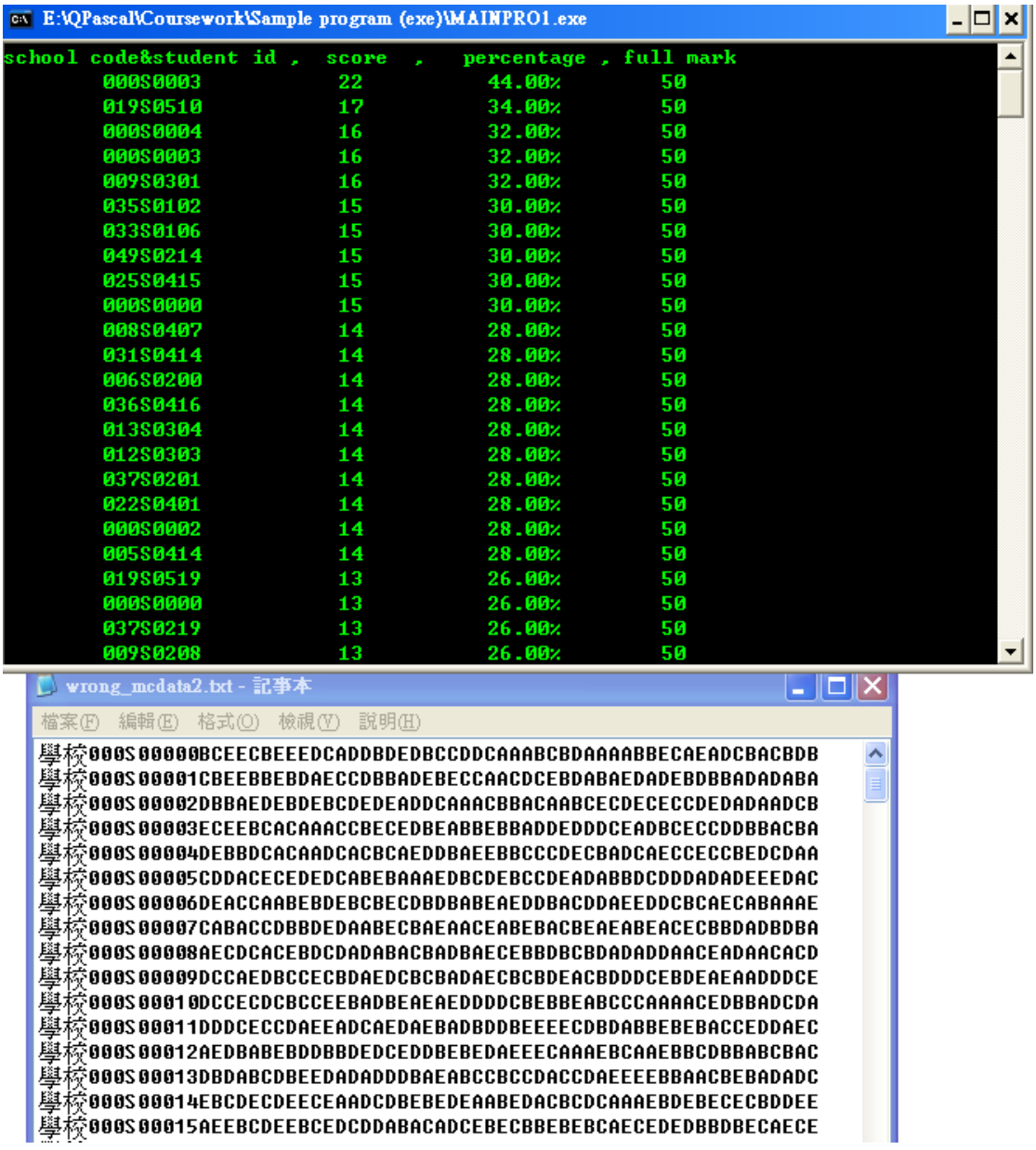


There is still this error after I make a little change before the second testing and doesn't change back.

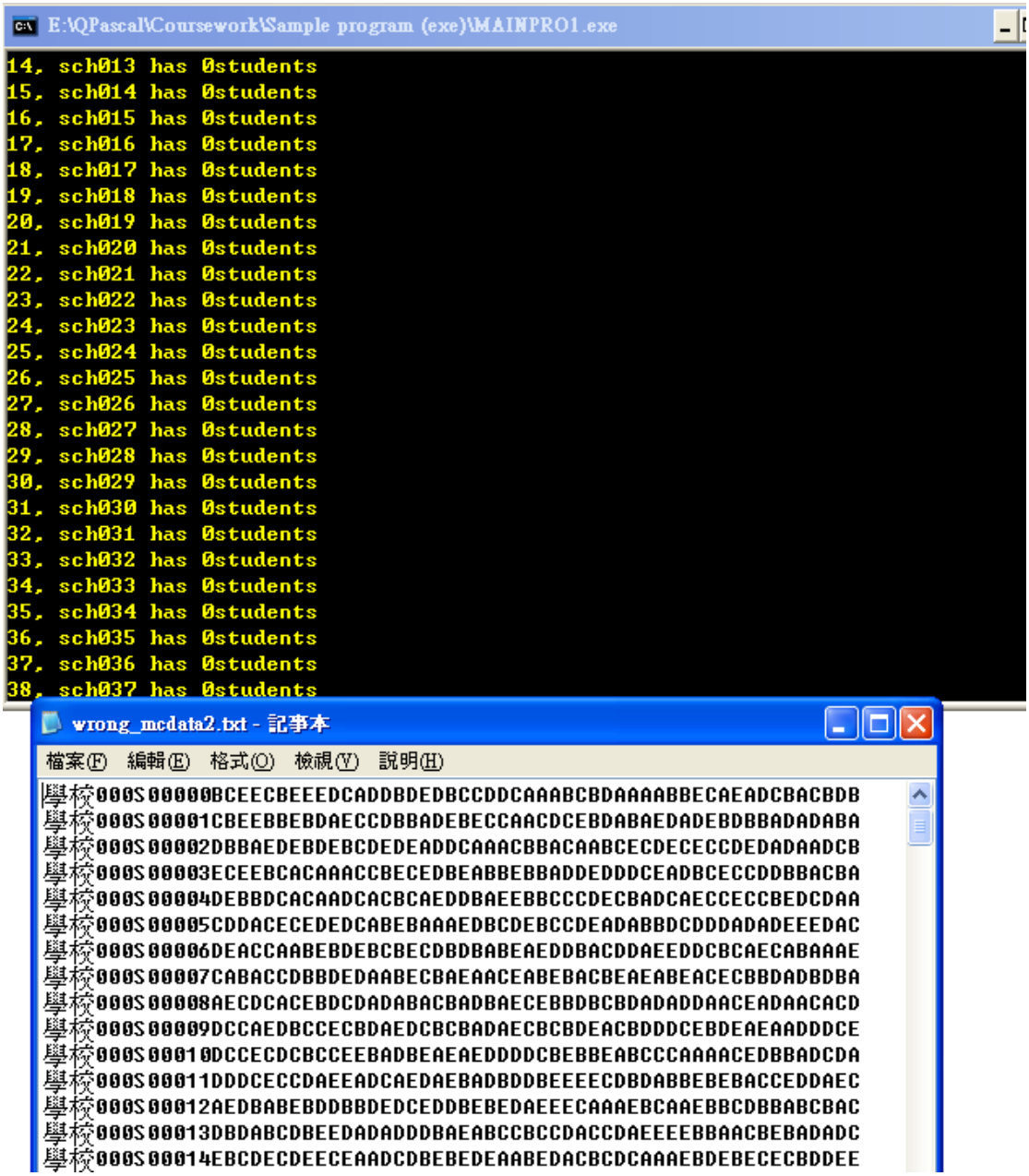
```
program project;
uses crt;                                                    {maxnoqu
const                                                        {maxstud
   maxnoques = 60;  maxstudno =210;  maxschoolno =60; noprize = 5;
var
   anskey :string;                                           {anskey
   no, total :integer;
   studno : array[1..maxstudno] of string[6];
```

And I just find out that I make a wrong change in maxnoques. It made me confused.

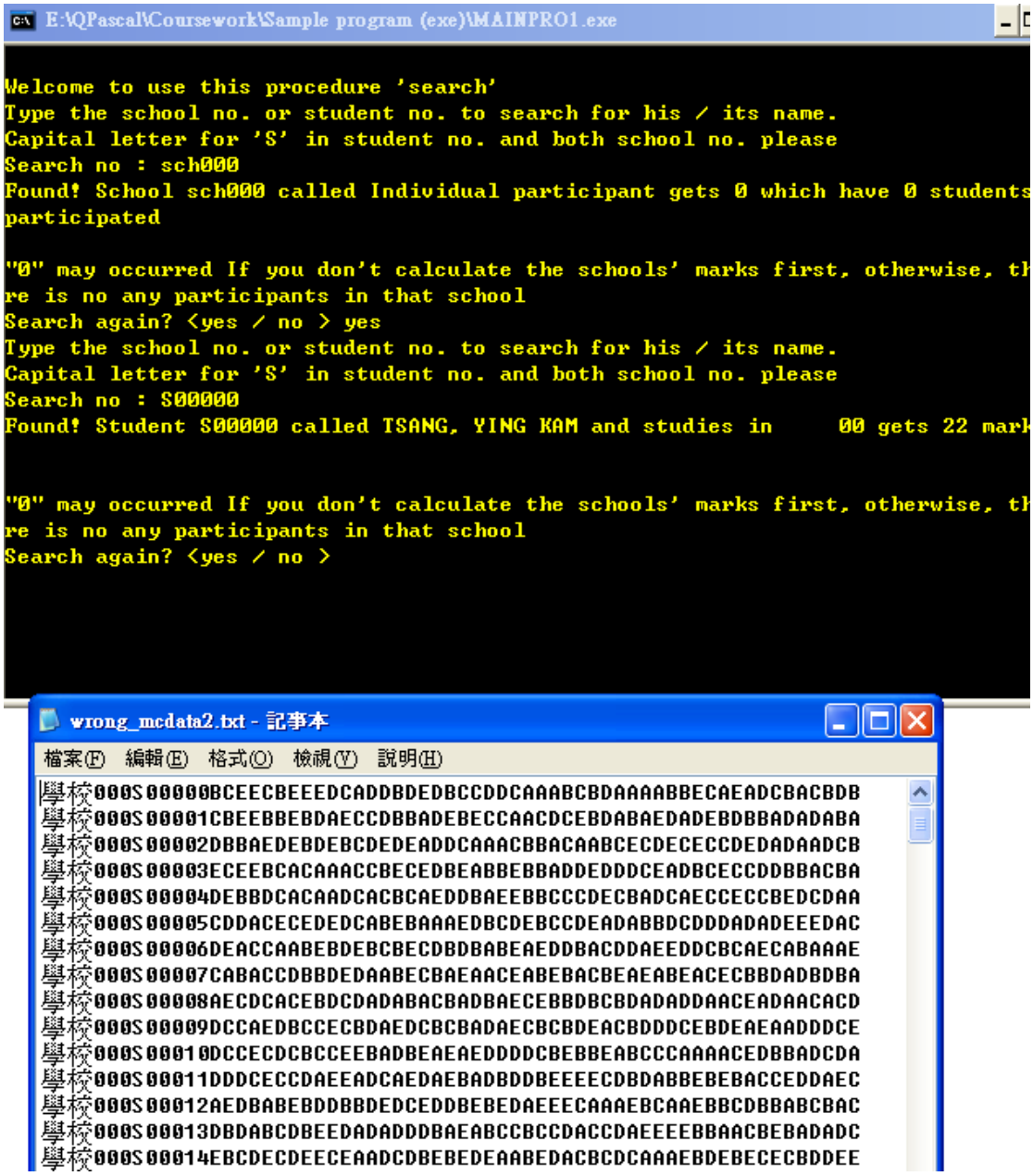
```
program project;
uses crt;                                                    {maxnoques i
const                                                        {maxstudno i
   maxnoques = 50;  maxstudno =210;  maxschoolno =60; noprize = 5;
var
   anskey :string;                                           {anskey is t
   no, total :integer;
   studno : array[1..maxstudno] of string[6];
```



The error of the full mark is changed!. And the effects of Chinese word to my program is no, only space occurred.



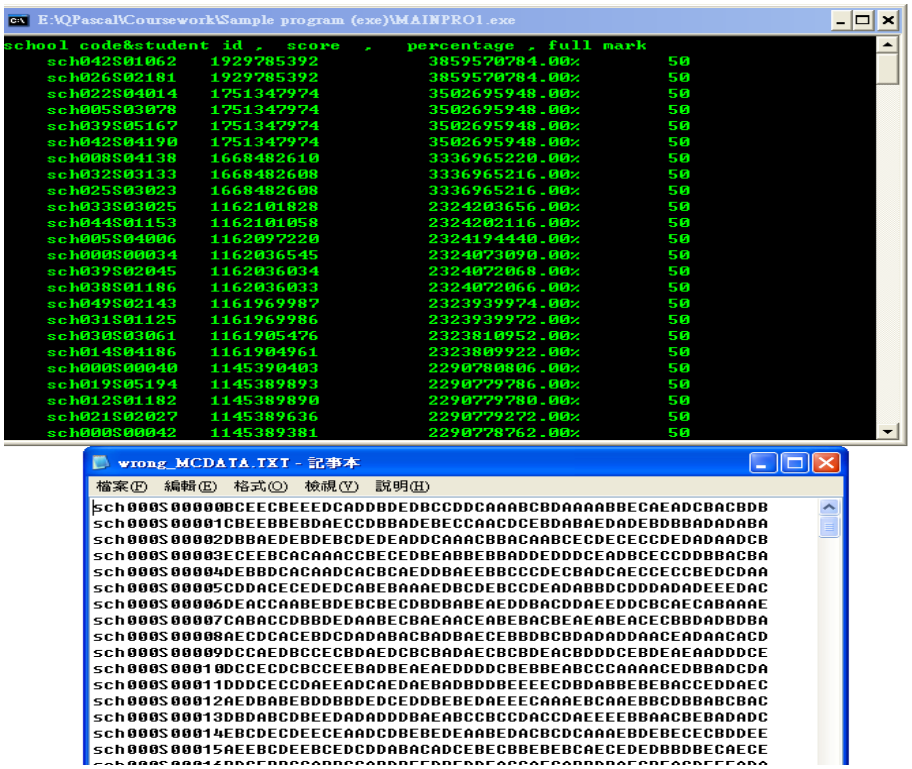
And I make the schools confused to realize their students.



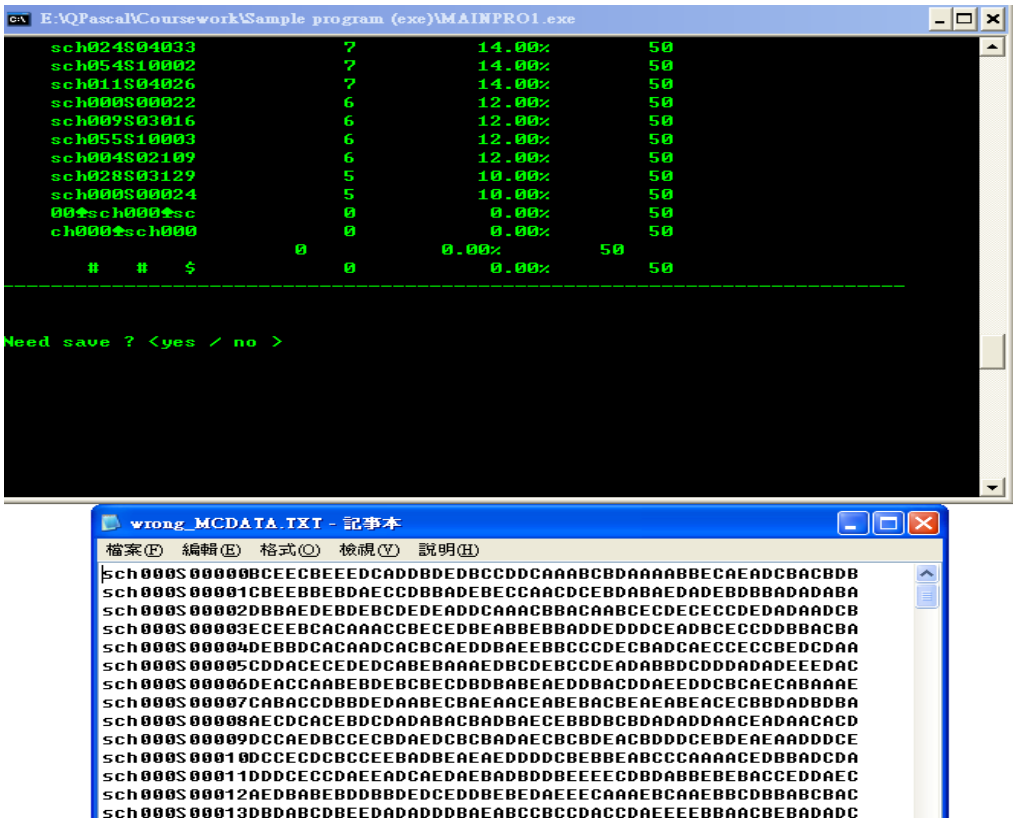
The school can be found, but the school of the student cannot be found.
The result of this error running is totally succeeded.

Overall result : successfully done

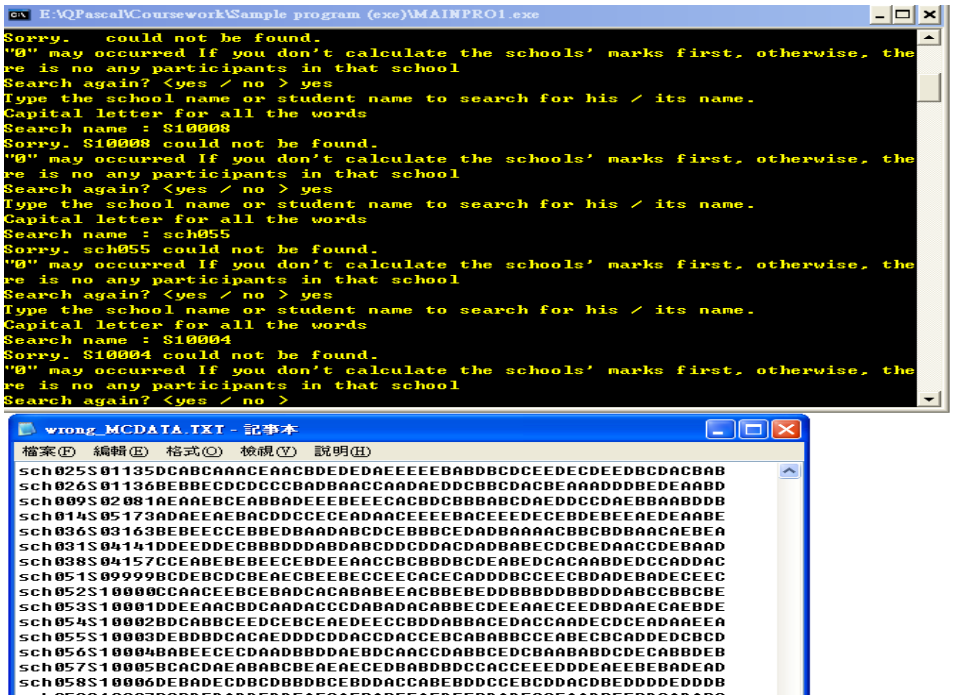
Forth testing, re-do the second test.



As like as the test before, and the full mark become normal

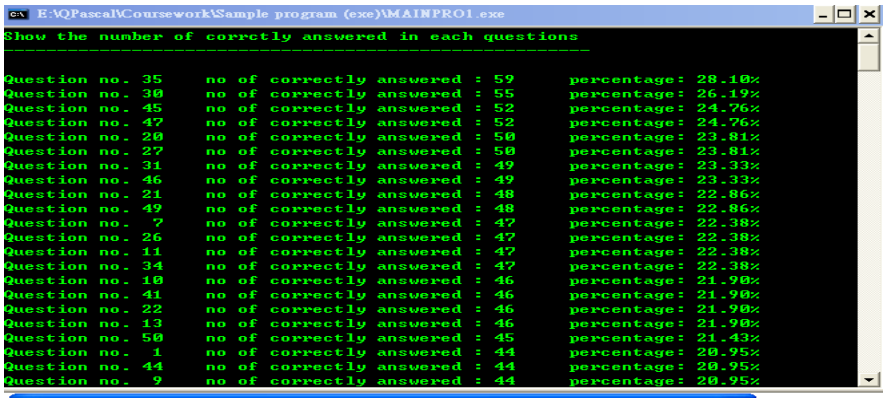


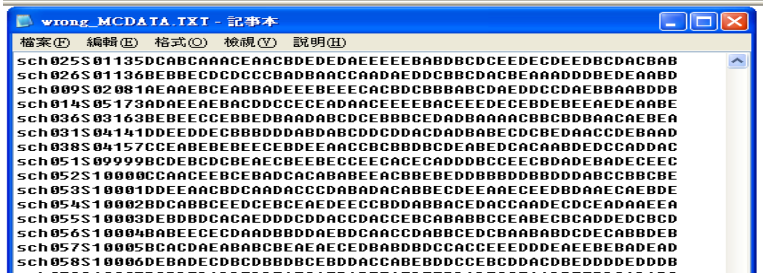
Confused code also occurred.



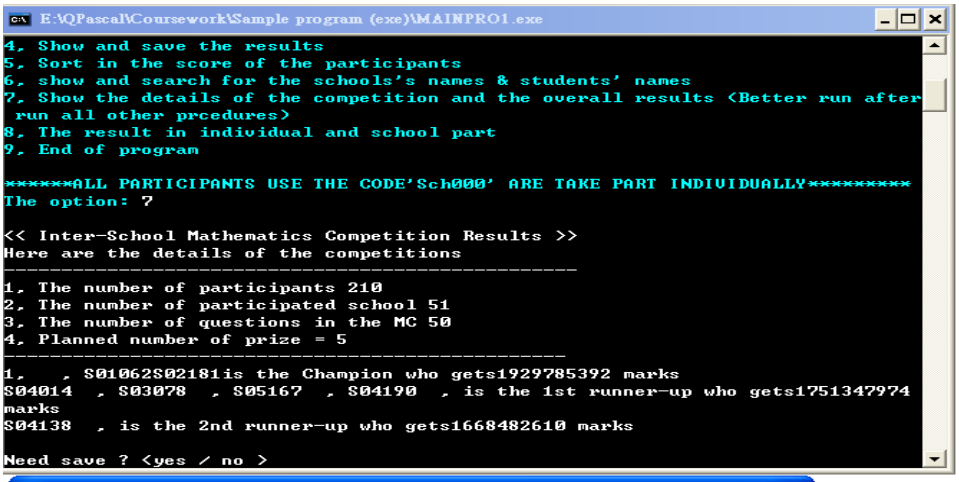
as like as before, cant be found.

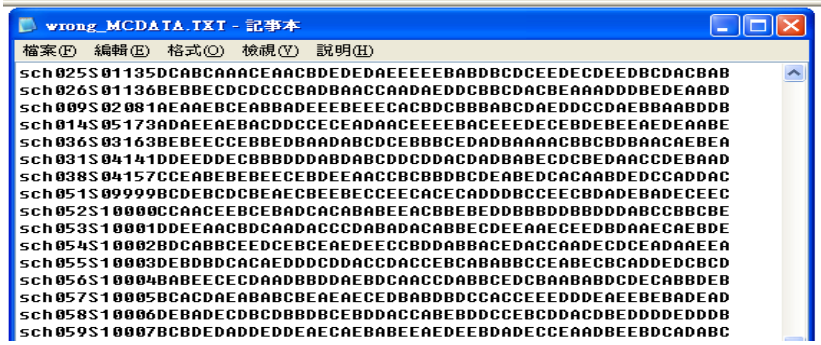
About the results of questions.



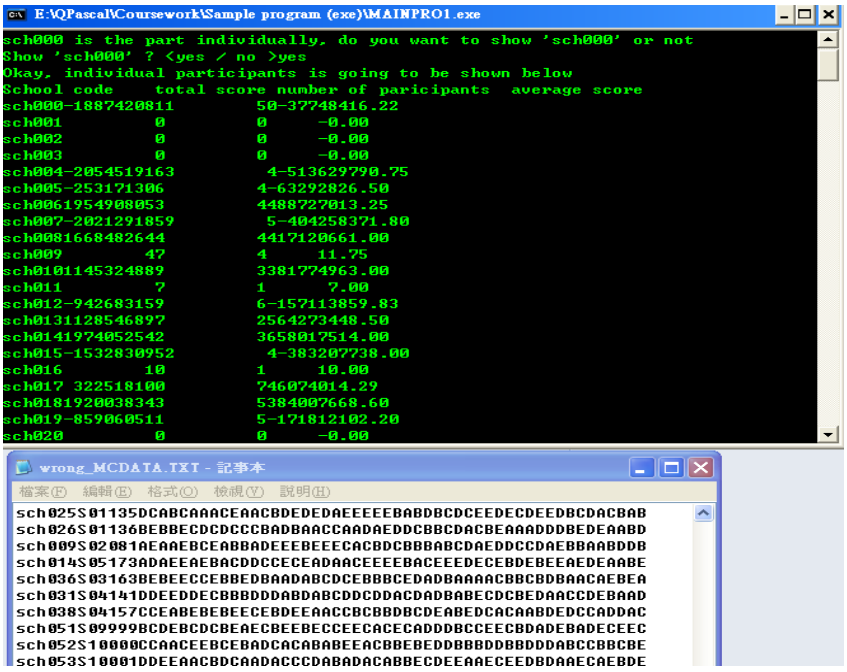


It is back to normal.





The effect of wrong_mcdata is calculating a wrong score of participants, no effect in run another procedures. But of course the school score is effected.



The schools have no student participate remaining no changed.

The winner of overall result is changed, of course the results of school and individual part is affected, no need to post here.

Adding the future improvement that I will modify the calculating process.

Overall result : failed

Fifth test with the time used for running the program with right data file normally.

I do this test because I think that It takes too much time to run is not good. But , I think I can improve the menu.

- Beginning, reset to 0 second.
- The time used up until main menu occurred, 3second.
- The time used up until the answer key inputted, 7second.
- The time used up until the mcdata inputted, 12second.
- Run 3 to calculate to mark and show the result in 4, 1, 16second
- Run all procedure in the statistics menu(except5,6,8,11), 32second
- Run all procedure in 5, sort show data, 47second
- Run all procedure in 6, search and show data, 86second
- Run the 7, 8 procedure to show overall result, 104 second
- Run the remaining statistics procedure, 116second

However, it takes nearly 2 minutes is very slow. But it is mainly because of my typing speed, warning sentence occurred, save results, back to the main menu, etc.

My program is too complex so many steps must follow and it leads slow.
I will mention it on future improvement.

Overall result : fair

Chapter 6 Conclusion & Discussion

6.1 Pros and cons of my Program

The pros of my program are many procedures is involved and the results are accurate. Searching function is successfully created and completed. Only a few words are typed but can also find the target. And the overall results, the same high mark winners can be shown and stopped at the least exceed of planned winner (stop at the level that the numbers of winner is full).

The cons is my program is too trouble when running, first two procedure to

read the data is a must, then use 3 to calculate. At this time, the program still cannot be used freely also, read the school and student data, then sort the result. After these trouble procedures, the program can be run freely. At this moment, all the procedures have been run and the user has no interest to run the program at this time. But I don't sort the data immediately after calculation is because I prefer to see a graph with no order than that with order. When inputting data, I let the user choose to input is because I hope the program can be reused, then I prefer the user can input the data by their hands and their choice then the fixed input. As the testing above, it takes nearly 2 minutes to run through the whole program. And method used to calculate score is not flexible. From the testing above, I should not use the fixed variable to calculate to score.

6.2 Future Improvement

In the part of inputting data, if the user typed the wrong assign run-time error would be occurred. It is hard to debug as the string of text file is not only <.txt>. If I fixed the last 3 word must be txt, it is useless at another text structure and both a wrong typing with "jkdlasfmlakgdnwbaltxt". If I fixed it with my data file name, it was extremely not work because my program is better be reusable. The best method is hoping the user be careful. I have used too much variable but still can't let the program become more flexible. Some variable in the program can be cancelled.

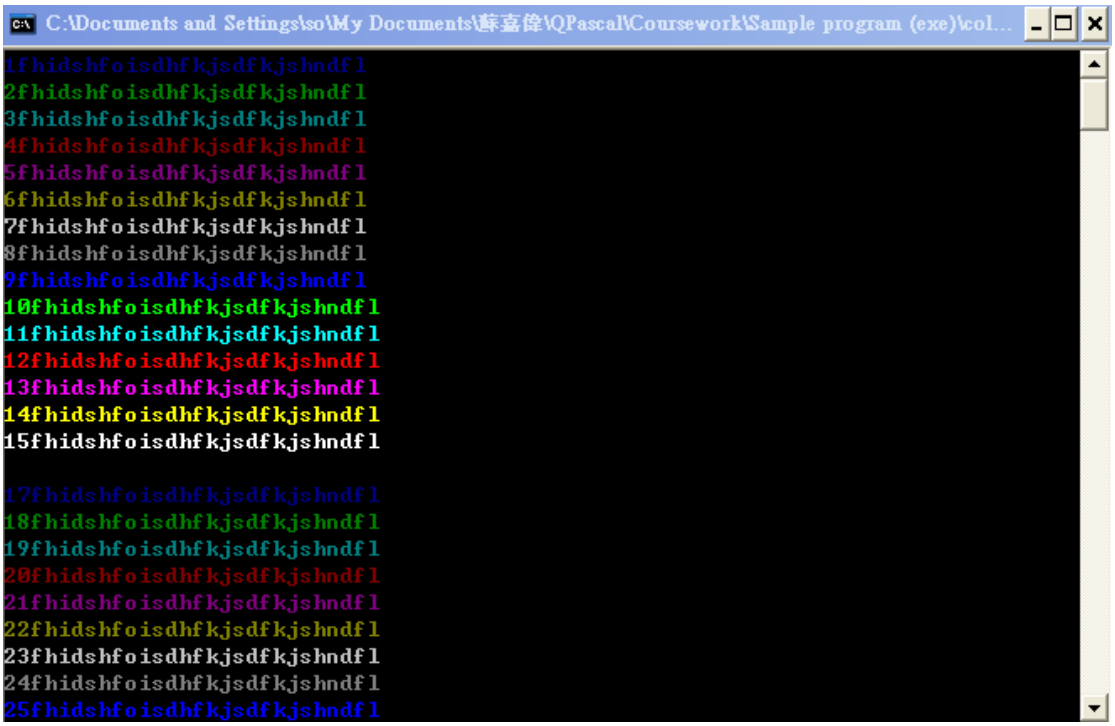
The program is over fixed and leads slow also the calculating method should be modified.

And as I mentioned above, the unknown error is occurred, but I still don't know how to do. I will try to learn it. Then solve it.

6.3 Self-Reflection

The ability of creating Pascal project is increased. At the first few day, I need to refer to the reference of teacher frequent. At last, I can debug myself and do the testing above. I can make programs by my mind without topic after finish

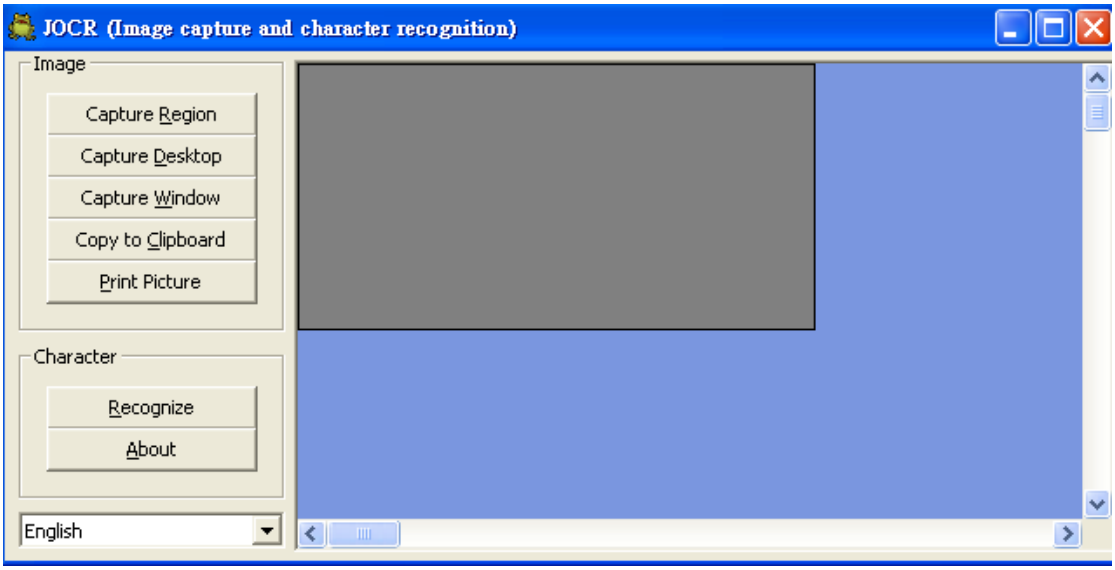
this program. For example, I had made an program to show colours with their code in Pascal. Although it is simple to do, I haven't do this program I still don't know how to make it.



Chapter 7 Reference and Acknowledgement

From Internet websites

1. http://www.macdonald.egate.net/CompSci/Pascal/hstrings.html#upcase
2. http://www.programmersheaven.com/user/Actor/blog/115-Trimming-strings
3. http://mc-computing.com/Languages/Strings.htm
4. A capture software called JOCR 



From books

1. Longman Pascal Programming Today

Acknowledgement

1. Simple Pascal usage
2. comments given by classmates.

1.Good to have welcome interface.

2.Intructions are too complicated to be user-frienly.

3.Bugs easily occur as instructions are hard to follow.

4.Low readability in sorting interface,

as the text colour and BG colour and grey and black respectively.

5.Menu and pages are poorly organized.

6.Needed manually running analyzing procedure, terribly complicated.

7.Different kinds of esult needed to save individually, unacceptable.

Appendices

Appendix 1 – Program Code

```
program project;
uses crt;                                                    {maxnoques is the
maximum number of questions}
const                                                         {maxstudno is
the maximum number of sudent}
    maxnoques = 50;   maxstudno =200;   maxschoolno =60; noprize = 5;
{maxschoolno is the maximum number of school}
var
    anskey :string;                                          {anskey is the
string is used for store answer key}
    no, total :integer;
    studno : array[1..maxstudno] of string[6];
    real_studans : array[1..maxstudno] of string[maxnoques];
    stud_score : array[1..maxstudno] of integer;
    thestudans : array[1..maxstudno] of string[100];
    ansper_ques : array[1..maxstudno] of integer;
    studsch : array [1..maxstudno] of string[6];
    corrper_ques : array[1..maxnoques] of integer;
    school : array[1..maxschoolno] of string[80];
    student : array[1..maxstudno] of string[50];
    remember : array[1..maxstudno] of string[18];
    stud_file, sch_file : text;
    stud_count, sch_count :integer;
    school_name : array[1..maxschoolno] of string[100];
    student_name : array[1..maxstudno] of string[20];
    ques_no : array[1..maxnoques] of integer;
    no_top : integer;
    sch_mark : array[1..maxschoolno] of integer;
    studper_sch : array[1..maxschoolno] of integer;
    run : array[1..12] of boolean; a : integer;
    check : boolean;
    show : string;

procedure readans;
var
    ansfile_name : string;
    ansfile: text;
begin
    writeln('Enter the filename of the answers ');
    writeln('   (.txt) is needed to type together ');
    write('   Capital letters do not required : ');
    readln(ansfile_name);
    assign(ansfile, ansfile_name);
```

```
    reset(ansfile);
    readln(ansfile, anskey);
    writeln('Press <Enter> to continue');
    readln;
    close(ansfile);
    run[1]:=true;
end;

procedure readstudans;
var
    studansfile : string;
    studans : text;
    k : integer;
begin
    k:=0;
    writeln('Enter the filename of participants'' answers ');
    writeln('    (.txt) is needed to type together ');
    write('    Capital letter also :');
    readln(studansfile);
    assign(studans, studansfile);
    reset(studans);
    while not eof(studans) do
    begin
    k:=k+1;
    readln(studans, thestudans[k]);
    end;
    stud_count:=k;
    writeln('Press <Enter> to continue');
    readln;
    close(studans);
    run[2]:=true;
end;

procedure cal_stud_mark;
var
       i, j, n :integer;
begin
       total:=0;
    for i:= 1 to maxnoques do     begin
          ques_no[i]:=0;
       ansper_ques[i]:=0;
       corrper_ques[i]:=0;
       end;
    for i:= 1 to stud_count do
     begin
       stud_score[i]:=0;
       studsch[i] := copy(thestudans[i], 1, 6);
       studno[i]   := copy(thestudans[i], 7, 6);
       real_studans[i]:=copy(thestudans[i],13,(maxnoques));
     for j := 1 to maxnoques do
       begin
       If copy(real_studans[i], j, 1)=copy(anskey, j, 1)then
```

```
          begin
            stud_score[i]:=stud_score[i]+1;
            ansper_ques[j]:=ansper_ques[j]+1;
            total:=total+1;
          end; end;
        end;
        for n := 1 to maxnoques do
      ques_no[n]:=n;
      writeln('Press <Enter> to continue');
      readln;
      run[3]:=true;
end;

procedure cal_schmark;
var
    n, m : integer;
begin
      run[12]:=true;
      clrscr;
           for n:= 1 to maxnoques do
      begin
      sch_mark[n]:=0;
      studper_sch[n]:=0;
      end;
      for n := 1 to sch_count do
         for m := 1 to stud_count do
          if copy(school[n], 1, 6) = studsch[m] then
         begin
         sch_mark[n]:=sch_mark[n]+stud_score[m];
         studper_sch[n]:=studper_sch[n]+1
         end;

    writeln('Here is the competition between schools ');
    writeln('sch000 is the part individually, do you want to show "sch000" or not ');
    write('Show "sch000" ? <yes / no >');
    readln(show);
    If (show <> 'yes') and (show <> 'no')   and (show <> 'NO') and (show <> 'N')
and (show <>'YES') and (show <>'Y')then
        repeat
            writeln('Wrongly inputted !');
            writeln('The option is only < yes / no > ');
            writeln('sch000 is the part individually, do you want to show "sch000" or
not ');
            write('Show "sch000" ? <yes / no >');
            readln(show);
        until (show = 'yes') or (show = 'no') OR (show = 'NO')OR (show = 'N') OR
(show ='YES') OR (show ='Y');

    If (show = 'no') OR (show = 'NO') OR (show = 'N') then
        begin
            writeln('Okay, no individual participants will be shown below ');
            writeln('School code ', 'total score ':15, 'number of paricipants ':15,
```

```
'average score ':15);
            for n := 1 to sch_count do
                If copy(school[n], 1, 6) <> 'sch000' then       begin
                    write(copy(school[n], 1, 6), sch_mark[n]:10, studper_sch[n]:10);
                    If studper_sch[n]=0 then studper_sch[n]:=-1;
                    writeln((sch_mark[n]/studper_sch[n]):10:2);    end;

writeln('-------------------------------------------------------------------------------');
           writeln('Press <Enter> to continue');
           readln;
         end;

    If (show ='yes') or (show ='YES') or (show ='Y') then
        begin
            writeln('Okay, individual participants is going to be shown below ');
            writeln('School code ', 'total score ':15, 'number of paricipants ':15,
'average score ':15);
            for n := 1 to sch_count do
                   begin
                    write(copy(school[n], 1, 6), sch_mark[n]:10, studper_sch[n]:10);
                    If studper_sch[n]=0 then studper_sch[n]:=-1;
                    writeln((sch_mark[n]/studper_sch[n]):10:2);    end;

writeln('-------------------------------------------------------------------------------');
            writeln('Press <Enter> to continue');
            readln;
       end;
       for n:= 1 to sch_count do
       If studper_sch[n]=-1 then studper_sch[n]:=0;
end;


procedure show_in_graph;
var
    h, i   : integer;
begin
clrscr;
       writeln('Here is the results of students show in graph ');
  for h := 1 to stud_count do       begin
           write(studno[h]:2, ',   '); for   i := 1 to stud_score[h] do write('*');
writeln('[', stud_score[h],']');    end;

writeln('_____________________________________________________________________
_____________');
           writeln('0      5       10      15      20      25      30      35      40      45
50');
           writeln('                                [mark of participants]');
           writeln('Press <Enter> to continue');
     readln;
end;

procedure show_no_graph;
```

```
var
    h, i   : integer;
begin
clrscr;
       writeln('Here is the results of correctly answered questions in graph ');
  for h := 1 to maxnoques do
          begin
          write(ques_no[h]:2, ',   '); for   i := 1 to ansper_ques[h] do write('*');
writeln('[', ansper_ques[h],']');   end;

writeln('_____________________________________________________________________
_____________________');
          writeln('0      5       10      15      20      25      30      35      40      45
50');
          writeln('                                [number of questions]');
          writeln('Press <Enter> to continue');
     readln;
end;

procedure show_sch_graph;
var
    h ,i :integer;
begin
    clrscr;
       writeln('Here is the results of the school in graph ');
        If (show = 'no') OR (show = 'NO') OR (show = 'N') then begin
  for h := 1 to sch_count do
          begin
          If copy(school[h], 1, 6) <> 'sch000' then       begin
          write(copy(school[h], 1, 6)); for   i := 1 to sch_mark[h] do write('*');
write('[', sch_mark[h],']'); writeln('[', studper_sch[h], ']'); end; end;

writeln('_____________________________________________________________________
_____________________');
          writeln('0      5       10      15      20      25      30      35      40      45
50');
          writeln('                          [number of schools][students in that school]');
          writeln('Press <Enter> to continue');
     readln;      end;
        If (show ='yes') or (show ='YES') or (show ='Y') then begin
  for h := 1 to sch_count do
          begin
          write(copy(school[h], 1, 6)); for   i := 1 to sch_mark[h] do write('*');
write('[', sch_mark[h],']'); writeln('[', studper_sch[h], ']'); end;

writeln('_____________________________________________________________________
_____________________');
          writeln('0      5       10      15      20      25      30      35      40      45
50');
          writeln('                          [number of schools][students in that school]');
          writeln('Press <Enter> to continue');
     readln;      end;
```

```
end;

procedure show_corrques;
var
       n : integer;
       save : string;
       result_name : string;
       result_file : text;
begin
clrscr;
      n:=1;
      writeln('Show the number of corrctly answered in each questions ');
      writeln('-----------------------------------------------------');
      writeln;
      for n:= 1 to maxnoques do
      writeln('Question no. ', ques_no[n]:2, '       no of correctly answered : ',
ansper_ques[n]:2, '        percentage: ', (ansper_ques[n]/ stud_count*100):5:2,'%');
      writeln;
      write('Need save ? <yes / no >');
      readln(save);
        If (save <> 'yes') and (save <> 'no')   and (save <> 'NO') and (save <> 'N')
and (save <>'YES') and (SAVE <>'Y')then
            repeat
      writeln('Wrongly inputted !');
      writeln('The option is only < yes / no > ');
      write('Need save ? <yes / no >');
      readln(save);
            until (save = 'yes') or (save = 'no') OR (save = 'NO')OR (save = 'N') OR
(save ='YES') OR (SAVE ='Y');
      If (save = 'yes') OR (save ='YES') OR (SAVE ='Y')then
      begin
      write('Input the file name of the result ( include <.txt> ) :');
      readln(result_name);
      assign(result_file, result_name);
      rewrite(result_file);
      n:=1;
      writeln(result_name, 'Show the number of corrctly answered in each questions
');
      writeln(result_name, '-----------------------------------------------------');
      writeln(result_name);
      for n:= 1 to maxnoques do
      writeln(result_name, 'Question no.', ques_no[n]:4, '       no of correctly
answered :', ansper_ques[n]:5, '     percentage: ', (ansper_ques[n]/
stud_count*100):5:2,'%');
      close(result_file);
      writeln('The result is successfully saved ! ');
      end;
      readln;
end;
procedure cal_mean;
var
    mean : real;
```

```
begin
      mean:=total/stud_count;
      writeln('The mean of the marks is ', mean:5:2);
      writeln('Press <Enter> to continue');
      readln;
end;

procedure cal_median;
var
    median : real;
begin
       If (stud_count mod 2) > 0 then
       median := stud_score[round(stud_count/2)]
         else if   (stud_count mod 2) = 0 then
            median := (stud_score[trunc(stud_count/2)] +
stud_score[round(stud_count/2)+1])/2;
       writeln('The median of the marks is ', median:2:2);
       writeln('Press <Enter> to continue');
       readln;
end;

procedure cal_mode;
var
    stud_mode : array[0..maxnoques] of integer;
    n, m : integer;
    mode : integer;
begin
    for n := 0 to maxnoques do
       stud_mode[n]:=0;

    for n := 1 to stud_count do
          stud_mode[stud_score[n]]:= stud_mode[stud_score[n]]+1;

     mode:=0;
     for m:= 1 to maxnoques do
          If stud_mode[m] > stud_mode[mode] then
              mode:= m ;

    write('The mode of the students is ');
    for n := 0 to maxnoques do
       If stud_mode[n] = stud_mode[mode]
       then   write(n, ' ');
     writeln;
     writeln('Press <Enter> to continue');
     readln;
end;


procedure cal_quartile;
var
  st, nd, rd : real;
begin
```

```
      If stud_count mod 2 = 0 then    begin

st:=(stud_score[trunc(stud_count*0.25)]+stud_score[round(stud_count*0.25+1)])
/2;

nd:=(stud_score[trunc(stud_count*0.5)]+stud_score[round(stud_count*0.5+1)])/2
;

rd:=(stud_score[trunc(stud_count*0.75)]+stud_score[round(stud_count*0.75+1)])
/2 ;end
         else    if stud_count mod 2 > 0 then    begin
              st:=stud_score[round(stud_count*0.25)];
              nd:=stud_score[round(stud_count*0.5)];
              rd:=stud_score[round(stud_count*0.75)];           end;
    writeln('The 1st quartile is ', st:2:2);
    writeln('The 2nd quartile is ', nd:2:2);
    writeln('The 3rd quartile is ', rd:2:2);
    writeln('Press <Enter> to continue');
    readln;
end;

procedure cal_sd;
var
    sd, mean: real;
    diff_sum : real;
    n : integer;
    absol_diff : array[1..maxstudno] of real;
begin
    n:=1;
    mean:=total/stud_count;
    for n := 1 to stud_count do
    begin
    absol_diff[n]:=(mean-stud_score[n]);
    diff_sum:=(diff_sum)+sqr(absol_diff[n]);
    end;
    sd := sqrt(diff_sum/(stud_count-1));
    writeln('The standard deviation of the participants is ', sd:5:2 );
    writeln('Press <Enter> to continue');
    readln;
end;

procedure read_student;
var
    n : integer;
begin
clrscr;
       run[10]:=true;
    n:=1;
    assign(stud_file, 'name_list.txt');
    reset(stud_file);
    while not eof(stud_file) do
    begin
```

```
    readln(stud_file, student[n]);
    n:=n+1;
    end;
    n:=1;
    for n:=1 to stud_count do
    writeln(student[n]);
    writeln('Press <Enter> to continue');
    readln;
    close(stud_file);
end;

procedure read_school;
var
    n : integer;
begin
clrscr;
       run[11]:=true;
    n:=0; sch_count:=0;
    assign(sch_file, 'school_list.txt');
    reset(sch_file);
    while not eof(sch_file) do
    begin
    n:=n+1;
    sch_count:=sch_count+1;
    readln(sch_file, school[n]);
    end;
    for n := 1 to (sch_count+1) do
    writeln(school[n]);
    writeln('Press <Enter> to continue');
    readln;
  close(sch_file);
end;

procedure top_five;
var
    m : integer;
    save : string;
begin
       no_top:=0;
       write('How many students are ranged from all of the participants would you like
to show? ');
       readln(no_top);
       writeln(no_top, ' of highest mark participants you would like to show ');
       writeln('-------------------------------------------------------------');
       writeln('school code, student no,      score,');
       for m := 1 to no_top do
       writeln(m, ',is ', studsch[m]:8, studno[m]:10,   stud_score[m]:6);
       writeln('Want to remember the student no. of the participants above ?');
       writeln('You can use another procdure to find their names after saving it ');
       write('Need temporary remember ?<yes / no > ');
       readln(save);
        If (save <> 'yes') and (save <> 'no')   and (save <> 'NO') and (save <> 'N')
```

```
and (save <>'YES') and (SAVE <>'Y')then
            repeat
      writeln('Wrongly inputted !');
      writeln('The option is only < yes / no > ');
      write('Need temporary remember ? <yes / no >');
      readln(save);
            until (save = 'yes') or (save = 'no') OR (save = 'NO')OR (save = 'N') OR
(save ='YES') OR (SAVE ='Y');
      If (save = 'yes') OR (save ='YES') OR (SAVE ='Y')then
      begin
      for m := 1 to no_top do
      remember[m]:=studsch[m]+'       '+studno[m];
      writeln('The data are successfully remembered ! ');
      writeln('You can find that procdure in ''5, show the schools''s names & students''
names ''in the main program ');
      writeln('Press <Enter> to continue');
      readln;
      end;
end;

procedure name_top;
var
    m, n, p : integer;
    score_stud : array[1..maxstudno] of integer;
begin

       writeln;
       writeln('**The name and school of the top participants will be shown below ');
       writeln('**school code&student id,   School name,     Student name ');
       writeln;
       for m:= 1 to no_top do
       for n := 1 to sch_count do
       begin
       If copy(remember[m], 1, 6) = copy(school[n], 1, 6) then
           school_name[m] := copy(school[n], 9, 109);
       end;
       for m := 1 to no_top do
       for p := 1 to stud_count do
       begin
       If copy(remember[m], 11, 6) = copy(student[p], 1, 6) then
           student_name[m] := copy(student[p], 9, 29);
       end;
       for m:= 1 to no_top do
       for p := 1 to stud_count do
       If copy(remember[m], 11, 6) = studno[p] then
       score_stud[m]:=stud_score[p];
       for m:= 1 to no_top do
       writeln( m, remember[m], ' is ',   student_name[m], ' studies in ',
school_name[m], ' who gets ',   score_stud[m]);
       writeln('-------------------------------------------------------------------------');
       writeln('Press <Enter> to continue');
       readln;
```

```
end;

procedure show_result;
var
   h : integer;
   save : string;
   result_name : string;
   result_file : text;
   begin
   clrscr;
            writeln('school code&student id ,   score   ,     percentage , full mark ');
    for h := 1 to stud_count do
            writeln(studsch[h]:10, studno[h]:2, stud_score[h]:13, '                ',
(stud_score[h] / maxnoques*100):5:2, '%', maxnoques:10 );
    writeln('-------------------------------------------------------------------------');
    writeln;
         writeln;
     write('Need save ? <yes / no > ');
     readln(save);
        If (save <> 'yes') and (save <> 'no')   and (save <> 'NO') and (save <> 'N')
and (save <>'YES') and (SAVE <>'Y')then
            repeat
     writeln('Wrongly inputted !');
     writeln('The option is only < yes / no > ');
     write('Need save ? <yes / no >');
     readln(save);
            until (save = 'yes') or (save = 'no') OR (save = 'NO')OR (save = 'N') OR
(save ='YES') OR (SAVE ='Y');
     If (save = 'yes') OR (save ='YES') OR (SAVE ='Y')then
     begin
     write('Input the file name of the result ( include <.txt> ) :');
     readln(result_name);
     assign(result_file, result_name);
     rewrite(result_file);
    h:=1;
            writeln(result_file, 'school code&student id ,   score   ,     percentage , full
mark ');
    for h := 1 to stud_count do
            writeln(result_file, studsch[h]:10, studno[h], stud_score[h]:13, '
', (stud_score[h] / maxnoques*100):2:2, '%', maxnoques:15 );
    writeln(result_file,
'-------------------------------------------------------------------------');
    writeln(result_file);
     close(result_file);
     writeln('The result is successfully saved ! ');
     end;
     writeln('Press <Enter> to continue');
     readln;
end;

procedure sort_ques;
var
```

```
    x, y : integer;
    temp_ques, temp_ques_no : integer;
begin
       for x := 1 to maxnoques-1 do
          for y := 1 to maxnoques-x do
           begin
              if ansper_ques[y] <= ansper_ques[y+1] then
                 begin
                        temp_ques := ansper_ques[y];
                        ansper_ques[y] := ansper_ques[y+1];
                        ansper_ques[y+1] := temp_ques;

                        temp_ques_no := ques_no[y];
                        ques_no[y] := ques_no[y+1];
                        ques_no[y+1] := temp_ques_no;
                 end;
           end;
    writeln('Press <Enter> to continue');
    readln;
end;

procedure sort_desend;
var
      x, y: integer;
      tem_stud : integer;
      tem_sch, tem_no : string;
begin
      for x := 1 to (stud_count-1) do
            for y := 1 to (stud_count-x) do
              begin
              if stud_score[y] <= stud_score[y+1] then
                 begin
                       tem_stud := stud_score[y];
                       stud_score[y] := stud_score[y+1];
                       stud_score[y+1] := tem_stud;

                       tem_sch := studsch[y];
                       studsch[y] := studsch[y+1];
                       studsch[y+1] := tem_sch;

                       tem_no := studno[y];
                       studno[y] := studno[y+1];
                       studno[y+1] := tem_no;
                 end;    end;
    writeln('Press <Enter> to continue');
    readln;
end;

procedure show_ques;
var
       n : integer;
begin
```

```
        clrscr;
       writeln('Show the number of corrctly answered in each questions ');
       writeln('-----------------------------------------------------');
       for n:= 1 to maxnoques do
       writeln('Question no. ', ques_no[n]:2, '        no of correctly answered ',
ansper_ques[n]:2, '     percentage ', ansper_ques[n]/stud_count*100:0:2);
       writeln;
       writeln('-----------------------------------------------------');
       writeln('If you want to save the result, please go to main program then go to "4,
Show and save the results '");
       readln;
end;

procedure no_stud_sch;
var    n , m : integer;
       stud_sch : array [1..maxschoolno] of integer;                    {stud_sch
is used to store the number of students in each school}
begin
        clrscr;
        for n := 1 to sch_count do
            stud_sch[n]:=0;
        writeln('The number of the students in each school ');
        writeln('-----------------------------------------');
        for n := 1 to stud_count do
           for m := 1 to sch_count do
              IF copy(school[m], 1, 6)=copy(studsch[n], 1, 6) then
                  stud_sch[m]:=stud_sch[m]+1;
        for n := 1 to sch_count do
        writeln(n:2, ', ', copy(school[n], 1, 6) , ' has ' ,stud_sch[n], 'students ');
        writeln('-------------------------------------------------------------');
        writeln('Press <Enter> to continue');
        readln;
end;

procedure show_sort_desend;
var
     n : integer;
begin
        writeln('The result sorted into Decending order ');
        writeln('The top gets the highest mark ');
        writeln('school code, student no,       score,');
        for n := 1 to stud_count do
        writeln(studsch[n]:10, studno[n]:10,    stud_score[n]:6);
        writeln('-----------------------------------------------------');
        writeln('If you want to save the result, please go to main program then go to "4,
Show and save the results '");
        readln;
end;

procedure search_name;
var
     search_no, search_name : string;
```

```
    found : boolean;
    n : integer;
    again : string;
begin
       search_no:=' ';
       writeln;
       writeln('Welcome to use this procedure "search" ');
       repeat
       found:=false;
       writeln('Type the school name or student name to search for his / its name. ');
       writeln('Capital letter for all the words ');
       write('Search name : ');
       readln(search_no);
           iF search_no = '' THEN
              search_no:=' ';
       for n := 1 to stud_count do
       begin If copy(student[n], 9, length(search_no)) = search_no then
                begin
                search_name := copy(student[n], 9, 29);
                writeln('Found! Student ', search_name, ' is ', copy(student[n], 1, 6) , '
and studies in ', studsch[n], ' gets ', stud_score[n]);
                found:=true;
                end;
       end;
       for n := 1 to sch_count do
       begin If copy(school[n], 9, length(search_no)) = search_no then
                  begin
                  search_name := copy(school[n], 1, 6);
                  writeln('Found! School ', copy(school[n], 9, 109) , ' is ', search_name,
' gets ', sch_mark[n], ' which have ', studper_sch[n], ' students participated ');
                  found:=true;
                  end;   end;
       If not found then writeln('Sorry. ', search_no, ' could not be found. ');
       writeln('"0" may occurred If you don''t calculate the schools'' marks first,
otherwise, there is no any participants in that school ');
             write('Search again? <yes / no > ');
       readln(again);
             If (again <> 'yes') and (again <> 'no')   and (again = 'NO') and (again =
'N') and (again ='YES') and (again ='Y')then      begin
             repeat
      writeln('Wrongly inputted !');
      writeln('The option is only < yes / no > ');
      write('Search again? <yes / no >');
      readln(again);
             until (again = 'yes') or (again = 'no') OR (again = 'NO')OR (again = 'N') OR
(again ='YES') OR (again ='Y');          end;

       until (again ='no')   or (again ='NO') or (again ='N');
       writeln('Press <Enter> to continue');
       readln;
end;
```

```
procedure search;
var
    search_no, search_name : string;
    found : boolean;
    n : integer;
    again : string;
begin
       clrscr;
       search_no:=' ';
       writeln;
       writeln('Welcome to use this procedure "search" ');
       repeat
       found:=false;
       writeln('Type the school no. or student no. to search for his / its name. ');
       writeln('Capital letter for "S" in student no. and both school no. please ');
       write('Search no : ');
       readln(search_no);
       iF search_no = '' THEN   search_no:=' ';
       for n := 1 to stud_count do
       begin If copy(student[n], 1, 6) = search_no then
              begin
              search_name := copy(student[n], 9, 29);
              writeln('Found! Student ', copy(student[n], 1, 6) , ' called ',
copy(student[n], 9, 29), ' and studies in ', studsch[n], ' gets ', stud_score[n], '
marks');
              found:=true;
              end;
        end;
        for n := 1 to sch_count do
        begin If copy(school[n], 1, 6) = search_no then
                  begin
                  search_name := copy(school[n], 9, 109);
                  writeln('Found! School ', copy(school[n], 1, 6) , ' called ',
copy(school[n], 9, 109), ' gets ', sch_mark[n], ' which have ', studper_sch[n], '
students participated ');
                  found:=true;
                  end;
        end;
        If not found then writeln('Sorry. ', search_no, ' could not be found. ');
       writeln;
       writeln('"0" may occurred If you don"t calculate the schools" marks first,
otherwise, there is no any participants in that school ');
            write('Search again? <yes / no > ');
       readln(again);
            If (again <> 'yes') and (again <> 'no')   and (again = 'NO') and (again =
'N') and (again ='YES') and (again ='Y')then
            repeat
      writeln('Wrongly inputted !');
      writeln('The option is only < yes / no > ');
      write('Search again? <yes / no >');
      readln(again);
            until (again = 'yes') or (again = 'no') OR (again = 'NO')OR (again = 'N') OR
```

```
(again ='YES') OR (again ='Y');

        until (again = 'no')    or (again = 'NO') or (again = 'N');
        writeln('Press <Enter> to continue');
        readln;
end;

procedure show_detail;
var
        h : integer;
   save : string;
   result_name : string;
   result_file : text;
    stud_mode : array[0..maxnoques] of integer;
    n, m ,i, curr_score : integer;
    full : boolean;
begin
        run[7]:=true; full:=false;
        writeln;
        writeln('<< Inter-School Mathematics Competition Results >>');
        writeln('Here are the details of the competitions');
        writeln('-------------------------------------------------');
        writeln('1, The number of participants ', stud_count);
        writeln('2, The number of participated school ', sch_count);
        writeln('3, The number of questions in the MC ', maxnoques);
        writeln('4, Planned number of prize = 5 ');
        writeln('-------------------------------------------------');
        curr_score := stud_score[1];
        i := 0;
        write('1, ',   studno[i], '    , ');
        repeat
          i := i + 1;
          if stud_score[i] = curr_score then
              write(studno[i]:5)
        until stud_score[i] <> curr_score;
        write('is the Champion who gets', curr_score, ' marks ');
        writeln;

        curr_score := stud_score[i];

        if not full then     begin
        If i >= 5   then full:= true;
        repeat           begin
         if stud_score[i] = curr_score then
              write(studno[i]:5, '    , ');
          i := i + 1;                                  end
        until stud_score[i] <> curr_score;
        write('is the 1st runner-up who gets', curr_score, ' marks ');
        writeln;           end;

              curr_score := stud_score[i];
```

```
            if not full then     begin
        If i >= 5   then full:= true;
          repeat
            begin
            if stud_score[i] = curr_score then
                write(studno[i]:5, '    , ');
                i := i + 1;             end
           until stud_score[i] <> curr_score;
        write('is the 2nd runner-up who gets', curr_score, ' marks ');
        writeln;     end;

            curr_score := stud_score[i];

          if not full then     begin
        If i >= 5   then full:= true;
        repeat
            begin
          if stud_score[i] = curr_score then
              write(studno[i]:5, '    , ');
                i := i + 1;             end;
        until stud_score[i] <> curr_score;
        write('is the forth place who gets', curr_score, ' marks ');
        writeln;        end;

            curr_score := stud_score[i];

          if not full then     begin
        If i >= 5   then full:= true;
        repeat
          begin
          if stud_score[i] = curr_score then
              write(studno[i]:5, '    , ');
              i := i + 1;                       end;
        until stud_score[i] <> curr_score;
        write('is the fifth place gets', curr_score, ' marks ');
        writeln;     end;


        writeln;

        write('Need save ? <yes / no > ');
       readln(save);
          If (save <> 'yes') and (save <> 'no')    and (save <> 'NO') and (save <> 'N')
and (save <>'YES') and (SAVE <>'Y')then
            repeat
       writeln('Wrongly inputted !');
       writeln('The option is only < yes / no > ');
       write('Need save ? <yes / no >');
       readln(save);
            until (save = 'yes') or (save = 'no') OR (save = 'NO')OR (save = 'N') OR
(save ='YES') OR (SAVE ='Y');
       If (save = 'yes') OR (save ='YES') OR (SAVE ='Y')then
```

```
   begin
   write('Input the file name of the result ( include <.txt> ) :');
   readln(result_name);
   assign(result_file, result_name);
   rewrite(result_file);
full:=false;
    writeln(result_file);
    writeln(result_file, '<< Inter-School Mathematics Competition Results >>');
    writeln(result_file, 'Here are the details of the competitions');
    writeln(result_file, '-----------------------------------------------');
    writeln(result_file, '1, The number of participants ', stud_count);
    writeln(result_file, '2, The number of participated school ', sch_count);
    writeln(result_file, '3, The number of questions in the MC ', maxnoques);
    writeln(result_file, '4, Planned number of prize = 5 ');
    writeln(result_file, '-----------------------------------------------');
    curr_score := stud_score[1];
    i := 0;
    write(result_file, '1, ',   studno[i], '   , ');
    repeat
      i := i + 1;
      if stud_score[i] = curr_score then
          write(result_file, studno[i]:5)
    until stud_score[i] <> curr_score;
    write(result_file, 'is the Champion who gets', curr_score, ' marks ');
    writeln(result_file);

    curr_score := stud_score[i];

    if not full then     begin
    If i >= 5   then full:= true;
    repeat           begin
     if stud_score[i] = curr_score then
          write(result_file, studno[i]:5, '   , ');
      i := i + 1;                                end
    until stud_score[i] <> curr_score;
    write(result_file, 'is the 1st runner-up who gets', curr_score, ' marks ');
    writeln(result_file);           end;

          curr_score := stud_score[i];

          if not full then     begin
    If i >= 5   then full:= true;
      repeat
         begin
         if stud_score[i] = curr_score then
             write(result_file, studno[i]:5, '   , ');
             i := i + 1;             end
       until stud_score[i] <> curr_score;
    write(result_file, 'is the 2nd runner-up who gets', curr_score, ' marks ');
    writeln(result_file);     end;

          curr_score := stud_score[i];
```

```
   if not full then     begin
  If i >= 5   then full:= true;
  repeat
       begin
   if stud_score[i] = curr_score then
       write(result_file, studno[i]:5, '    , ');
         i := i + 1;            end;
  until stud_score[i] <> curr_score;
  write(result_file, 'is the forth place who gets', curr_score, ' marks ');
  writeln(result_file);        end;

       curr_score := stud_score[i];

   if not full then     begin
  If i >= 5   then full:= true;
  repeat
   begin
   if stud_score[i] = curr_score then
       write(result_file, studno[i]:5, '    , ');
       i := i + 1;                    end;
  until stud_score[i] <> curr_score;
  write(result_file, 'is the fifth place gets', curr_score, ' marks ');
  writeln(result_file);     end;


  writeln(result_file);
  writeln('The result is successfully saved ! ');
 { repeat
  for n := 1 to maxnoques do
     stud_mode[stud_score[n]]:= stud_mode[stud_score[n]]+1;

  for n := 1 to stud_mode[stud_score[1]]   do        begin
    writeln('The Champion is ', student[1], ' who gets ', stud_score[1]);
    m:=m+1;         end;                  If m >5 then     full:=true;
  for n := 1 to stud_mode[stud_score[2]] do begin
    writeln('The First runner up is ', student[m+n], ' who gets ',
stud_score[m+n]);
    m:=m+1;         end;                  If m >5 then     full:=true;
  for n := 1 to stud_mode[stud_score[3]] do begin
    writeln('The Second runner up is ', student[m+n], ' who gets ',
stud_score[m+n]);
    m:=m+1;         end;                  If m >5 then     full:=true;
  for n := 1 to stud_mode[stud_score[4]] do   begin
    writeln('The Forth place is ', student[m+n], ' who gets ', stud_score[m+n]);
    m:=m+1;         end;                  If m >5 then     full:=true;
  for n := 1 to stud_mode[stud_score[5]]   do begin
    writeln('The Fifth place is ', student[m+n], ' who gets ', stud_score[m+n]);
    m:=m+1;         end;                  If m >5 then     full:=true;

  until full;     }
```

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

procedure compare;
var
    m, n :integer;
    comp_no : array[1..maxstudno] of string;
    comp_score : array[1..maxstudno] of integer;
    h : integer;
  save : string;
  result_name : string;
  result_file : text;
begin
       clrscr;
       run[8]:=true;
       writeln('ALL PARTICIPANTS USE THE CODE"Sch000" ARE TAKE PART
INDIVIDUALLY');
       writeln('The result in individual part ');
       writeln('--------------------------------------------------------------------------------');
       n:=0;
       for m := 1 to stud_count do
          If studsch[m]='sch000' then        begin     n:=n+1;
        comp_no[n]:=studno[m]; comp_score[n]:=stud_score[m];       end;
       writeln('The Champian in individual part is ', comp_no[1] , ' who gets ',
comp_score[1]);
       writeln('The first runner-up in individual part is ' , comp_no[2] , ' who gets ' ,
comp_score[2]);
       writeln('The second runner-up in individual part is ' , comp_no[3] , ' who gets ' ,
comp_score[3]);
       writeln('The forth place in individual part is ' , comp_no[4] , ' who gets ' ,
comp_score[4]);
       writeln('The fifth place in individual part is ' , comp_no[5] , ' who gets ' ,
comp_score[5]);
       writeln('--------------------------------------------------------------------------------');
       writeln;
       readln;
       for n:=1 to stud_count do   begin
       comp_no[n]:='0';   comp_score[n]:=0; end;
       m:=0;
       writeln('The others are representing to their school ');
       writeln('The result in school part ');
       writeln('--------------------------------------------------------------------------------');
        for n := 1 to stud_count do
          If studsch[n]<> 'sch000' then     begin   m:=m+1;
       comp_no[m]:=studno[n]; comp_score[m]:=stud_score[n];   end;
       writeln('The Champian in school part is ', comp_no[1] , ' who gets ',
comp_score[1]);
       writeln('The first runner-up in school part is ' , comp_no[2] , ' who gets ' ,
comp_score[2]);
       writeln('The second runner-up in school part is ' , comp_no[3] , ' who gets ' ,
```

```
comp_score[3]);
        writeln('The forth place in school part is ' , comp_no[4] , ' who gets ' ,
comp_score[4]);
        writeln('The fifth place in school part is ' , comp_no[5] , ' who gets ' ,
comp_score[5]);
        writeln('--------------------------------------------------------------------------------');
        writeln;
        readln;


              write('Need save ? <yes / no > ');
      readln(save);
         If (save <> 'yes') and (save <> 'no')    and (save <> 'NO') and (save <> 'N')
and (save <>'YES') and (SAVE <>'Y')then
              repeat
      writeln('Wrongly inputted !');
      writeln('The option is only < yes / no > ');
      write('Need save ? <yes / no >');
      readln(save);
              until (save = 'yes') or (save = 'no') OR (save = 'NO')OR (save = 'N') OR
(save ='YES') OR (SAVE ='Y');
      If (save = 'yes') OR (save ='YES') OR (SAVE ='Y')then
      begin
      write('Input the file name of the result ( include <.txt> ) :');
      readln(result_name);
      assign(result_file, result_name);
      rewrite(result_file);
        writeln(result_file);
        writeln(result_file, 'ALL PARTICIPANTS USE THE CODE"Sch000" ARE TAKE
PART INDIVIDUALLY');
        writeln(result_file, 'The result in individual part ');
        writeln(result_file,
'--------------------------------------------------------------------------------');
        n:=0;
        for m := 1 to stud_count do
           If studsch[m]='sch000' then    begin     n:=n+1;
           comp_no[n]:=studno[m]; comp_score[n]:=stud_score[m];    end;
        writeln(result_file, 'The Champian in individual part is ', comp_no[1] , ' who
gets ', comp_score[1]);
        writeln(result_file, 'The first runner-up in individual part is ' , comp_no[2] , '
who gets ' , comp_score[2]);
        writeln(result_file, 'The second runner-up in individual part is ' , comp_no[3] , '
who gets ' , comp_score[3]);
        writeln(result_file, 'The forth place in individual part is ' , comp_no[4] , ' who
gets ' , comp_score[4]);
        writeln(result_file, 'The fifth place in individual part is ' , comp_no[5] , ' who
gets ' , comp_score[5]);
        writeln(result_file,
'--------------------------------------------------------------------------------');
        writeln(result_file);

        writeln(result_file, 'The others are representing to their school ');
```

```
        writeln(result_file, 'The result in school part ');
        writeln(result_file,
'--------------------------------------------------------------------------------');
        for n:=1 to stud_count do   begin
        comp_no[n]:='0';   comp_score[n]:=0; end;
        m:=0;
        writeln(result_file, 'The others are representing to their school ');
        writeln(result_file, 'The result in school part ');
        writeln(result_file,
'--------------------------------------------------------------------------------');
         for n := 1 to stud_count do
           If studsch[n]<> 'sch000' then     begin    m:=m+1;
        comp_no[m]:=studno[n]; comp_score[m]:=stud_score[n];    end;
        writeln(result_file, 'The Champian in school part is ', comp_no[1] , ' who gets ',
comp_score[1]);
        writeln(result_file, 'The first runner-up in school part is ' , comp_no[2] , ' who
gets ' , comp_score[2]);
        writeln(result_file, 'The second runner-up in school part is ' , comp_no[3] , '
who gets ' , comp_score[3]);
        writeln(result_file, 'The forth place in school part is ' , comp_no[4] , ' who gets
' , comp_score[4]);
        writeln(result_file, 'The fifth place in school part is ' , comp_no[5] , ' who gets ' ,
comp_score[5]);
        writeln(result_file,
'--------------------------------------------------------------------------------');
        writeln(result_file);

        close(result_file);
        writeln;
        writeln('The result is successfully saved ! ');
        end;
        writeln('Press <Enter> to continue');
        readln;
end;

procedure show_datafile;
var
    choi : integer;
    found : boolean;
begin
textcolor(14);
repeat
repeat
clrscr;
writeln('The information of the students and school names ');
writeln('1, The name & no of the students ');
writeln('2, The school names & no in the program ');
writeln('3, The number of students in each school ');
writeln(' Run the top[n] procedure before run   4, ');
writeln('4, The name & school of the top students ');
writeln('**************************************************');
writeln('          Run 1 & 2 to read the data before search          ');
```

```
writeln('5, Search the name of school & the student in numbers');
writeln('6, Search the name of school & the student in letters');
writeln('7, Back to main program ');
write('The choice : <type number only > ');
readln(choi);
                If (choi=5) or (choi=6) then if (run[10]=false) or (run[11]=false)
then begin found:=false; writeln('Read 1 & 2 to read the data before search'); readln;
end
                else found:=true
      until found=true;
    case choi of
      1 : read_student;
      2 : read_school;
      3 : no_stud_sch;
      4 : name_top;
      5 : search;
      6 : search_name;
    end;
until choi =7;
writeln;
run[5]:=true;
end;

procedure sort_main;
var
    choice : integer;
begin
textcolor(24);
    repeat;
    clrscr;
    writeln('The sorted results ');
    writeln('-------------------');
    writeln;
    writeln('1, Sort the results of the participants in descending order ');
    writeln('2, Sort the no. of correctly answered questions in descending order ');
    writeln('3, Show the range of the participants'' results in descending order ');
    writeln('4, Show the no. of correctly answered questions in descending order ');
    writeln('5, No. of students are ranged from all of the participants ');
    writeln('6, Back o the main program ');
    write('The option : <type number only > ');
    readln(choice);
    case choice of
        1 : sort_desend;
        2 : sort_ques;
        3 : show_ques;
        4 : show_sort_desend;
        5 : top_five;
    end;
    until choice = 6 ;
    writeln;
    run[6]:=true;
end;
```

```
procedure show_main_result;
var
    option : integer;
begin
textcolor(10);
    repeat
    clrscr;
    writeln;
    writeln('Showing of the results of the competition ');
    writeln('-------------------------------------------------');
    writeln;
    writeln(' 1, Show the score of the students ');
    writeln(' 2, Show the correctly answerd in each question ');
    writeln(' 3, Show the score of the students in graph ');
    writeln(' 4, Show the correctly answerd in each question in graph ');
    writeln(' 5, Calculate and show school mark and average ');
    writeln(' 6, Show the score of schools in graph ');
    writeln(' 7, Calculate and show the mean of the mark of the participants ');
    writeln(' 8, Calculate and show the median of the mark of the participants ');
    writeln(' 9, Calculate and show the mode of the mark of the participants ');
    writeln('10, Calculate and show the standard deviation of the mark of the
participants ');
    writeln('11, Calculate the 1st, 2nd and 3rd quartile of the students ');
    writeln('12, Back to main program ');
    write('The option : <type number only >');
    readln(option);
         If (option =11) then If run[6]=false then begin option :=0; writeln('PLease
sort the results before calculate quartile '); readln; end;
         If (option =6) then If run[12]=false then begin option :=0; writeln('Calculate
the school mark and average before show the graph '); readln; end;
         If (option =5) then If (run[11]=false) or (run[10]=false) then begin
option :=0; writeln('Plaase read the school and student data first '); readln; end;
    case option of
        1 : show_result;
        2 : show_corrques;
        3 : show_in_graph;
        4 : show_no_graph;
        5 : cal_schmark;
        6 : show_sch_graph;
        7 : cal_mean;
        8 : cal_median;
        9 : cal_mode;
        10 : cal_sd;
        11 : cal_quartile;
    end;
    until option = 12;
    writeln;
    run[4]:=true;
end;

begin
```

```
textbackground(9);
textcolor(15);
clrscr;
delay(50);   writeln('
MMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM
MMMMMMMMMMMMMMMMMMMMM');
delay(50);   writeln('    MMMMMMMMMM
MMMMMMMMMM');
delay(50);   writeln('    MMMMMM
MMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM
MMMMMM');
delay(50);   writeln('    MMMMMM    MMMMMMMM   MMMMMMMMMMMM
MMMMMM         MMMMMMM    MMMMMM');
delay(50);   writeln('    MMMMMM    MMMMMMMM   MMMMMMMMMMMM
MMMMM    MMMMM    MMMMMM    MMMMMM');
delay(50);   writeln('    MMMMMM    MMMMMMMM     MMMMMM
MMMMM    MMMMMMMMMMMMMMMM    MMMMMM');
delay(50);   writeln('    MMMMMM    MMMMMMMM   MM   MM   MM
MMMMM    MMMMMMMMMMMMMMMM    MMMMMM');
delay(50);   writeln('    MMMMMM    MMMMMMMM   MMMM   MMMM
MMMMM    MMMMMMMMMMMMMMMM    MMMMMM');
delay(50);   writeln('    MMMMMM    MMMMMMMM   MMMM   MMMM
MMMMM    MMMMMMMMMMMMMMMM    MMMMMM');
delay(50);   writeln('    MMMMMM    MMMMMMMM   MMMMMMMMMM
MMMMMM    MMMM    MMMMMM    MMMMMM');
delay(50);   writeln('    MMMMMM    MMMMMMMM   MMMMMMMMMM
MMMMMMM         MMMMMMM    MMMMMM');
delay(50);   writeln('    MMMMMM
MMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM
MMMMMM');
delay(50);   writeln('    MMMMMMMMMM
MMMMMMMMMM');
delay(500);
delay(50);
WRITELN('AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAAAA');
delay(50);   WRITELN('AAAA    AAAAA  AAAA  AAAAA    AAAAA  AAAAA
AAAA  AAAA     AAAAA  AAAA     AAA');
delay(50);   WRITELN('AA   AA   AAA  AAAA  AAA   AA   AAA  AAAAA
AAAA  AAA  AAA  AAAA  AAA  AAA  AA');
delay(50);   WRITELN('AA  AAAA  AAA   AAA  AAA  AAAA  AAA  AAAAA
AAAA  AAA  AAAAAAAAA  AAA  AAAAAAA');
delay(50);   WRITELN('AA  AAAA  AAA     A  AAA  AAAA  AAA  AAAAAA  AA
AAAAAA    AAAAA  AAAA   AAAAA');
delay(50);   WRITELN('AA        AAA  A     AAA         AAA  AAAAAAA
AAAAAAAAA   AAAA  AAAAAAA   AA');
delay(50);   WRITELN('AA  AAAA  AAA  AA    AAA  AAAA  AAA  AAAAAAAA
AAAAAAAAAAAAA AAA  AAAAAAAAA  A');
delay(50);   WRITELN('AA  AAAA  AAA  AAA   AAA  AAAA  AAA  AAAAAAAA
AAAAAA  AAAA  AAA  AAA  AAA   A');
delay(50);   WRITELN('AA  AAAA  AAA  AAAA  AAA  AAAA  AAA     AAAA
AAAAAAA      AAAA  AAAA     AAA');
```

```
delay(50);
WRITELN('AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAAAAAAAAAAAAAAAAA');
delay(50);     WRITELN;
    WRITE('This is the front page of the MC anaylsis. ');
    readln;
    for a := 1 to 12 do
    run[a] := false;
textbackground(16);
    repeat
    repeat
    clrscr;

WRITELN('OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO');
    WRITELN('OO   OOOOO   OOOO          OOOO   OOOOOOOOOO
OOOOOO      OOOOO OOOOOOO OOO          OO');
    WRITELN('OO   OOOOO   OOOO   OOOOOOOOO   OOOOOOOOO   OOO
OOOO   OO   OOOO   OOOOO   OOO   OOOOOOO');
    WRITELN('OO   OO OO   OOOO   OOOOOOOOO   OOOOOOOO   OOOOOOOOO
OOOO   OOO    OOO    OOO   OOOOOOO');
    WRITELN('OO   OO OO   OOOO          OOOO   OOOOOOOO   OOOOOOOOO
OOOO   OOO   O O O   OOO        OOO');
    WRITELN('OO   OO OO   OOOO   OOOOOOOOO   OOOOOOOO   OOOOOOOOO
OOOO   OOO   OO OO   OOO   OOOOOOO');
    WRITELN('OOO    O    OOOOO   OOOOOOOOO   OOOOOOOO   OOOOOOOOO
OOOO   OOO   OO OO   OOO   OOOOOOO');
    WRITELN('OOO   OOO   OOOOO   OOOOOOOOO   OOOOOOOOO   OOO
OOOO   OO   OOOO   OOOOO   OOO   OOOOOOO');
    WRITELN('OOO   OOO   OOOOO          OOOO          OOOOO       OOOOOO
OOOOO   OOOOO   OOO          OO');

WRITELN('OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO
OOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO');
textcolor(15);
    WRITELN('---------------------------------------------------------------------------');
    WRITELN('MC analysis in a mathematics competition,
by SoKaWai ');
    writeln('-------------------------------------------------------------------------');
textcolor(11);
    writeln('CIT project main program
menu');
    writeln('-------------------------------------------------------------------------');
    writeln('1, Add the answer key ');
    writeln('2, Add the participants'' answers ');
    writeln('3, Calcualte participants'' scores and correct numbers in each questions');
    writeln('4, Show and save the results ');
    writeln('5, Sort in the score of the participants ');
    writeln('6, show and search for the schools''s names & students'' names');
    WRITELN('7, Show the details of the competition and the overall results (Better
run after run all other prcedures)');
    writeln('8, The result in individual and school part ');
```

```
    writeln('9, End of program ');
    writeln;
    writeln('******ALL PARTICIPANTS USE THE CODE''Sch000'' ARE TAKE PART
INDIVIDUALLY*********');
    write('The option: ');
textcolor(15);
    readln(no);
    check := true;
     If (no <> 1) and (no <> 2) and (no <> 9) then
      begin
         check := false;
          if run[1]=false then
              begin writeln('Run option 1 first to read the answer key');
              readln; end else

              if run[2]=false then
                 begin writeln('Run option 2 first to read the participants'' answer ');
                  readln; end
              else
                 check := true end;
         If (no = 4 ) or (no = 5) or (no = 7 ) or (no = 8 )then
            begin check:= false;
             if (run[3] = false) then
                  begin    writeln('Calculate the scores before show the scores ');
readln;
                   end else
                  check := true;    end;
          If   (no = 5 ) then if (run[3] = false) then
               begin check := false; writeln('Calculate the scores before sort the
results');    readln; end
                      else check := true;
               If   (no = 7 ) or (no = 8 ) then if (run[6] = false) then
                    begin check := false; writeln('Sort the scores before show the
results');    readln; end
        else check := true;
               If ( no <> 1 ) and    ( no <> 2 ) and ( no <> 3 ) and ( no <> 4 ) and ( no
<> 5 ) and ( no <> 6 ) and ( no <> 7 ) and ( no <> 8 ) and ( no <> 9 ) then begin
               check:= false; writeln('wrongly inputted!'); readln; end;
       until check;
      case no of
         1 : readans;
         2 : readstudans;
         3 : cal_stud_mark;
         4 : show_main_result;
         5 : sort_main;
         6 : show_datafile;
         7 : show_detail;
         8 : compare;
      end;
      until no = 9;
      writeln('Thanks for using this program ');
      READLN;
```

```
end.
```

Appendix 2 - Working schedule

Date	Event
10/1/09	Create the ch.1 in the report.
17/1/09	Create the ch.2 and some of ch3 in the report.
24/1/09	Finish ch1-3 and start making program.
25/1/09	The program can be used to read answer and mcdata.
28/1/09	The program can be used to calculate the marks for participants and questions.
29/1/09	The marks can be shown and sorting is done.
1/2/09	Searching function is created.
3/2/09	The save function can be used. (Result of participants and school)
4/2/09	Mean, median, mode, standard deviation is done.
5/2/09	The graph function and quartile is finished
6/2/09	Background colour, delay function and the frontpage logo is created.
7/2/09	Clean the error in the above functions
8/2/09	Calculate the championships and save function of the result.
9/2/09	Calculate the championships in individual part and school part, and save function of the result.
10-13/2/09	Debug
11/2/09	Do the chapter 4 until 4.3
12/2/09	Finish chapter 4
13/2/09	Do the first 3 testing and write it down
14/2/09	Finish the whole report and confirm the program