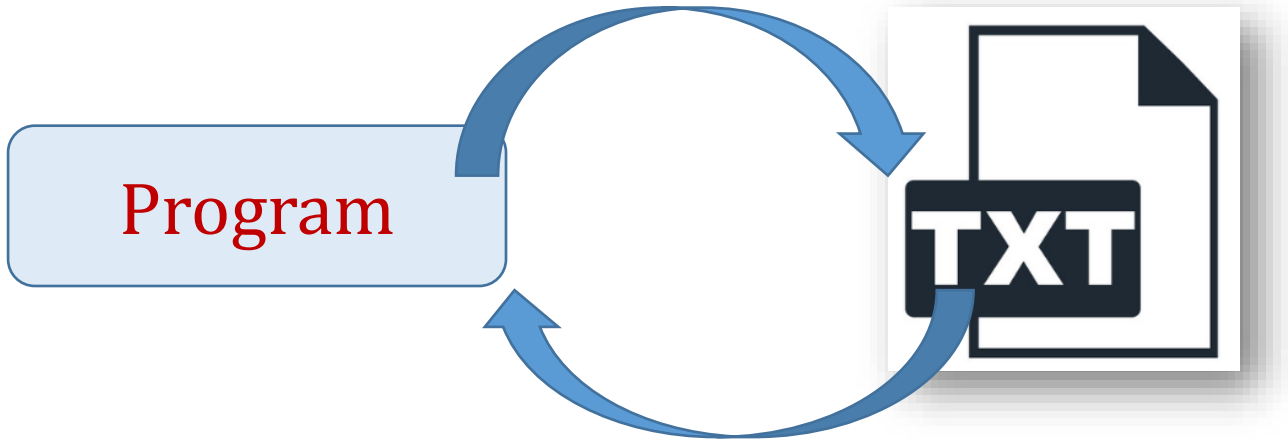
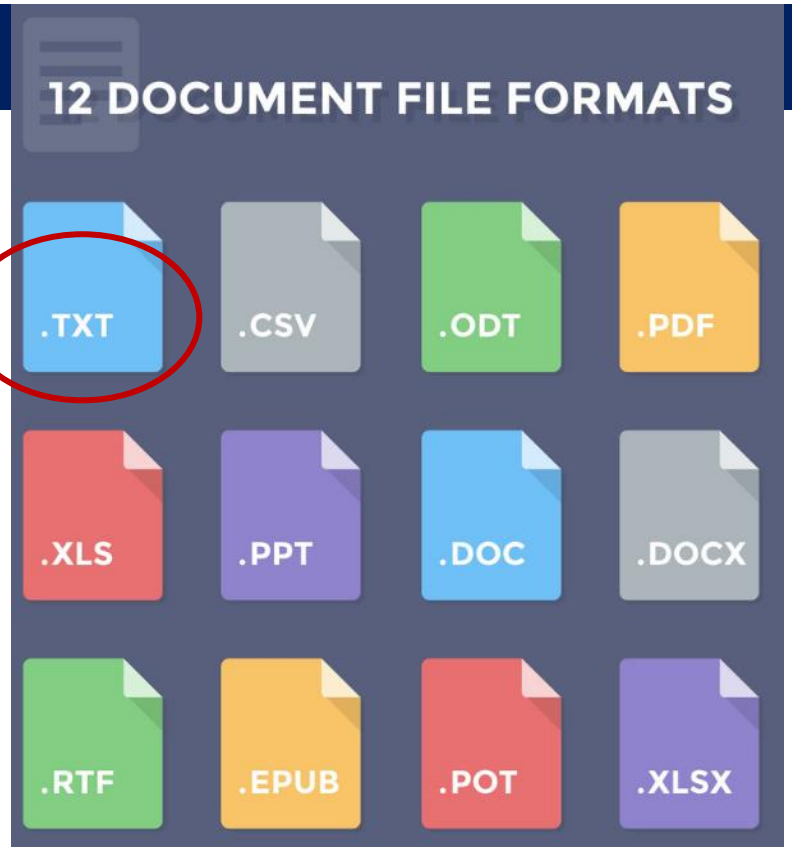
Advaced algorithm

File IO (Input/Output) in C++



Outline

- What is File IO? File extensions?
- File Operations
  - Read data from file
  - Write data to file
- Examples

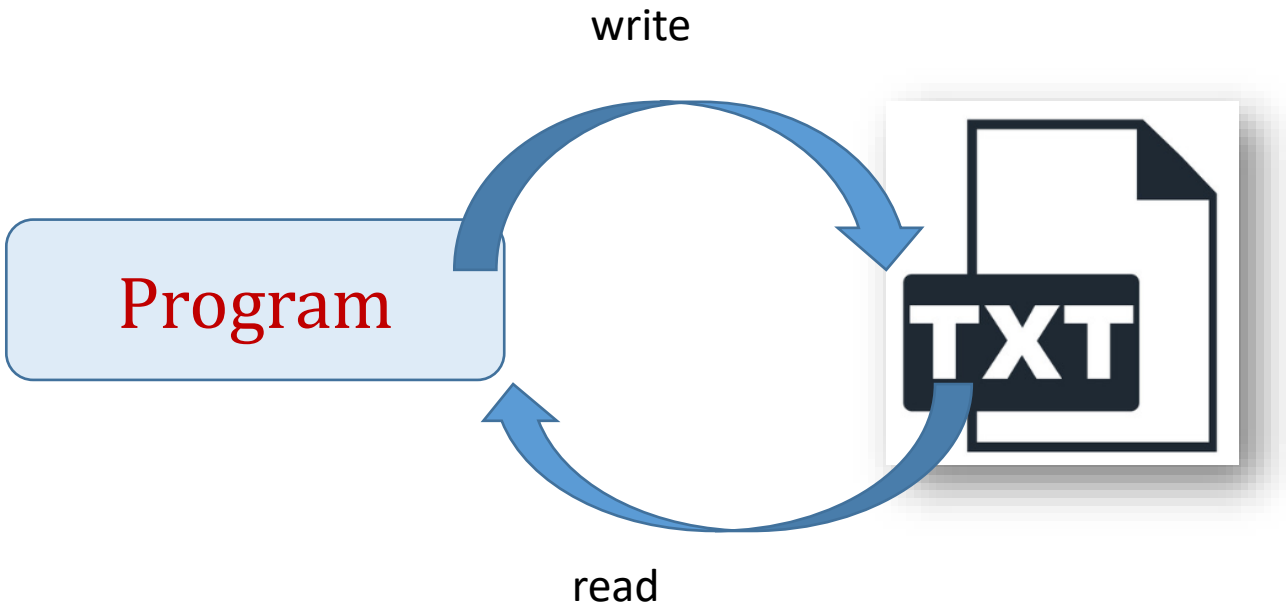


"File IO refers to the transfer of data either to or from a ***storage medium.***"

File IO

❑ What?

- "File IO refers to the transfer of data either to or from a ***storage medium.***"

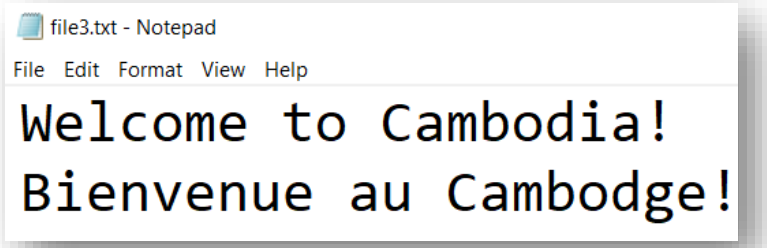


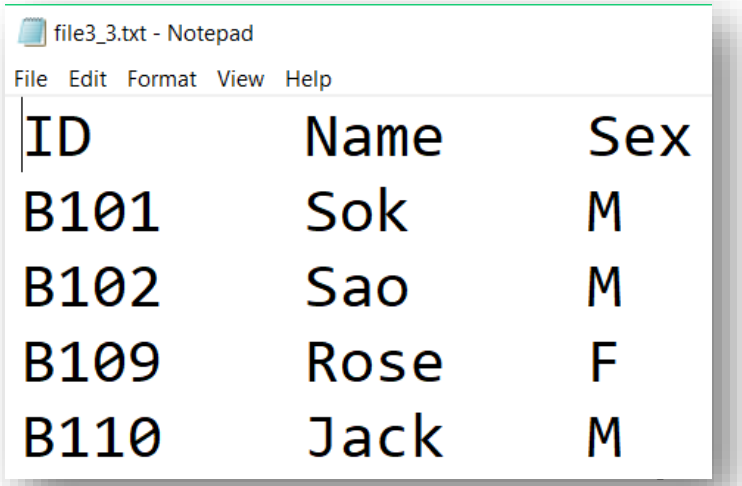
File IO

❑ What?

- **iostream** library provides *cin* and *cout* methods for reading from keyboard and writing/displaying on screen
- **fstream** library is used for writing and reading file
  - ofstream : only for wring data to file
  - ifstream : only for reading data from file
  - fstream : can write/read data to/from file

```
#include <iostream>
#include <fstream>
```





File IO

❑ Opening a file

- To write file, we have to open a file first with **open** function.
  - We can use either ofstream or fstream

open(filename)

open(filename, mode)

Mode	Description
ios::app	Append mode. Data is added more
ios::in	Open file for reading.
ios::out	Open file for writing. If file does not exist, create a new file. If file exists, content is overridden

ofstream file
file.open("filename.dat")

fstream file
file.open("filename.dat", **ios::out**)

fstream file
file.open("filename.dat", **ios::app**)

File IO

❑ Closing a file

- We should close file before terminate the program `file.close( );`

Open a file with appropriate mode

Add login to process file

Close file when done

```
fstream file;
file.open("filename.dat", ios::out)

.....
//read/write code here
.....

file.close( );
```

An overall template

File IO

❑ Writing data to a file

- We can use **ofstream** or **fstream** for creating file variable
- Then use << to write data
  - file<<data1<<data2<<endl;

```
ofstream   file;
file.open("MyFile.dat");
```

```
fstream file;
file.open("MyFile.data", ios::out);
```

```
fstream file;
string filename="MyFile.dat";

//file.open(filename, ios::out); //error
file.open(filename.c_str( ),  ios::out);
```

Pass string as filename to function

Functions for write data to file

Function	Description
file<<word;	Write one data in word to file
file<<text1<<"\t"<<**text2**<<"\n";	Write two data (word1 and word2) separated by a tab to file

Remark: You can write data to file just similar way you display data using *cout*

Writing data to a file

```
#include <fstream>
#include <iostream>
using namespace std;

int main () {
  string data;
  // open a file in write mode.
  ofstream file;
  file.open("filename.txt");
  //file.open(“filename.txt", ios::app); //append

  cout<<"Writing data to the file"<< endl;
  cout<<"Enter your name: ";
  cin>>data;
  file<<data<<endl;

  cout<<"Enter your age: ";
  cin>>data;
  file<<data<<endl;

  file.close();
}
```

Using **ofstream**

```
#include <fstream>
#include <iostream>
using namespace std;

int main () {
  string data;  //char data[100];
  // open a file in write mode.
  fstream file;
  file.open("filename.txt", ios::out);
  //file.open("filename.txt", ios::app); //append

  cout<<"Writing data to the file"<< endl;
  cout<<"Enter your name: ";
  ciin>>data;
  file<<data<<endl;

  cout<<"Enter your age: ";
  cin>>data;
  file<<data<<endl;

  file.close();
}
```

Using **fstream** with **ios::out mode**

A program to store number from 100 to 1 in a file data.txt

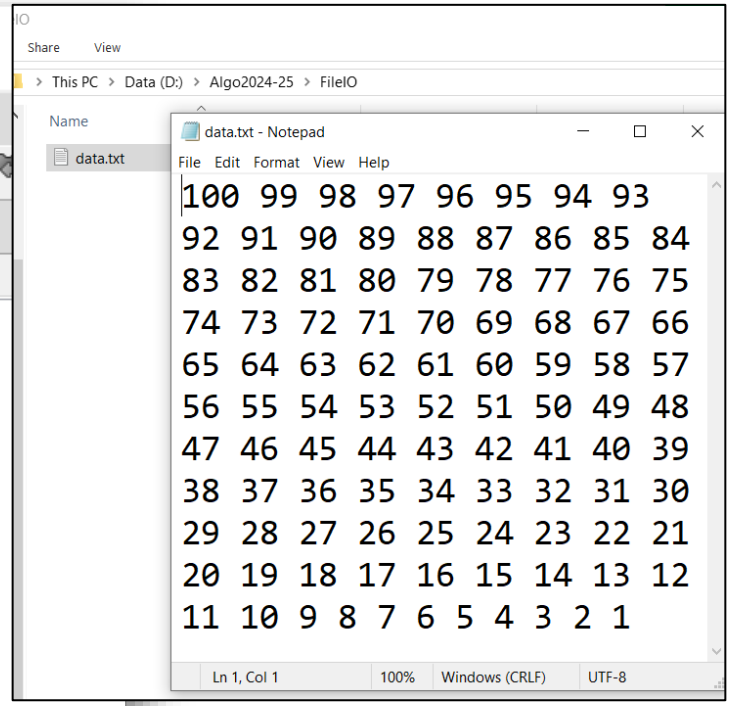
Test2.cpp - Code::Blocks 20.03

File Edit View Search Project Build Debug Fortran wxSmith Tools Tools+ Plugins DoxyBlocks Settings Help

Test2.cpp

```
1  #include<iostream>
2  #include<fstream>
3
4  using namespace std;
5
6  main(){
7      fstream file;
8
9      //file.open("D:/Algo2024-25/FileIO/data.txt", ios::out);
10     file.open("FileIO/data.txt", ios::out);
11
12     for(int k=100; k>0; k--){
13         file<<k<<" ";
14     }
15
16     file.close();
17 }
```

Write k to file using <<



File IO

❑ Reading from a file

- We can use ifstream or fstream for creating file variable
- Then use >> to read data

```
ifstream file;
file.open("filename.dat");
```

```
fstream file;
file.open("filename.dat", ios::in);
```

Functions for reading data from file

Mode	Description
file>>word	Read data from file one word at a time
file.eof( )	Return true when reach **end of file** (data has been read till the end). Otherwise, return false
file.get(ch)	Read data from file one character at a time.
getline(file, line)	Read data from file one line at a time. Return false when no data to read

Reading from a file: One word at a time

```
#include <fstream>
#include <iostream>
using namespace std;

int main () {
  string data;

  // open a file in read mode.
  ifstream file;
 file.open("filename.txt");

  if(!file){
      cout<<"Error opening file OR file does not exist"<<endl;
  }else{
     cout << "Reading from the file" << endl;
     file >> data;
     cout << data << endl;
     file >> data;
     cout << data << endl;

     file.close();
   }
}
```

```
#include <fstream>
#include <iostream>
using namespace std;

int main () {
  string data;

  // open a file in read mode.
  fstream file;
  file.open("filename.txt", ios::in);

  if(!file){
      cout<<"Error opening file OR file does not
exist"<<endl;
  }else{
     cout << "Reading from the file" << endl;
     file >> data;
     cout << data << endl;
     file >> data;
     cout << data << endl;

     file.close();
   }
}
```

File IO

❑ Examples

- Read and write data from/to file

```
1  #include <fstream>
2  #include <iostream>
3  using namespace std;
4  int main (){
5      char data[100];
6      // open a file in write mode.
7      ofstream outfile;
8      outfile.open("afile.dat");
9      cout << "Writing to the file" << endl;
10     cout << "Enter your name: ";
11     cin.getline(data, 100);
12     // write inputted data into the file.
13     outfile << data << endl;
14     cout << "Enter your age: ";
15     cin >> data;
16     // again write inputted data into the file.
17     outfile << data << endl;
18     // close the opened file.
19     outfile.close();
```

```
21
22     // open a file in read mode.
23     ifstream infile;
24     infile.open("afile.dat");
25     cout << "Reading from the file" << endl;
26     infile >> data;
27     // write the data at the screen.
28     cout << data << endl;
29     // again read the data from the file and
30     infile >> data;
31     cout << data << endl;
32     // close the opened file.
33     infile.close();
34 }
```

```
Writing to the file
Enter your name: Jack Rose
Enter your age: 18
Reading from the file
Jack
Rose
```

Example

Write data to file

```
1   #include<iostream>
2   #include<fstream>
3
4   using namespace std;
5
6   main(){
7
8       fstream f1,f2,f3;
9
10      f1.open("mydata.txt", ios::out);
11
12      //write data to file
13      f1<<"Save data to file";
14      for(int k=1; k<50; k=k+1){
15          f1<<k<<" ";
16      }
17      f1.close();
18
19  }
```

Write data from user input to file

Example

```
#include<iostream>
#include<fstream>

using namespace std;

struct Student{
   string ID;
   string name;
   int age;
};

main(){
    Student st[50]; //create array with 50 size
    // st[0].ID     st[1].ID       st[0].name
    //using dot operator to access data in structure

    for(int k=0; k<=4; k=k+1){
        cout<<"\n\t*** Input data for student "<<k+1<<endl;
        cout<<"Enter your name: "; cin>>st[k].name;
        cout<<"Enter your ID: "; cin>>st[k].ID;
        cout<<"Enter your age: "; cin>>st[k].age;
    }
```

```
    fstream f1;

    f1.open("StudentList.txt", ios::out);

    for(int k=1; k<=5; k=k+1){
        cout<<st[k-1].ID<<" ";
        cout<<st[k-1].name<<" ";
        cout<<st[k-1].age<<"\n";


        f1<<st[k-1].ID<<" ";
        f1<<st[k-1].name<<" ";
        f1<<st[k-1].age<<"\n";
    }

    f1.close();
}
```

Example

```
1   #include<iostream>
2   #include<fstream>
3
4   using namespace std;
5   main(){
6       fstream f1;
7       string ID;
8       string name;
9       int age;
10
11      f1.open("StudentList.txt", ios::in);
12
13      while(!f1.eof()){
14          f1>>ID;
15          f1>>name;
16          f1>>age;
17          cout<<name<<" "<<age<<" "<<ID<<endl;
18      }
19      f1.close();
20  }
```

Read all data from file

Write data from user input to file

```
1   #include<iostream>
2   #include<fstream>
3
4   using namespace std;
5   main(){
6       fstream f1;
7       string ID;
8       string name;
9       int age;
10
11      f1.open("StudentList.txt", ios::in);
12
13      while(!f1.eof()){
14          f1>>ID;
15          f1>>name;
16          f1>>age;
17          cout<<name<<" "<<age<<" "<<ID<<endl;
18      }
19      f1.close();
20  }
```

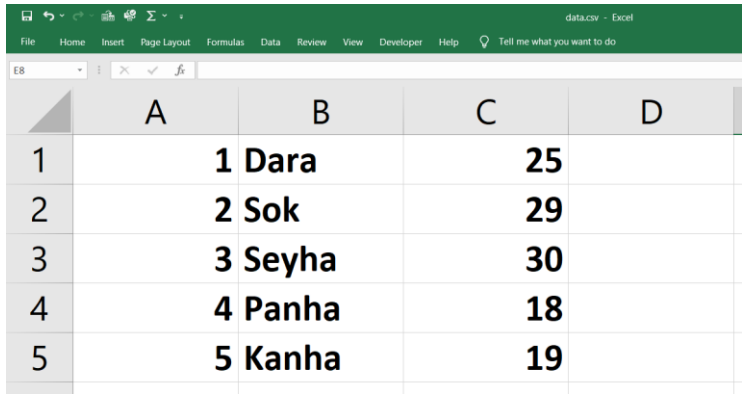
Q & A

Reading data from CSV file

- **A CSV (Comma-Separated Values)** file is a simple text file used to store tabular data, such as a spreadsheet or database, in a plain-text format.
- Each line in a CSV file represents a row of data. In each row, individual fields (or columns) are separated by commas.

```
1,Dara,25
2,Sok,29
3,Seyha,30
4,Panha,18
5,Kanha,19
```

data.txt



data.csv

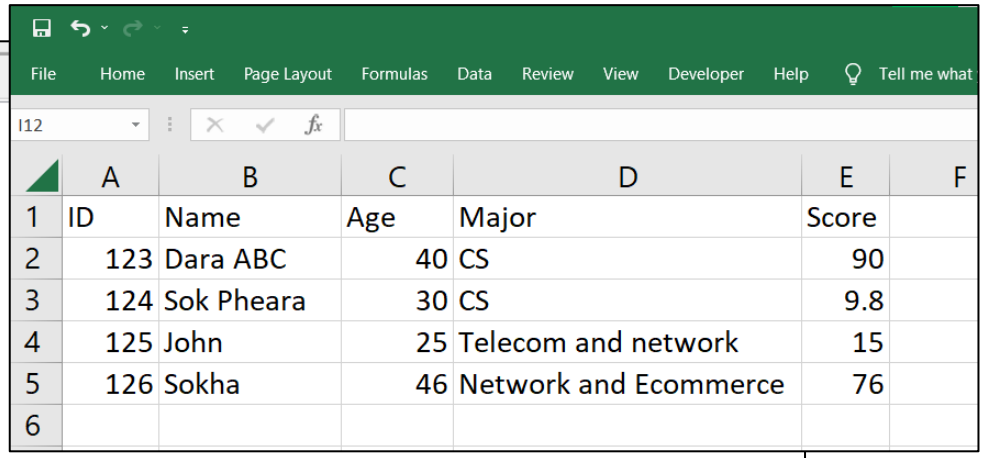
CSV files are widely used because they are easy to create, read, and compatible with a variety of applications, including spreadsheet programs like Microsoft Excel, Google Sheets, and data processing tools.

ReadCSV-G1.cpp

```cpp
#include<iostream>
#include<sstream>
#include<fstream>
using namespace std;

main(){
    string line="ID,Name,Age,Major";
    string word;
    fstream f;

    f.open("Mydata.csv", ios::in);
    while(getline(f, line)){ //read data from file csv line by line
        //cout<<line<<endl;
    }
}
```



File Home Insert Page Layout Formulas Data Review View Developer Help Tell me what

I12

	A	B	C	D	E	F
1	ID	Name	Age	Major	Score	
2	123	Dara ABC	40	CS	90	
3	124	Sok Pheara	30	CS	9.8	
4	125	John	25	Telecom and network	15	
5	126	Sokha	46	Network and Ecommerce	76	
6						

Student.csv

A C++ program to read file CSV data using ***getline*** and ***stringstream***

Assignment lab6

Exercise 1

Design a program that read data from a file called Book List and store in a linked list. The list has 25 books. Each book has ISBN, title, category, authors, price, published year.

Assignment lab6

Exercise 2

Design a program that write data from program into file.

The program ask information of 10 employees from user then store in file. Each employee has name, age, gender, salary, email.

Assignment lab6

Exercise 3

Design a program that manipulate data from one file to another.

Read student data from data.csv. Then write into data_report.csv by adding some computed statistics data including:

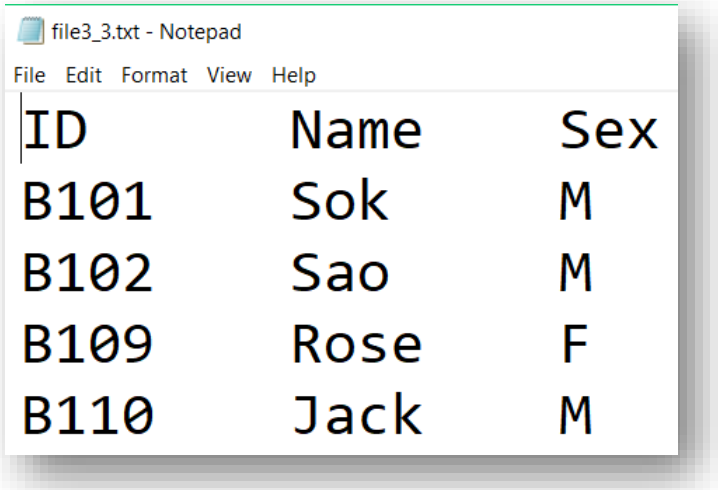
a) How many students in total? How many are males? How many are females?

b) What is the max score? What is the minimum score?

Practice

❑ Exercise

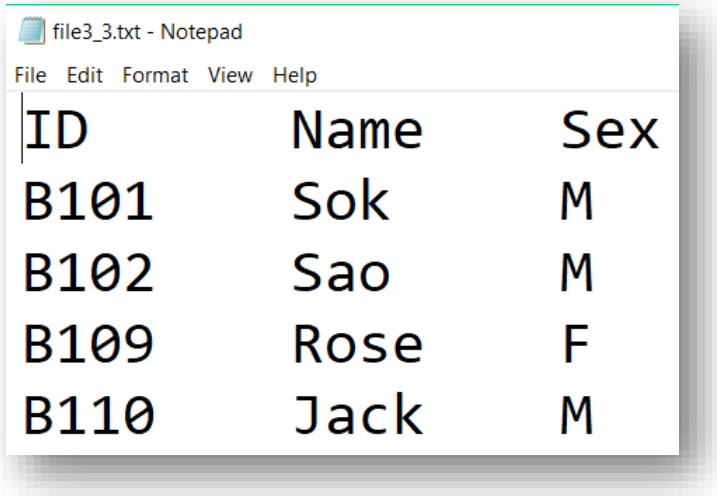
1. Write a program to read data from a file below. Store those data in an array of structure. Then add one more info of a student to that array. Ask a user for that info. Finally store all data in this array to a file having the same name as the previously read file.



Lab - File IO

❑ Exercise

1. Write a program to read data from a file below . Store those data a singly linked list. Then add one more info of a student to that list. Ask a user for that info. Finally store all data in this list to a file having the same name as the previously read file.



Lab

❑ Exercise

2. Write a program to read data from a file below. Store those data a singly linked list. Keep asking a user to check whether he/she wants to add another student. If yes, ask user for information of student and add to list. If no stop asking user then display data in the list and finally store all those data in this list to a file having the same name of the previously read file.