

Data Structure Programming Exercise



Lab #1

Class on 3/13

**Assignment by 3/19
(23:59)**



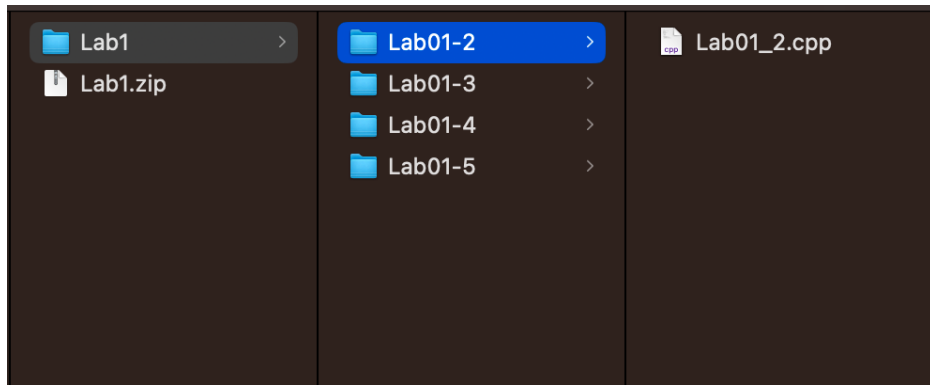
Overview

- Visual Studio for Windows / Xcode for Mac are **highly recommended**.
- Templates (.h/.cpp) for assignments/exams will be provided.
 - Students are expected to submit the **entire folder including sources**.
 - **Do not change** any file/class/method names.
- If you have issues with the provided templates, check the next slide.
- Feel free to ask questions to me via email.



Assignment Guideline (1/5)

1. Download and unzip lab1.zip





Assignment Guideline (2/5)

2. Open Lab1 folder in your IDE (Visual Studio or xCode)
 - Open **Lab01.sln** if you use **Visual Studio**
 - Open **Lab01.xcodeproj** if you use **xCode**

The screenshot shows a Visual Studio editor with a C++ file open. The code includes a header file, a struct definition for StudentRecord, and a main function. The solution explorer on the right shows the project structure, including a Lab01 folder with subfolders Lab01-2, Lab01-3, and Lab01-4, each containing C++ and header files.

```
4 // Lab01
5 // Modified by Jeman Park on 2024/03/12.
6
7
8 #include <iostream>
9 using namespace std;
10
11 struct StudentRecord
12 {
13     char department[20];
14     char name[14];
15     int student_id;
16     float gpa;
17     int totalCredits;
18 };
19
20 int main(int argc, const char * argv[]) {
21     StudentRecord sstudent;
22     StudentRecord sstudents[100];
23 }
```

The screenshot shows a Visual Studio editor with a C++ file open. The code includes a header file, a struct definition for StudentRecord, and a main function. The solution explorer on the left shows the project structure, including a Lab01 folder with subfolders Lab01-2, Lab01-3, and Lab01-4, each containing C++ and header files. The code in the editor is a C++ file for a SquareMatrix class, showing a Subtract method and a Copy method.

```
Lab01 > Lab01-3 > C SquareMatrix > M SquareMatrix::Copy(m)
66 // Subtract input 'm' from matrix 'this'.
67 // Store the added result into 'result' and return it.
68 SquareMatrix SquareMatrix::Subtract(SquareMatrix m)
69 {
70     SquareMatrix result;
71     /* Implement the function here */
72     /* Return SquareMatrix (result of subtract) */
73     /* Hint: result[i][j] = matrix[i][j] - m.matrix[i][j] */
74
75     return result;
76 }
77
78 // Copy 'm' into 'this'.
79 void SquareMatrix::Copy(SquareMatrix m)
80 {
81     /* Implement the function here */
82     /* Return nothing (void) */
83     /* Hint: Copy all values of m.matrix to matrix */
84
85 }
86
87
```



Assignment Guideline (3/5)

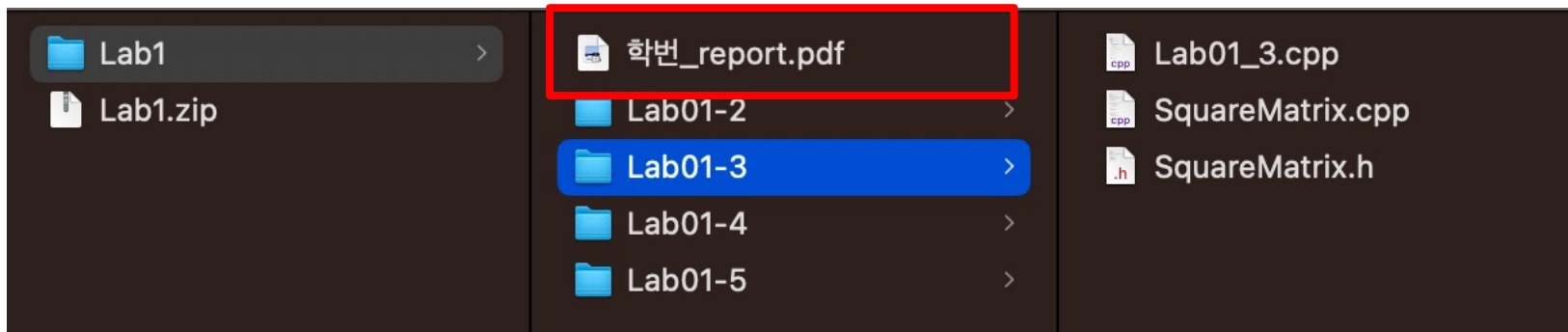
3. Do your best!
DO NOT change folder/file names.





Assignment Guideline (4/5)

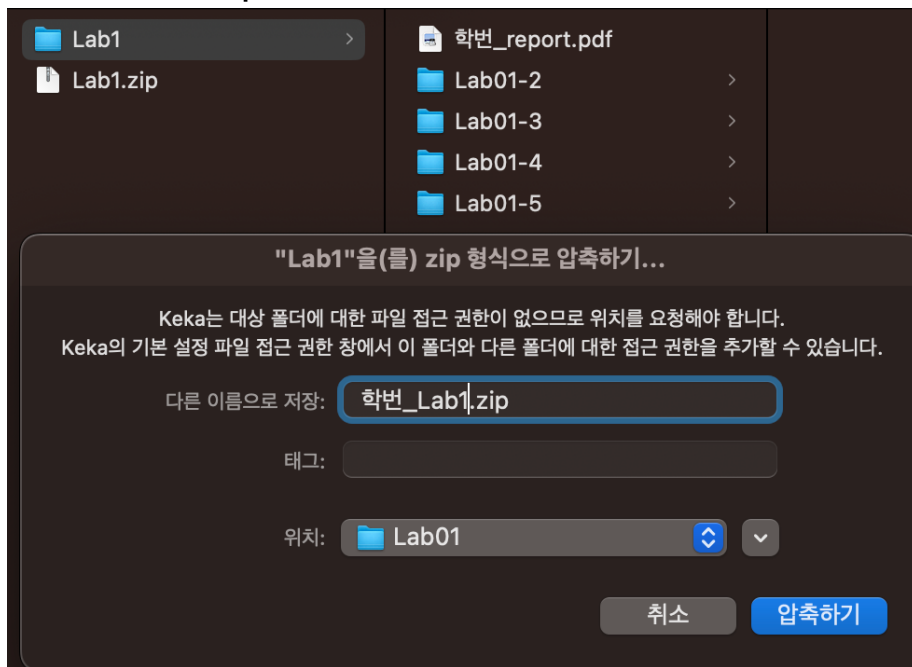
4. (After finishing your assignment) put your report into Lab1 folder.
Name: “studentID_report.pdf”





Assignment Guideline (5/5)

5. Zip your **Lab1 folder** and submit it.
Name: "studentID_Lab1.zip"





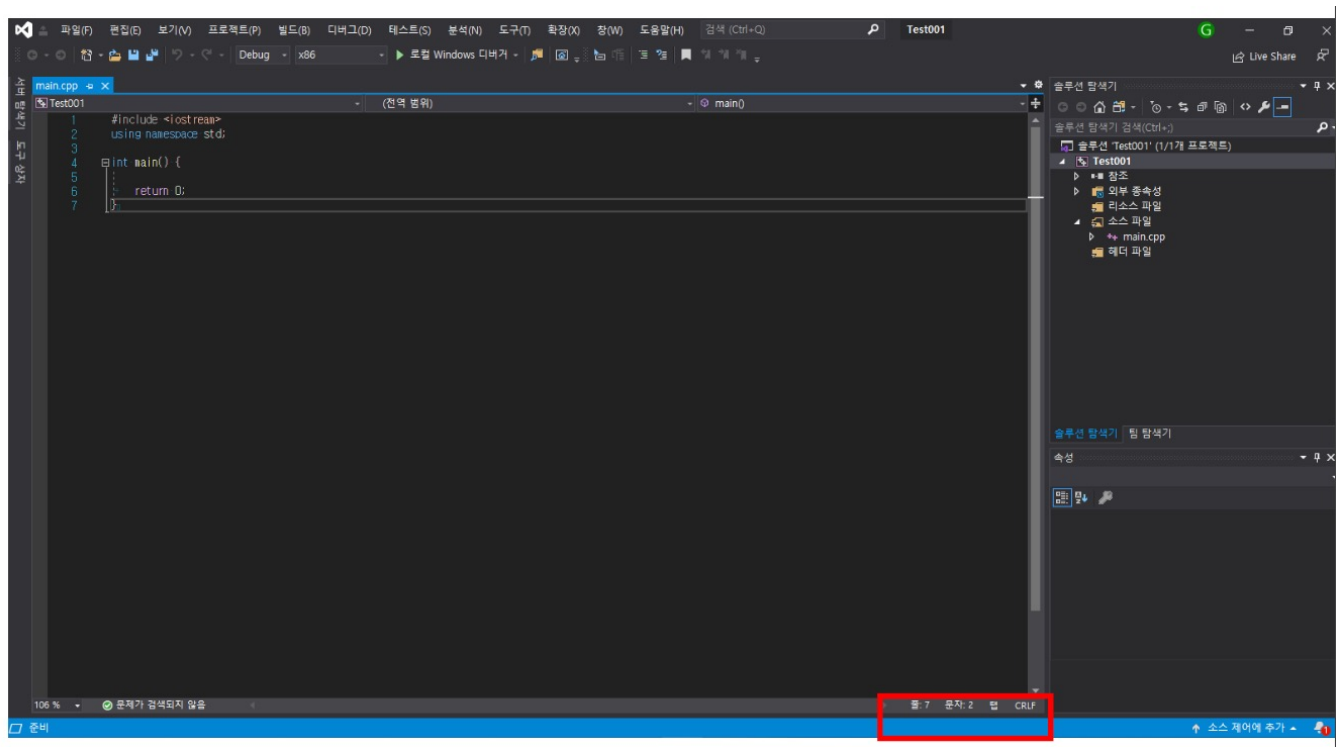
Encoding errors

- Mac and Windows use different encoding schemes for “new line”.
 - Mac: CR (Carriage Return)
 - Unix: LF (Line Feed)
 - Windows: CR LF
- The provided templates are written in Mac environment, so it may need to be converted into the correct encoding.



Encoding errors

- If you use Windows (Visual Studio): change “LF” or “CR” to “**CRLF**”.





How to build a specific file

- Multiple questions/folders (each has own main()) will be provided, resulting in compile error.
- Need to build each group separately.

✓ >- howtobuild 2 issues

✗ 1 duplicate symbol for
architecture x86_64

✗ Linker command failed with exit
code 1 (use -v to see
invocation)



How to build a specific file (xCode - MAC)

1

2

3

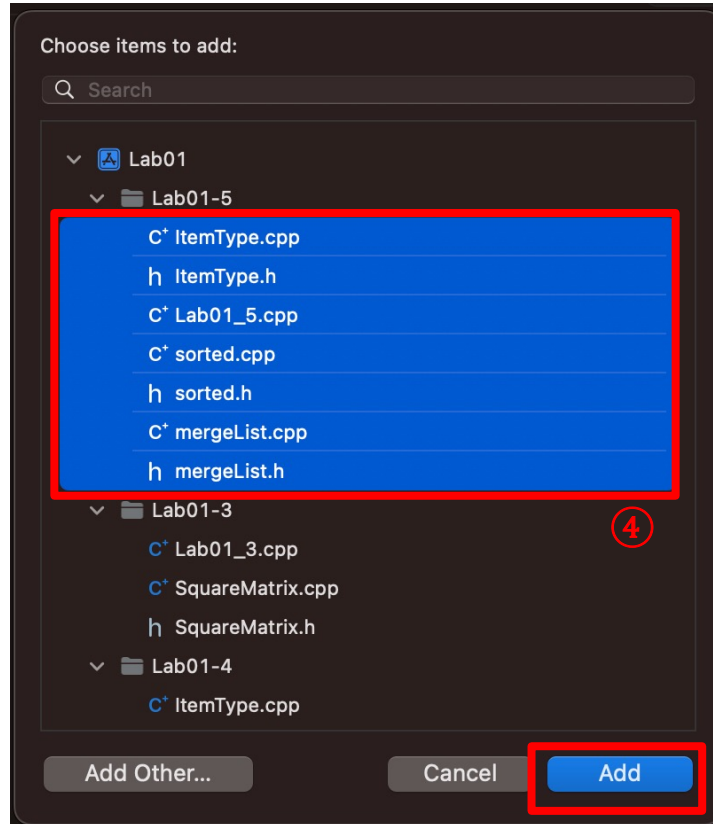
The screenshot shows the Xcode interface with the following elements:

- Left Sidebar (1):** A red box highlights the 'Lab01' project in the project navigator.
- Top Right (2):** A red box highlights the 'Build Phases' tab in the top right corner.
- Build Phases Panel:** The 'Compile Sources' phase is expanded, showing a table with the following content:

Name	Compiler Flags
Lab01_2.cpp ...in Lab01-2	

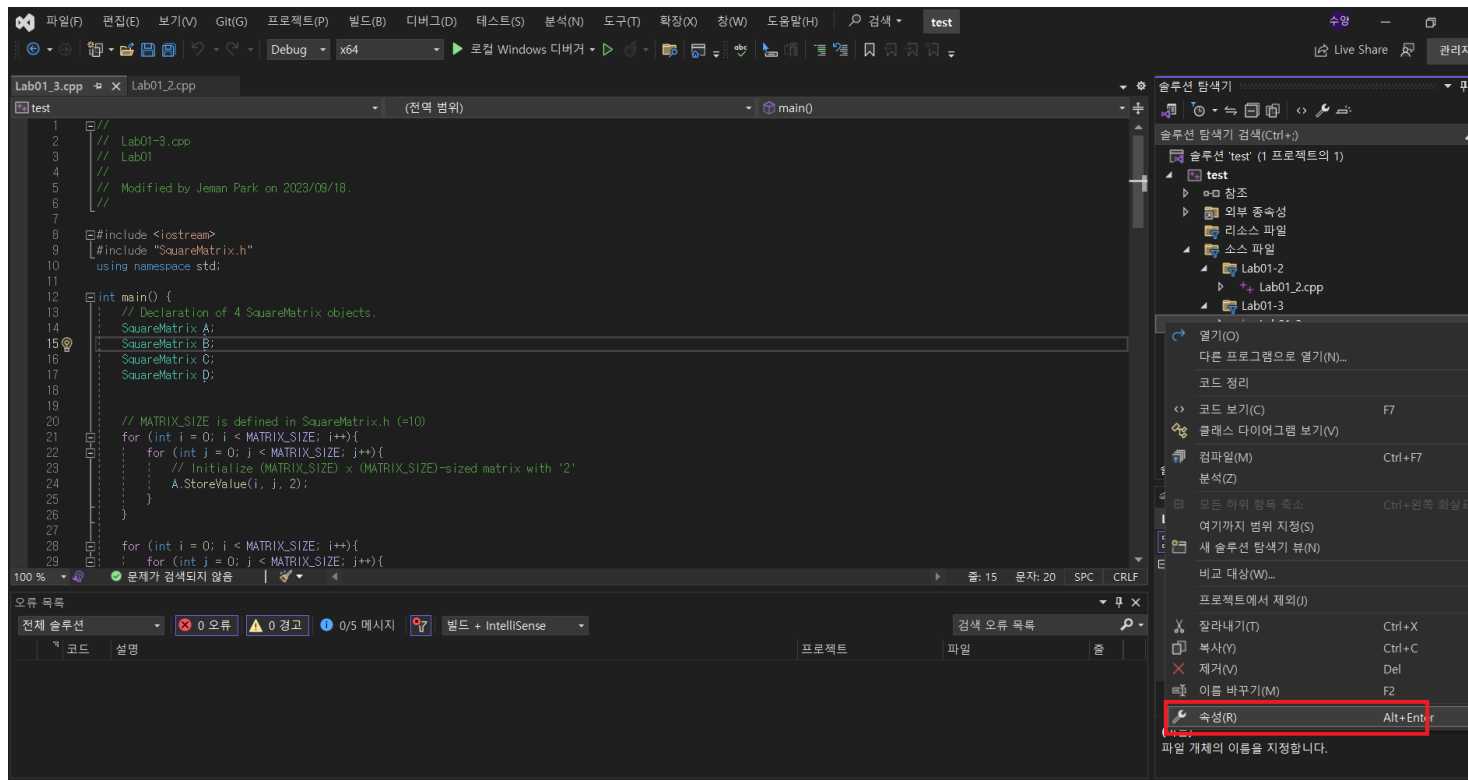


How to build a specific file (xCode - MAC)



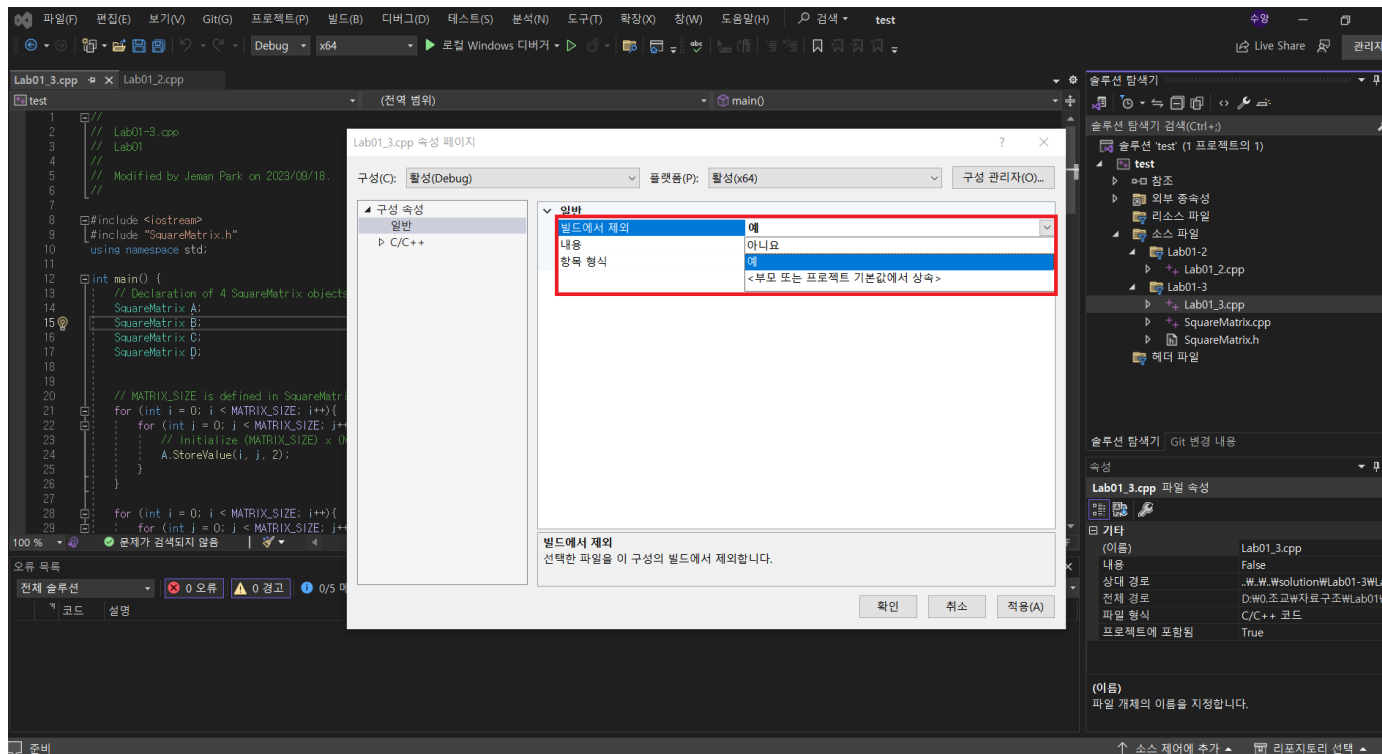


How to build a specific file (Visual Studio – Windows)



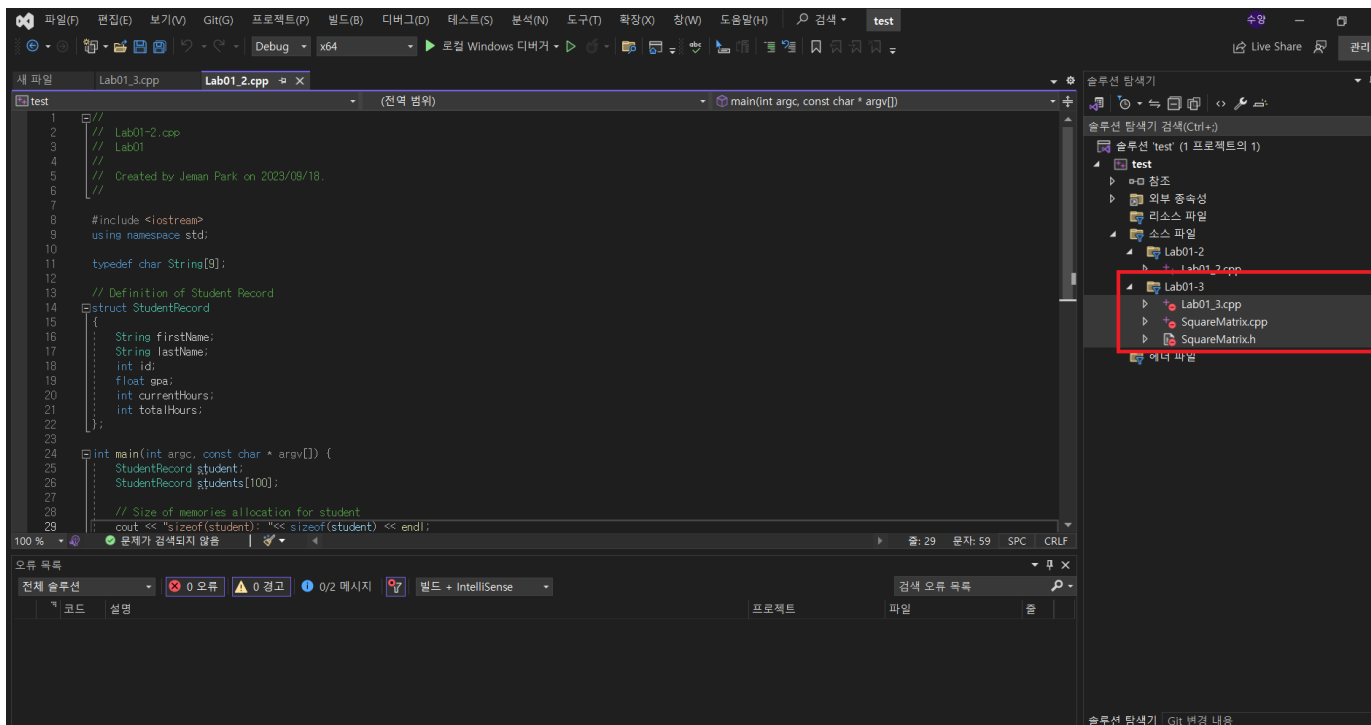


How to build a specific file (Visual Studio – Windows)





How to build a specific file (Visual Studio – Windows)





How my codes will be graded?

The files provided

```
// Lab01_X.cpp which includes main( )  
// This includes the testcase for assignments  
# include "addFunction.h"  
int main( ){  
    int a = 10;  
    int b = 12;  
    int result = add(a ,b);  
  
    return 0;  
}
```

```
// addFunction.h / addFunction.cpp  
// This is what you need to work on  
  
int add(int input1, int input2){  
    int ret = 0;  
    // Implement the function here  
    // .....  
    return ret;  
}
```

Testcases for grading

```
// Lab01_3_test1.cpp  
#include "addFunction.h"  
int main( ){  
    int a = 5;  
    int b = 3;  
    int result = add(a ,b);  
  
    return 0;  
}
```

```
// Lab01_3_test2.cpp  
#include "addFunction.h"  
int main( ){  
    int a = 7;  
    int b = -3;  
    int result = add(a ,b);  
  
    return 0;  
}
```





How my codes will be graded?

The files provided

```
// Lab01_X.cpp which includes main( )  
// This includes the testcase for assignments  
# include "addFunction.h"  
int main( ){  
    int a = 10;  
    int b = 12;  
    int result = add(a ,b);  
  
    return 0;  
}
```

```
// addFunction.h / addFunction.cpp  
// This is what you need to work on  
  
int plus(int input1, int input2){  
    int ret = 0;  
    // Implement the function here  
    // .....  
    return ret;  
}
```

Testcases for grading

```
// Lab01_3_test1.cpp  
#include "addFunction.h"  
int main( ){  
    int a = 5;  
    int b = 3;  
    int result = add(a ,b);  
  
    return 0;  
}
```

```
// Lab01_3_test2.cpp  
#include "addFunction.h"  
int main( ){  
    int a = 7;  
    int b = -3;  
    int result = add(a ,b);  
  
    return 0;  
}
```

Compile error



How my codes will be graded?

The files provided

```
// Lab01_X.cpp which includes main( )  
// This includes the testcase for assignments  
# include "addFunction.h"  
int main( ){  
    int a = 10;  
    int b = 12;  
    int result = add(a ,b);  
  
    return 0;  
}
```

```
// addFunction.h / addFunction.cpp  
// This is what you need to work on  
  
int add(int input1, int input2, int num){  
    int ret = 0;  
    // Implement the function here  
    // .....  
    return ret;  
}
```

Testcases for grading

```
// Lab01_3_test1.cpp  
#include "addFunction.h"  
int main( ){  
    int a = 5;  
    int b = 3;  
    int result = add(a ,b);  
  
    return 0;  
}
```

```
// Lab01_3_test2.cpp  
#include "addFunction.h"  
int main( ){  
    int a = 7;  
    int b = -3;  
    int result = add(a ,b);  
  
    return 0;  
}
```

Compile error



How my codes will be graded?

- If you change **function name/parameter types/file name/class name**, etc., my testcases will result in compile errors.
- In each lab class, there will be **3-4 questions given**, and they will be graded using **2-3 testcases each (7-8 testcases in total)**.
- A failure to execute or return the correct result will result in -1.
(Each lab is 10 points)
- Example: if your codes return the **correct answer for 5 testcases** (out of 8 → 3 wrong answers), your score will be 7/10 (no partial points).



How my codes will be graded?

- No submission: 0/10
- Late submission will give you another penalty of -1 (per day, -7 max).
- 8 days late submission: 0/10
- Correct answers vs. Late submission (it's up to you).
- After submitting, please double-check if you submit correct files (if it correctly includes all .cpp/.h files)



Exercise #1

Problems

- Create a table of member variable lengths and offsets for 'StudentRecord'.
(Assuming `sizeof(int) = 4` and `sizeof(float) = 4`)

```
struct StudentRecord
{
    char department[20];
    char name[14];
    int student_id;
    float gpa;
    int totalCredits;
};

StudentRecord student;
StudentRecord students[100];
```

	Length	Offset
department	?	0
name	?	?
student_id	?	?
gpa	?	?
totalCredits	?	?

- How to submit (**only in report**)
 - Write a table in the report.



Exercise #1

- Length means the size of each variable.
- Offset means the location of each variable.
- For example, (assuming that `sizeof(short) = 2`)

```
struct Item
{
    short item_code;
    int price;
    char name[10];
};
```

	Length	Offset
item_code	2	0
price	4	2
name	10	6

- Note that **you should consider** only the **answer by your computation**.
You don't have to consider the actual length/offset when executing the code.



Exercise #2

Problems

- How much memory space does the compiler reserve for 'student' and 'students'?

```
struct StudentRecord
{
    char department[20];
    char name[14];
    int student_id;
    float gpa;
    int totalCredits;
};

StudentRecord student;
StudentRecord students[100];
```

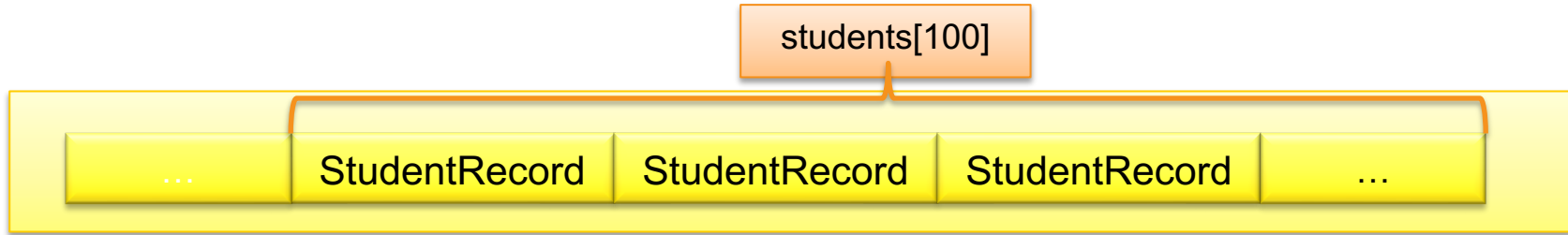
How to submit (only in report)

- 1) What are your **estimated sizes** of **student** and **students** (from Exercise #1)?
- 2) What are **actual sizes** when executing the code Lab01_2 (screenshots)
: include the screenshots of sizeof(student) and sizeof(students)
- 3) If the estimated value and measured value are different, discuss why.



Exercise #2

- 'Students' is an array of 'StudentRecord' structure



'students' allocated on memory



Exercise #3

- Implement member functions for ADT SquareMatrix.
- (A square matrix can be represented by a two-dimensional array with N rows and N columns.) Include the following operations.

MakeEmpty(): Set all rows and columns to 0.

StoreValue(i, j, value): Stores the value in the i-th row and j-th column.

Add: Adds two matrices together and return the result.

Subtract: Subtract one matrix from another and return the result.

Copy: Copy one matrix to another.

- How to submit (**source codes**)
 - Files: Lab01_3.cpp, SquareMatrix.h, SquareMatrix.cpp.
 - Do: Implement member functions in SquareMatrix.cpp.