

1 Introduction

Student ID	Full name	Course
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2 Statement

- This project is about using **Socket** to write a 1-to-n **Server-Client** program.
- The **Client** will send a string expressing a mathematical expression to the **Server**.
- The **Server** will calculate the result the expression and send it back to the **Client**.
- If the expression is invalid, the **Server** will send back an error message.
- The **Server** will be able to handle multiple **Clients** at the same time.

3 Idea

3.1 Server

- **Initialization:** Initialize the Server Socket, bind it to a specific port, and listen for incoming connections.
- **Multi-Client Handling:** Implement a multi-threaded approach to handle multiple Client connections concurrently.
- **Expression Evaluation:** Receive infix expressions from Clients, convert them to Polish Notation, evaluate, and send back the results.

3.2 Client

- **Initialization:** Create a Client Socket and attempt to connect to the Server.
- **User Interaction:** Allow users to input mathematical expressions in infix notation.
- **Expressions Sending:** Send expressions to the Server for evaluation and display the received results.

4 Implementation

4.1 Server

- **Socket Setup:** Use `socket()`, `bind()`, and `listen()` functions to set up the Server Socket.
- **Multi-threading:** Implement a loop to accept connections and create a new Thread for each Client using `pthread_create()`.
- **Expression Handling:** Upon receiving expressions, convert them from infix to Polish Notation and evaluate the result.
- **Thread Management:** Ensure proper handling of Thread creation, detachment, and resource release using `pthread_detach()` and `pthread_join()`.

4.2 Client

- **Socket Setup:** Use `socket()` and `connect()` functions to establish a connection to the Server.
- **User Input:** Allow users to input mathematical expressions in infix notation.
- **Sending Data:** Send the expressions to the Server using `write()` and wait for the response.
- **Display Results:** Receive and display the evaluated results from the Server.

5 Result

```
(base)
[~/SnowyField] as apple in ~/Data/code rides me/University-of-Science/Introduction to Operating System/Lab2 on (main1)xxx
[~/Data/] g++ -o server server.cpp
server.cpp:36:17: warning: range-based for loop is a C++11 extension [-Wc++11-extensions]
    for (char c : infix)
               ^
server.cpp:81:21: warning: range-based for loop is a C++11 extension [-Wc++11-extensions]
    for (char c : postfix)
                   ^
2 warnings generated.
(base)
[~/Data/] ./server
Server is waiting...
[~/Data/]
[~/SnowyField] as apple in ~/Data/code rides me/University-of-Science/Introduction to Operating System/Lab2 on (main1)xxx
[~/Data/]

Lab2 - apple@SnowyField - ..g System/Lab2 - -zsh - 83x32
(base)
[~/Data/code rides me/University-of-Science/Introduction to Operating System/Lab2]
[~/Data/] g++ -o client client.cpp
(base)
[~/Data/code rides me/University-of-Science/Introduction to Operating System/Lab2]
[~/Data/] ./client
Enter expression...
- Only + - * / ( ) are supported
- Enter "q" to close
Your expression: 8+(3+2*9)-5
Result from server: 24.000000

Enter expression...
- Only + - * / ( ) are supported
- Enter "q" to close
Your expression: (3+4)*(4+9)
Result from server: 91.000000

Enter expression...
- Only + - * / ( ) are supported
- Enter "q" to close
Your expression: 3+2-
Result from server: Invalid expression: Too few operands

Enter expression...
- Only + - * / ( ) are supported
- Enter "q" to close
Your expression: q
Goodbye!
(base)
[~/Data/code rides me/University-of-Science/Introduction to Operating System/Lab2]
[~/Data/]

Lab2 - apple@SnowyField - ..g System/Lab2 - -zsh - 86x32
(base)
[~/Data/code rides me/University-of-Science/Introduction to Operating System/Lab2]
[~/Data/] g++ -o client client.cpp
(base)
[~/Data/code rides me/University-of-Science/Introduction to Operating System/Lab2]
[~/Data/] ./client
Enter expression...
- Only + - * / ( ) are supported
- Enter "q" to close
Your expression: 9-2*(3+6)
Result from server: -7.000000

Enter expression...
- Only + - * / ( ) are supported
- Enter "q" to close
Your expression: 1-9
Result from server: -8.000000

Enter expression...
- Only + - * / ( ) are supported
- Enter "q" to close
Your expression: q
Goodbye!
(base)
[~/Data/code rides me/University-of-Science/Introduction to Operating System/Lab2]
[~/Data/]
```

Figure 1: result

6 Specifications

No.	Specifications	Total Percentage	Estimated
1	The programs can be compiled.	10%	10%
2	Server and Client's Socket connect correctly.	30%	30%
3	Thread creation and management work correctly.	30%	30%
4	Expression evaluation works correctly.	30%	20%