COMPUTER NETWORKS PROJECT REPORT

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I. CONTRIBUTIONS
    a. MASON DOHERTY
        i. Math Client development
        ii. Makefile
    b. BEN TENNYSON
        i. Math Server development

II. PROTOCOL DESIGN
    a. Message format for sending and receiving math calculations
        i. Client sends a single-line infix expression to server i.e.
            1. "2+3", "10 * 4", "100 / 5"
        ii. Server receives the single-line infix expression and sends a single-line string with the result i.e.
            1. "= 5.0", "=40.0"
            2. Errors
                a. "ERROR: Division by zero"
                b. "INVALID FORMAT"
    b. Message format for joining and terminating connection
        i. Client sends "NAME <client_name>" to open connection
        ii. Server sends acknowledgement (ACK) or negative acknowledgement (INVALID INIT)
        iii. Client transmits "CLOSE" to close connection
    c. Format for keeping logs of client's activities at server side
        i. Server prints log messages to console such as
            1. Client connected from <IP>:<port> at <timestamp>
            2. Client connected: <client_name>
            3. Received from <client_name>: <expression>
            4. Sending response to <client_name>: <solution>
            5. Client <client_name> disconnected.
            6. Client <IP>:<port> processing done at <disconnect_timestamp>. Session processing duration: <duration> seconds.

III.   PROGRAMMING ENVIRONMENT
    a.   Language
        i.   Java
    b.   IDE
        i.   Visual Studio Code
    c.   Versions
        i.   Java 24 (ver 2025-03-18)
        ii.   Java(TM) SE Runtime Environment (build 24+36-3646)
    d.   OS
        i.   Windows
    e.   Makefile
        i.   GNU Make 4.4.1

IV.   COMPILATION AND EXECUTION
    a.   Compiled using javac 24
        i.   Practically achieved using "make all" inside the ./ServerApplication directory
    b.   Executed via command line
        i.   Enter ./ServerApplication directory in two or more command prompts
        ii.   Execute MathServer.java via "java MathServer.java" in only one prompt
        iii.   Execute MathClient .java via "java MathClient.java" in one or more prompts

V.   PARAMETERS REQUIRED
    a.   Offered by actor
        i.   Client name
    b.   Generated
        i.   IP
        ii.   Port number

VI.  CHALLENGES FACED
   a. Server client handshake
   b. Proper disconnection
   c. Expression calculation

VII.  WHAT HAVE WE LEARNED
   a. Server/client communication in java
      i. Handshakes, proper closure, transmission and reception of messages
   b. Proper handshake and disconnection techniques
      i. Handled gracefully via socket.close() in a finally block

## VIII. OUTPUTS

### a. Client m

i.
```
C:\Users\mason\Documents\GitHub\ComputerNetworkingProject\ServerApplication>java MathClient.java
Enter your name: m
Connected successfully as m
Sending: 2 + 3
Received: = 5.0
Sending: 2 + 3
Received: = 5.0
Sending: 9 / 0
Received: ERROR: Division by zero
Sending CLOSE request.
```

### b. Client b

i.
```
C:\Users\mason\Documents\GitHub\ComputerNetworkingProject\ServerApplication>java MathClient.java
Enter your name: b
Connected successfully as b
Sending: 10 * 4
Received: = 40.0
Sending: 8 - 3
Received: = 5.0
Sending: 8 - 3
Received: = 5.0
Sending CLOSE request.
```

### c. Server

i.
```
C:\Users\mason\Documents\GitHub\ComputerNetworkingProject\ServerApplication>java MathServer.java
The server is running.
Client connected from /127.0.0.1:53064 at Thu May 01 13:19:15 CDT 2025
Client connected: m
Client connected from /127.0.0.1:53070 at Thu May 01 13:19:24 CDT 2025
Received from m: 2 + 3
Sending response to m: = 5.0
Client connected: b
Received from b: 10 * 4
Sending response to b: = 40.0
Received from b: 8 - 3
Sending response to b: = 5.0
Received from b: 8 - 3
Sending response to b: = 5.0
Client b disconnected.
Client /127.0.0.1 processing done at Thu May 01 13:19:29 CDT 2025. Session processing duration: 5.075 se
conds.
Received from m: 2 + 3
Sending response to m: = 5.0
Received from m: 9 / 0
Sending response to m: ERROR: Division by zero
Client m disconnected.
Client /127.0.0.1 processing done at Thu May 01 13:20:08 CDT 2025. Session processing duration: 53.9 sec
onds.
```