# Internet Programming Exam

## June 30th, 2003

---

**Duration of the exam:** 1 hour
**This is a closed book exam:** no documentation is allowed

---

## 1 Program Output

What will be the output of the following program?

```c
#include <stdio.h>
#include <sys/types.h>
#include <unistd.h>

int main() {
  int i, x;

  x = 0;
  for (i=0;i<3;i++) {
    if (fork()==0) {
      x = x+1;
    }
  }
  printf("%d ",x);
  return 0;
}
```

## 2 Trade Market Index Server

The goal of this exercise is to design a system which computes trade market indexes (like the Dow-Jones or the AEX). An index is a weighted average value of a selected number of stock values.

$$Index = \frac{W_1 S_1 + W_2 S_2 + ... + W_n S_n}{X}$$

The weights $W_1, W_2, ..., W_n$ are constants. The value $X$ is also a constant. The values of stocks $S_1, S_2, ..., S_n$ change all the time due to market conditions.

The actual computation of the stock values $S_1, S_2, ..., S_n$ is out of the scope of this exercise. Just assume that there exists a function `float stock(char* stockname)` or `float stock(String stockname)` that gives these values.

Stock values are computed on different machines: for example, $S_1$ and $S_2$ must be computed on machine A, $S_3$ must be computed on machine B, etc.

The index server is supposed to query the stock values from servers A, B, . . . and compute the values of the index. Clients can send requests to the index server to ask for the current value of the index.

## 2.1  Closed System Design

Assume that you can write the complete software of this system, including the clients, the index server and all the stock value servers.

How would you structure your programs using sockets? Using Sun-RPC? Using Java-RMI?

- For each architecture, give a **brief** sketch of the programs running on the client, the index server, and on one of the stock value servers.

- Which architecture would you prefer? **Why?**

## 2.2  Open System Design

Now, assume that some software is already in place to compute stock values on servers A, B, etc. You cannot replace this software. In addition, different stock servers may be using different systems and languages: machine A uses function `float stock(char *stockname)` in C with Unix, machine B uses function `float stock(string stockname)` in Java with Windows, etc. The index server knows in advance which stock server runs which software.

Now, how would you realize the index server? Do not write program sketches, but explain which technology you would be using, and why it solves the problem.

— **the end** —