Code Jam 5

Names:

Complete the following exercises in 40 minutes. This activity is open book, open computer. All work should be your own group.

Question 1

Consider the following program that uses fork to spawn child processes.

(a) Draw a picture that visualizes the parent/child relationships. (b) In your picture, indicate what processes print which letters. (c) Which printf lines of the program run concurrently with other processes?

```
 6 int main() {
 7   pid_t ret;
 8 
 9   printf("A\n");
10 
11   ret = fork();
12   printf("B\n");
13 
14   ret = fork();
15   if (ret == 0) {
16     printf("C\n");
17     exit(0);
18   }
19 
20   return 0;
21 }
```

Question 2

Consider the following program. In the space to the right, draw the state of the function stack and heap on line 16.

```
 1 #include <stdio.h>
 2 
 3 int main() {
 4  int weights[] = {-3, 4, -1};
 5  float data[] = {0.1, 0.2, 0.25};
 6  float scale = 0.2;
 7 
 8  int* w = weights;
 9  float* p = data;
10 
11  float value = 0;
12  for (int i = 0; i < 3; i++) {
13    value += *(p+i) * *(w+i);
14  }
15  value = value * scale;
16  // Draw stack here
17  printf("The value is %.2f\n", value);
18  return 0;
19 }
```

- Suppose variable `p` has value `0x7fffffffe04c`. What is the value of `p+1`?

- What is the output of this program?

- In the program above, circle the variables with temporal locality.
- In the program above, underline the variables with spatial locality.

Question 3

In the program, dot.c, write a multithreaded algorithm (with 4 threads) that computes the dot product of two vectors.

You are given basecode that computes the dot product between two random vectors. Add code to compute the dot product using threads.

The dot product of two vectors is the sum of the products of each pair of components. For example, if v = (v1, v2, v3) and u = (u1, u2, u3), the dot product is v1*u1 + v2*u2 + v3*u3.

```
$ make dot
$ ./dot
Ground truth dot product: 16265901
Test with 4 threads
Answer with threads: 16265901
```

Last updated 2022-04-20 16:28:49 -0400