

FINAL CS I

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Instructions: time is three (3) hours. Total number of points is 100; each question has the number of points written before the statement of the question. Programs can be written in C or C++.

1. (5 pts) What will be the output of the following program? Justify your answer.

```
int main (void)
{
    int sum, i, j, k;
    for (sum = 0, i = 2; i <= 8; i += 2) {
        j = i;
        while (j < 4) {
            k = j;
            sum++;
            k += 2;
            while (k <= 3) {
                sum++;
                k += 2;
            };
            j++;
        }
    }
}
```



```
printf ("%d %d %d %d\n", sum, i, j, k);
}
```

2. (5 pts) Given $i = 2$, $j = 3$ and $k = 6$, what value do the following expressions have? Use 0 for false expression and 1 for true expression. Justify your answers.

(a) $(i < j) \ \&\& \ ((i * j) \leq k)$

(b) $((i * j) \leq k) \ || \ (i > j)$

3. (5 pts) Determine the value of each of the following operations on bits (warning, the operands $\&$ and $|$ are operands on bits, not logical operations!). Justify your answer.

(a) $3 \ | \ (2 \ \&1)$

(b) $3 \ \sim \ (2 \ \& \ 1)$

(c) $(((1 \ \ll \ 3) \ \gg \ 2) \ \ll \ 2) \ \gg \ 3$

4. (20 pts) A function is recursive if it calls itself (under certain conditions); for example, a function that computes the factorial by

```
fact (int n) {
    if (n == 1) return 1;
    else return (fact (n - 1)); }
```

The Fibonacci numbers are defined by recursion with $F_0 = 1$, $F_1 = 1$, $F_2 = F_0 + F_1$, ..., $F_n = F_{n-1} + F_{n-2}$. Write a program that uses a recursive function to compute Fibonacci numbers.

5. (20 pts) Write a program that prints the command line again. For example, if the command line is

```
./a.out this is a test
```

the output should be

```
./a.out this is a test
```

6. (20 pts) Write a program that appends a file to another, writing the result in

a third file. The names of all files should be given in the command line; for example, if your command is

```
./a.out file1 file2 file3
```

the file3 should contain file1 followed by file2

7. (25 pts) The continued fraction of a rational number, for example, $18/5$ is computed as follows. First divide 18 by 5, getting 3 as quotient and 3 as remainder, so $18/5 = 3 + (3/5)$. We now consider $5/3$ and apply the same procedure to get $5/3 = 1 + (2/3)$; then $3/2 = 1 + (1/2)$ and finally $2/1 = 2 + 0$. The continued fraction of $18/5$ is the sequence of quotients, $(3, 1, 1, 2)$, so

$$\frac{18}{5} = 3 + \frac{1}{1 + \frac{1}{1 + \frac{1}{2}}}$$

Write a program that reads two positive integers (from the command line or by asking the user, as you prefer) and computes the corresponding continued fraction.