

Exam 0, CSCI 210, Spring 2004

Name: _____

1. [10 pts] Suppose we have a file called *words*, which contains the words of the English language, one per line, *in random order*. Give a Unix command that would display the first word alphabetically in the English language containing the letter *q*.

```
unix% your command here...
acquaint
```

2. [10 pts] Translate the following Java class method into the closest equivalent C function.

```
public static double sumArray(double[] values) {
    double total = 0.0;
    for(int i = 0; i < values.length; i++) {
        total += values[i];
    }
    return total;
}
```

3. [10 pts] What does the following C program print when run?

```
#include <stdio.h>

int main() {
    int i;    int j;
    int **p; int *q;

    i = 2;
    j = 3;
    q = &i;
    p = &q;
    *q = 5;
    q = &j;
    **p = 7;
    printf("%d %d\n", i, j);
    printf("%d %d\n", **p, *q);
    return 0;
}
```

4. [5 pts] Approximate 2^{45} in the form $x \times 10^y$, with x and y both being base-10 numbers. (Your answer need not be normalized.)

5. [10 pts] Evaluate each of the following C expressions, giving your answer as a base-10 number. Assume `>>` does an arithmetic shift.

a. $(-14)^3 = \underline{\hspace{2cm}}$

b. $(-10) \gg 2 = \underline{\hspace{2cm}}$

6. [10 pts] Using only variable declarations, assignment statements, and a `return` statement, and without using the multiplication operator, write a C function that takes a number n as a parameter and returns $80 \cdot n$. The function must use at most five operations. (Adding n to itself 79 times would take 79 operations.) **Hint:** The shifting operations are useful here.

```
int mult80(int n) {
      
  
  
  
  
}
```

7. [15 pts] Suppose we are using an 8-bit floating-point representation with 3 bits for the excess-3 exponent and 4 bits for the mantissa. The representation includes both the denormalized and the nonnumeric cases. (Note that this does not match the 8-bit representation studied in class!)

a. What bit pattern represents $0.375_{(10)}$?

b. What value does 11010001 represent? Express your answer as a decimal number or a base-10 fraction.

c. What value does 00001100 represent? Express your answer as a decimal number or a base-10 fraction.

d. What is the bit pattern of the smallest positive number supported by this representation? Convert this to a decimal fraction or number.

e. What is the bit pattern of the largest number supported by this representation? (Infinity isn't a number.) Convert this to a decimal fraction or number.

8. [10 pts] Suppose we are using the eight-bit floating-point system studied in class (four bits for the excess-7 exponent, three for the mantissa). Give an example of three numbers x , y , and z for which the equation $(x + y) + z = (x + z) + y$ is false for arithmetic in this system. All three numbers must be representable within the system, without resorting to nonnumeric cases. **Note:** Your answer should explain the values of $(x + y) + z$ and $(x + z) + y$ for your values of x , y , and z .