

Université d'Ottawa
Faculté de genie

École d'ingénierie et de
technologies de l'information



University of Ottawa
Faculty of Engineering
School of Information
Technology and Engineering

Fall 2012 GNG 1106 Final Exam

- 180 minutes
- closed-book
- non-programmable calculators allowed
- The paper is out of 100 points, but you may get 107 points if you solve every question correctly. That is, there are 7 bonus points.

Question 1 ($5 \times 13 = 65$ points) Answer the following questions. Justify your answer.

1. What will the following code print?

```
#include <stdio.h>

int main(void)
{
    if (0)
        printf("Good Bye World,");
    else
        printf("Hello World,");

    printf(" if the world ends on December 21.\n");

    return 0;
}
```

2. When using a `char` array to store string "Hello", the array length need to be 5 or higher. Is this statement correct?
3. What is the value of variable `a` after the following code segment is executed?

```
double a;
a=3/5;
```

4. After the following code segment is executed, regarding the value of variable `c`, which one of the following is correct?
- (a) 0;
 - (b) a positive random number;
 - (c) a negative random number;
 - (d) `RAND_MAX`

```
int a1, b1, a2, b2, c;
srand(123);
a1=rand();
b1=rand();
srand(123);
a2=rand();
b2=rand();
c=a1+b1-a2-b2;
```

5. What will be printed when the following code is executed?

```
#include <stdio.h>

void swap (int a, int b)
{
    int tmp;
    tmp=a;
    a=b;
    b=tmp;
}

int main(void)
{
    int a=10;
    int b=20;
    swap(a, b);
    printf(" a=%d, b=%d\n", a, b);
    return 0;
}
```

6. Suppose that in the code above, the line “swap(a, b)” in the main function is replaced with “*(amp)=b”, then what do you expect? (Will the code compile? If it does not, identify the error; if it does compile, what is the result of the execution?)
7. The function getNext() is given as follows.

```
int getNext(void)
{
    static int prev=1;
    static int current=0;
    int tmp;
    tmp=prev+current;
    prev=current;
    current=tmp;
    return current;
}
```

When the function is called for the 6-th time, what is its return value?

8. Suppose that you are to read a binary file with name myBinFile.bin, when opening the file, you use the following line of c code (where variable fp has been declared as a FILE pointer):

```
fp=fopen(" myBinFile . bin", ?);
```

The question mark in the line above is meant to be a string. What is the string that you should use?

9. What will be printed by the following code?

```
#include <stdio.h>

int main(void)
{
    int a[]={1, 2, 3, 4, 5};
    printf("%d\n", a[3]);
    return 0;
}
```

10. What will be printed by the following code?

```
#include <stdio.h>

int main(void)
{
    int a[]={1, 2, 3, 4, 5};
    int b[]={2, 4, 6, 8, 10};
    int i;
    *a=*b;
    for (i=0; i<3;i++)
    {
        printf("a=%d, b=%d\n", a[i], b[i]);
    }
    return 0;
}
```

11. What will be printed by the following code?

```
#include <stdio.h>

int main(void)
{
    int a[]={1, 2, 3, 4, 5};
    int *b;
    int i;
    b=&a[2];
    for (i=0; i<3;i++)
    {
        printf("b=%d\n", b[i]);
    }
    return 0;
}
```

12. The function `simpleFunc` is given as follows.

```
int simpleFunc(int x)
{
    int out=-1;
    if (x>=3)
        out=simpleFunc(x-3);
    if (x<0)
        out=-1;

    return out;
}
```

What is the return value of the function if the function is called as `simpleFunc(23)`?

13. Determine if the following code segment has syntax error?

```
char *buff;
buff=(char *)malloc(sizeof(int));
*((int *)buff)=10;
```

Question 2 (10 points) Write the c code for the following program.

The program keeps prompting the user to enter (from the keyboard) positive integers until the user enters “0”. The program then prints the average value of all entered positive integers. Note that the average of a set of integers are typically not an integer. (There is no need to check if the user enters a valid input to the program, namely, assuming that the user always uses the program properly.)

Question 3 (10 points) Write the c code for the following function.

The function is to compare two integer vectors of the same length and returns the number of places at which the two vectors differ. For example, vector (0, 2, 2, 3, 5) and vector (1, 2, 3, 3, 5) differ in two places. Apparently, the vectors should be supplied to the function as input. Note that the length of the vectors may be arbitrary. Implement the function in any way you wish as long as it does the job.

Question 4 (7 points) Write the c code for the following function.

The function has the prototype

```
double **matrixMultiply(double **A, int nRowsInA, int nColsInA, double **B, int nRowsInB,
int nColsInB)
```

The function performs matrix multiplication, namely it multiplies (not necessarily square) matrices A and B and return matrix AB. Matrices need to be represented as pointers to pointers to double, as seen from the function prototype. The arguments `nRowsInA`, `nColsInA`, `nRowsInB` and `nColsInB` refer to respectively the number of rows of A, the number of columns of A, the number of rows of B and the number of columns of B.

Question 5 (15 points) Complete the following programming task.

A text file with name `students.dat` contains the following content.

```
10
james      bond      1234789
jacky      chan      9088712
jet        li        2119987
an         lee       9383783
james      smith     9838377
David      Webb      9988123
jason      borne     3467222
yong       chang     9383866
will       smith     2324242
jessy      Zhang    8498944
```

Note that except for the first line, every line in the file contains the record of a student (in the order of first name, last name and student number). The first line contains an integer that indicates how many records are contained in the file. (Verify that there are 10 student records in the above list).

You are to complete a program that reads the `students.dat` file (and other such files), and creates another text file that is in the same format except that

1. All letters are in capitalized.
2. the records are sorted in ascending order of the student numbers.

The program is partially written and the source code is given below. The `main` function of the program is not to be changed, and all you need to do is to fill in the details for all other functions.

```

#include <stdio.h>

struct student
{
    long studentNumber;
    char *firstName;
    char *lastName;
};

/* the function returns the address of an array of student-typed objects */
struct student *readStudentRecordFile(char *fileName, int *numOfStudents)
{
    /* fill in here */
}

/* the function writes an array of student-typed objects into a file */
void writeStudentRecordFile(char *fileName, struct student *AllStudents,
    int *numOfStudents)
{
    /* fill in here */
}

/* the function sorts an array of student-typed objects according to
student number and returns a sorted array of such objects */
struct student *sortStudents(struct student *AllStudents, int numofStudents)
{
    /* fill in here */
}

/* the function capitalizes the letters in the student names for an array of
student-type objects
*/
void capitalizeNames(struct student *AllStudents, int numofStudents)
{
    /* fill in here */
}

int main(void)
{
    int nStudents;
    struct student *readArray;
    struct student *sortedArray;
    readArray=readStudentRecordFile("students.dat", &nStudents);
    capitalizeNames(readArray, nStudents);
    sortedArray=sortStudents(readArray, nStudents);
    writeStudentRecordFile("students2.dat", sortedArray, &nStudents);
    return 0;
}

```