

ECE 361 Fall 2018  
Homework #1

THIS ASSIGNMENT SHOULD BE SUBMITTED TO D2L BY 10:00 PM ON SAT, 06-OCT-2018. THE ASSIGNMENT WILL BE GRADED AND IS WORTH 100 POINTS. IT IS EASIEST TO GRADE, AND I BELIEVE EASIEST FOR YOU SUBMIT ANY SOURCE CODE FILES AS TEXT FILES INSTEAD OF TRYING TO CUT/PASTE YOUR CODE INTO A .doc OR .docx FILE. SHORT ANSWER, TRUE/FALSE AND MULTIPLE CHOICE QUESTIONS SHOULD BE SUBMITTED IN A SINGLE TEXT OR .PDF FILE. CLEARLY NAME THE FILES SO THAT WE KNOW WHICH PROBLEM THE CODE REFERS TO AND SUBMIT THE PACKAGE AS A SINGLE .ZIP OR .RAR FILE (EX: rkravitz\_ece361f18\_hw1.zip) TO YOUR D2L HOMEWORK #1 DROPBOX

**Question 1 (60 pts): Short Answer, True/False, Multiple choice**

- a. [6] Genghis Khan organized his men into groups of 10 soldiers under a “leader of 10.” Ten “leaders of 10” were under a “leader of 100.” Ten “leaders of 100” were under a “leader of 1000.”
- 1) If Khan had an army of 10,000 soldiers at the lowest level, how many men in total were under him in his organization?
  - 2) If Khan had an army of 5763 soldiers at the lowest level, how many men in total were under him in his organization? Assume that the groups of 10 should contain 10 if possible, but that one group at each level may need to contain fewer.
- b. [6] Provide a concise (a few sentences) answer for these questions:
- 1) What is an algorithm?
  - 2) What is a program?
- c. [6] An app requires the execution of 30 million instructions to complete a task. Your CPU has an internal clock frequency of 2.8 GHz. Each instruction takes an average of 7.3 clock cycles to complete. What is the execution time of the task?
- d. [6] How long would it take to transfer a 600-MB database from disk to memory over a DMA channel with a bandwidth of 2.5 GB/s?
- e. [6] Answer the following True/False questions comparing main memory to disk storage:

1.	Main memory is volatile	T	F
2.	Main memory is accessed sequentially	T	F
3.	Disk storage is volatile	T	F
4.	Disk storage is accessed sequentially	T	F
5.	Main memory generally has a faster access time than disk storage	T	F
6.	Main memory generally provides greater storage capacity than disk memory	T	F

- f. [4] Git is an example of a distributed version control system. Systems such as SVN and CVS are centralized version control systems. Describe a few attributes of each type of version control system and list some the advantages and disadvantages of each.
- g. [6] Provide a concise (a few sentences) answer for these questions:
- 1) What does it mean to make a “commit” to a Git repository?
  - 2) What is the role of the “staging area” in a Git repository?
  - 3) How do you use the “staging area” to control what files you are committing to a repository?
- h. [5] GitHub provides a cloud-based host for your repositories. Describe the process (you can include/discuss the relevant Git commands if you’d like) to push your local repositories to “the cloud.”
- i. [5] What is a branch in Git and how do you create one? Give an example of how a branch can be used to debug a new code module without risking your working code.
- j. [10] We will cover recursion and recursive functions later in the term, but for now, let it suffice to say that **Recursion** is a computer programming technique involving the use of a procedure, subroutine, function, or algorithm that calls itself. Recursive functions must have a termination condition else the functions may never return. Consider the following C program:

```
#include <stdio.h>

int list[4];

int sum(int a[], int n) {
    // Returns the sum of the elements of a between a[0] and a[n].
    if (n == 0) {
        return a[0];
    }
    else {
        return a[n] + sum(a, n - 1); // ra2
    }
}

int main() {
    printf("Enter four integers: ");
    scanf("%d %d %d %d", &list[0], &list[1], &list[2], &list[3]);
    printf("Their sum is: %d\n", sum(list, 3));
    return 0;
}
```

Interactive Input/Output  
Enter four integers: 3 2 6 4  
Their sum is: 15

The function `sum()` is called for the first time by the main program. From the second time on, it is called by itself.

- 1) How many times is `sum()` called altogether, including the call from `main()`?
- 2) Draw a picture of the main program variables and the run-time stack just after the function is called for the third time. Do not draw the stack frame for `main()`. You should have three stack frames.

## **Question 2 (40 pts): C Programming**

The following questions ask you to write a program or a piece of a program. Submit your source code but you do not have to compile and execute the program. That will likely change after we complete the work session on the gcc tool chain.

- a. [10] The following function is supposed to return true if any element of the array `a[]` has the value 0 and false if all elements are nonzero. Sadly, it contains an error. Find the error and show how to fix it.

```
boolean has_zero(int a[], int n)
{
    int i;

    for (i = 0; i < n, i++) {
        return (a[i] == 0) ? true : false;
    }
}
```

- b. [10] The following function supposedly computes the sum and average of the numbers in the array `a[]` which has a length of `n`. `avg` and `sum` point to variables that the function should modify. Unfortunately, the function contains several errors. Find and correct the errors.

```
void avg_sum(double a[], int n, double *avg, double *sum)
{
    int i;

    sum = 0.0;
    for (i = 0; i < n; i++)
        sum += a[i];
    avg = sum / n;
}
```

- c. [20] Programming in C using pointers

- 1) Write a C program that prompts the user to enter a U.S. dollar amount and then shows how to pay that amount using the smallest number of \$20, \$10, \$5, and \$1 bills. *Hint: Divide the amount by 20 to determine the number of \$20 bills needed, and then reduce the amount by the total value of the \$20 bills. Repeat for the other bill sizes. Be sure to use integer values throughout, not floating point numbers.*
- 2) Refactor your program to include the following function:

```
void pay_amount(int dollars, int *twenties, int *tens, int *fives,
    int *ones) {};
```