CS 225 **Data Structures and Problem Solving** Test 1
Name: Maximum Points: 52

Important: This is an open book test. You can use any books, notes, or paper. *Do not log into the computer during the test.* Any calculations and rough work can be done on the back side of the test pages. If there is a syntax error in any program segment, just write it down and you will get full credit for the problem.

1. [4 pt] What is the value of `str[strlen(str)]` for any string?

2. [4 pt] In a certain C book, I found the following statement to illustrate the use of an empty string.

```
printf ( "You have %d egg%s", num_eggs == 1 ? "" : "s" );
```

   What is the purpose of this statement? Does it achieve that purpose? How (if true) or why not (if false)?

3. [10 pt] Using the library functions in `<string.h>`, write a function to test whether one string is a prefix of the other. Obviously, this function takes two strings as input parameters and returns the string that is the prefix. It returns a `NULL` is the string is not a prefix. The prefix string may be passed as the first or the second parameter.

4. [4 pt] Given the declaration below, what is the value of the expressions `s1 == s2` and `strcmp ( s1, s2 )`?

```
#define VALUE "This is a string."

char *s1 = VALUE;
char *s2 = VALUE;
```

5. [10 pt] The code fragment below allocates memory for a pointer and then stores the address of another memory block in the first one. How many calls to `free` will be required to return all the memory to the heap, one or two?

```
char **p;

p = ( char ** ) malloc ( sizeof ( char * ) );
*p = ( char * ) malloc ( 100 );
```

6. [10 pt] Using suffix rules, write a makefile definition to compile a target named `my_math` from the files `main.c`, `square.c`, `sqrt.c`, and `cube.c`. You will need the mathematics library at the time of linkage. Also, I need the code to be optimized and you should use the appropriate compiler flag for the purpose. Finally, I am using a header file `funcs.h` that contains prototype definitions and some constants. I want the make utility to recompile erveything when the header file is modified.

7. [10 pt] Write statements that accomplish each of the following.

   (a) Create a structure named `person` with fifteen characters for the last name, fifteeen characters for the first name, and a short integer for age. Create a type `person_type` using the above structure and the `typedfe` statement.

   (b) Open a file called `persons.dat` in which you can write the variables of the type declared above.

   (c) Initialize the above file so that there are 100 records with the last name as `unassigned` (put this string in the file), first name as blank (`NULL`), and age as 0.

   (d) Assign to the fifth record the last name `Clinton`, first name `Bill`, and age as `50`.

   (e) Write the fifth record into the file. (Don't write other records).