Worksheet 10

CS/ECE 354 - Spring 2016

Due: April 29th 2016 (Friday) in class

Read the following code and answer the questions that follow:

```c
#include <stdio.h>
#include <stdlib.h>
#define N 10

int arr_sum = 0;
static int count = 0;

int sum(int a, int b)
{
    count++;
    return a+b;
}

int main()
{
    int *parray = malloc(sizeof(int) * N);
    int i = 0;
    // Initialize the contents of the array.
    for (i = 0; i < N; ++i) {
        parray[i] = i;
    }
    // Add the elements in the array.
    for (i = 0; i < N; ++i) {
        arr_sum = sum(arr_sum, parray[i]);
    }
    printf("The sum of the elements in the array = %d\n", arr_sum);
    printf("The number of times sum() was called = %d\n", count);
    return 0;
}
```

1. During which phase of the build process (preprocessing, compiling, assembling, linking), will the value for the macro **N** be substituted in the source code?

2. During which phase of the build process, will the comments in the source code be removed?

3. In which part of the program memory (code, data, stack, and heap) are the following variables stored?
    a. Global integer variable **`arr_sum`** - _____
    b. Static integer variable **`count`** - _____
    c. The pointer variable **`parray`** in `main()` - _____
    d. The 40 bytes of memory allocated using **malloc** - _____
    e. Automatic integer variable **`i`** - _____

4. Which part of the program memory is the following binary version of the function `sum()` stored?

```
00000000 <sum>:
   0: 55                    push   %ebp
   1: 89 e5                 mov    %esp,%ebp
   3: a1 04 00 00 00        mov    0x4,%eax
   8: 83 c0 01              add    $0x1,%eax
   b: a3 04 00 00 00        mov    %eax,0x4
  10: 8b 55 08              mov    0x8(%ebp),%edx
  13: 8b 45 0c              mov    0xc(%ebp),%eax
  16: 01 d0                 add    %edx,%eax
  18: 5d                    pop    %ebp
  19: c3                    ret
```