CS3844 Homework 1
Assorted Topics
Due: January 23, 2014

1. The following is a simple shell script that executes at the command shell. Type the script into your virtual machine and save it as demo.sh. Execute it from the shell by typing the command ./demo.sh 4 With the program executing, run the appropriate commands to generate a process tree. What does this tree look like?

```
#!/bin/bash
echo The count is $1
COUNT=$1

while [ "$COUNT" -gt "1" ]
do
  echo $COUNT
  COUNT=$(($COUNT - 1))
  bash demo.sh $COUNT &
done

echo $1 has paused.
sleep 20
```

2. The following code segment (left uncommented for brevity) has multiple systems calls. Identify where a system call is likely to occur. How many are there, and where are they at?

```
#include <stdio.h>

int main(int argc, char *argv[])
{
  FILE* fptr;  /* Declare a file pointer.  This will serve as a handle for the file that is to be
                  opened. */

  printf("%s", argv[0]);  /* Print out arg[0] to the console.  This is the name of the program which
                             is executing. */

  fptr = fopen(argv[1], "r"); /* Open the file.  Note this program is sloppy in that it does not check
                                 for a NULL return from this routine.  A NULL return would be
                                 indicative of a non-existent file or other problems.   */

  while (!feof(fptr)) /* While we have not reached the end of the file, loop through the code. */
    {
      unsigned char text[255];   /* Declare an array of unsigned chars to hold the text we read in
                                    from the console. */
      fscanf(fptr, "%s", text);  /* Read in a string from the file. */
      printf("%s\n", text);      /* Print the file out to the console. */
    }
  fclose(fptr);                  /* Close the file. */
}
```

3. A process is running along when it encounters a mutex which is locked. When it encounters this situation, a transition occurs in the process state machine. What is the resulting state when this transition occurs?
4. A process spends 25ms running on the processor before a 5 ms context switch occurs. A second process then runs for 15ms before another 5 ms context switch occurs. This occurs 4 times. Overall, what percentage of time is spent doing context switches?
5. In your data structures course, you wrote a word search program, which would search through an array of characters. Sometimes this would be a CPU bound process. Other times it would be an IO bound process. Explain when it would be CPU bound and when it would be IO bound.
6. Explain the 3 main actions of the preprocessor.
7. What is the difference between the fork and exec POSIX operations?
8. When one declares a pipe between two processes, and array of two nts is used. What are these, and why are there two values?
9. A typical POSIX threads program will spawn a new thread with the following command. What does each part of the commands do / represent?

```
pthread_attr_init(&attr[0]);
pthread_create(&tids[0], &attr[0], thread1, (void*)messages[0]);
```

10. What is a signal handler, and how does it get invoked?