Spring 2023 - CS3523: Operating Systems 2
Theory Assignment 1: Threads & Scheduling
Deadline: 6th Feb 2023, 3:00 pm (Before the class)

Q1 **(5 points)**. The traditional UNIX scheduler enforces an inverse relationship between priority numbers and priorities: the higher the number, the lower the priority. The scheduler recalculates process priorities once per second using the following function:

$$\text{Priority} = (\text{recent CPU usage} / 2 + \text{base})$$

where base = 60 and *recent CPU usage* refers to a value indicating how often a process has used the CPU since priorities were last recalculated.
Assume that recent CPU usage for process P1 is 40, for process P2 is 18, and for process P3 is 10. What will be the new priorities for these three processes when priorities are recalculated? Based on this information, does the traditional UNIX scheduler raise or lower the relative priority of a CPU-bound process?

Q2 **(5 points)**. Question 4.19 from the 10th edition of the book on the page EX-9 of the book (page 257 of the pdf). The program shown in Figure 4.23 uses the Pthreads API . What would be the output from the program at LINE C and LINE P?

Listing 1: C program for Exercise 4.19

```
#include <pthread.h>
#include <stdio.h>
int value = 0;
void *runner(void *param); /* the thread */
int main(int argc, char *argv[])
{
    pid_t pid;
    pthread_t tid;
    pthread_attr_t attr;
    pid = fork();
}
if (pid == 0) { /* child process */
    pthread_attr_init(&attr);
    pthread_create(&tid,&attr,runner,NULL);
    pthread_join(tid,NULL);
    printf("CHILD: value = %d",value); /* LINE C */
}
else if (pid > 0) { /* parent process */
    wait(NULL);
    printf("PARENT: value = %d",value); /* LINE P */
}
```

```
22      void *runner(void *param) {
23          value = 5;
24          pthread_exit(0);
25      }
```

Q3 **(16 points)**. Question 5.17 from the 10th edition of the book on the page EX-13 of the book (page 323 of the pdf).

Q4 **(10 points)**. Question 5.24 from the 10th edition of the book on the page EX-14 of the book (page 324 of the pdf).

Q5 **(10 points)**. Question 5.35 from the 10th edition of the book on the page EX-16 of the book (page 326 of the pdf).