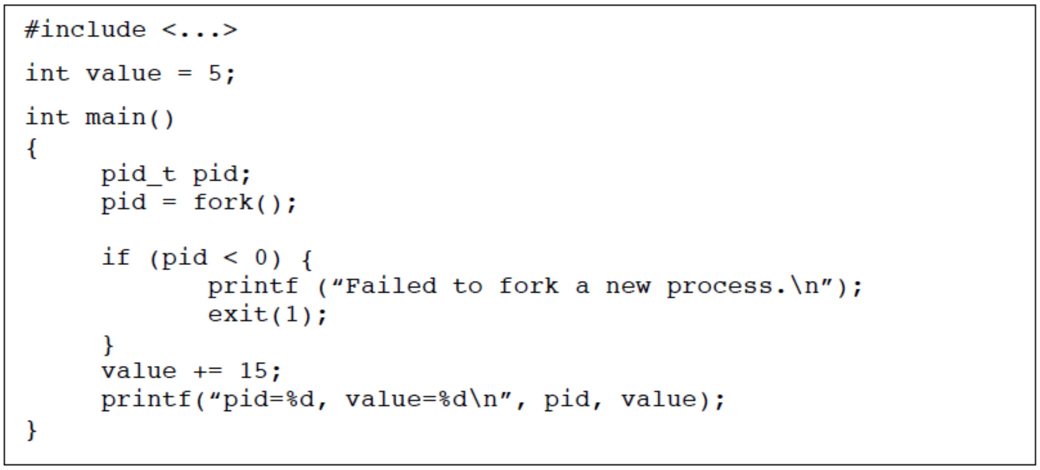
Chapter 2 Assignment

Q1. Processes



```
#include <...>

int value = 5;

int main()
{
     pid_t pid;
     pid = fork();

     if (pid < 0) {
            printf (“Failed to fork a new process.\n”);
            exit(1);
     }
     value += 15;
     printf(“pid=%d, value=%d\n”, pid, value);
}
```

This C program creates a child process using the system call fork(). If the child process is created successfully:

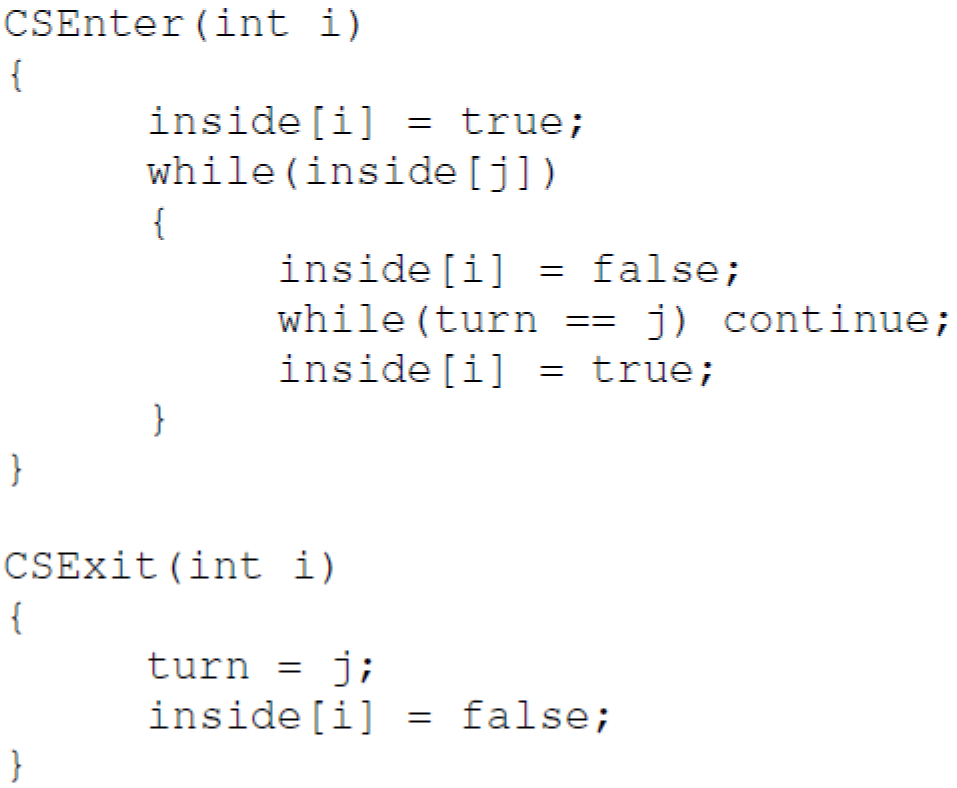
a) What will be the output? (Assume the created new child process pid = 1000);
b) How many lines will it output? (If your answer is one line, then skip part (c). Otherwise, continue.)
c) If we want to output the message only once, in the parent process, how should the program be modified?

Q2) Threads

a) What resources are shared among different threads in a multithreaded process?
b) What resources are private to each thread in a multithreaded process?
c) One problem for user-level thread packages is that the invocation of blocked system calls in one thread will block all the threads in the same process. How can we solve it?

Q3) Synchronization

Explain what goes wrong in the following synchronization Algorithm:

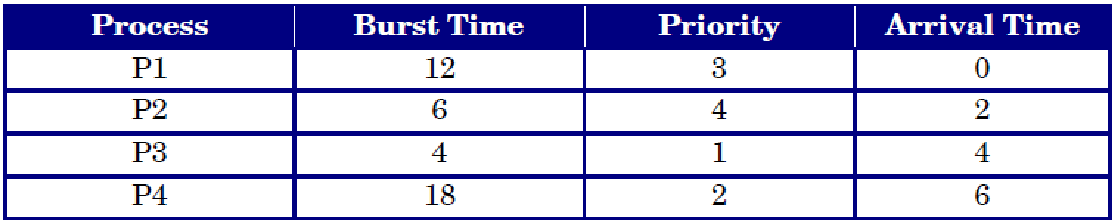


```
CSEnter(int i)
{
      inside[i] = true;
      while(inside[j])
      {
           inside[i] = false;
           while(turn == j) continue;
           inside[i] = true;
      }
}

CSExit(int i)
{
      turn = j;
      inside[i] = false;
}
```

Q4) Scheduling

Assume an OS needs to schedule four processes using different scheduling algorithms. For each process, the following table shows its burst time (processing time), priority (lower numbers mean higher priority), and arrival time.



Process	Burst Time	Priority	Arrival Time
P1	12	3	0
P2	6	4	2
P3	4	1	4
P4	18	2	6

Table 1. Process Information

Questions: What is the average waiting time of those processes for each of the following scheduling algorithms? (Draw a Gantt chart for each algorithm.)

a) First Come First Serve (FCFS)
b) Non-preemptive Shortest Job First (NP-SJF)
c) Preemptive Shortest Job First (P-SJF)
d) Priority Scheduling

e) Round Robin (Assumption 1: The scheduling time quantum is 5 time units. Assumption 2: If a new process arrives at the same time as the time slice of the executing process expires, the OS puts the executing process in the ready queue, followed by the new process.)

Q5) Scheduling

Five batch jobs A through E, arrive at a computer center at almost the same time. They have estimated running times of 11, 6, 2, 4, and 8 minutes. Their (externally determined) priorities are 3, 5, 2, 1, and 4, respectively, with 5 being the highest priority. For each of the following scheduling algorithms, determine the mean process turnaround time. Ignore process switching overhead.

a) Round-robin
b) Priority scheduling
c) First come, First served (run in order 11, 6, 2, 4, 8)
d) Shortest job first

For (a), assume that the system is multi-programmed, and that each job gets its fair share of the CPU. For (b) through (d) assume that only one job runs at a time, until it finishes. All jobs are completely CPU bound. Assume that the time quantum of the scheduler is 1 minute.