CS342 Fall 2016
Homework 2

Assigned: Nov 1, 2016, Monday
Due date: Nov 6, 2016, Sunday, 11:55pm, through Moodle.

Q1. How many processes, including the initial process, are created by the following pseudo-code? Which values are printed out?

```
int x=10;
main()
{
        for (i=0; i<5; ++i) {
                if ((i % 2) == 0) {
                        print (x);
                        x += 10;
                        fork();
                }
        }
}
```

Q2. Schedule the following processes using the earliest deadline first (EDF) algorithm for the first 300 time units.

A: cputime: 10; period: 80
B: cputime: 20 period: 60
C: cputime 40: period 150

Q3**.** Assume there are N processes in a ready queue in decreasing order with respect to their lengths (burst length). The length of process k is k time units ($1 <= k <= N$). Process N is head and process 1 is tail. Compute average waiting time (averaged over all processes) for each of the following scheduling algorithms: FCFS, SJF, RR(q=1 time unit). What is the maximum response time that a process can face when a) FCFS is used; b) SJF is used; c) RR(q=1) is used. Assume response time is not including executing time.

Q4. Assume a cigarette requires three ingredients (items) to smoke: Tobacco (t), Paper (p) and a Match (m). Assume there are 3 smokers around a table, each of whom has an infinite supply of one of the three ingredients (items) — one smoker has an infinite supply of tobacco, another has an infinite supply of paper, and the third has an infinite supply of matches. Assume there is also a non-smoking agent which has also an infinite supply of these items. The agent enables the smokers to make their cigarettes by randomly selecting and putting two items (out of three items) on the table. Then the smoker having the missing item will take the items from the table (in this way will make the table empty), will make his cigarette, and will be able to smoke for a while. When table becomes empty, agent again chooses two items in random and places them on the table. Another smoker can now smoke (or maybe the currently smoking smoker will take those items again and start smoking again after it has finished its current smoking). This process continues forever. Synchronize the agent and 3 smokers by use of semaphores to act in this way.

Q5. We have the following five processes (A, B, C, D, E) and their arrival times and CPU burst times respectively.

A 0 40
B 15 25
C 25 30
D 35 45
E 55 25

For each of the scheduling schemes below, find out the finish time, waiting time, and turnaround time of each process.

a) FCFS
b) Shorted Job First (SJF) (no pre-emption)
c) Round Robin RR (time quantum q=10)
d) Round Robin (RR) (time quantum q=30)

Q6. Assume a resource type X has N instances. Implement a monitor **MonitorAllocX** (write below the complete monitor pseudo-code) that will control access to this resource: that means at most N processes can access the resource concurrently. Your monitor should have two functions, request() and release(), that can be called by a process.

A process will access the resource according to the following protocol:

```
MonitorAllocX MX;//declare the monitor object MX
…
MX.request();
// access a resource instance …
     // a single instance is accessed
MX.release();
```

Monitor **MonitorAllocX** {

```
// write your answer her
```

}

Q7. Describe the system call invocation mechanism in a system.

Q8. Write the advantages of implementing threads in kernel space compared to user space.