CMPT-300 Day: Mid-Term Examination SAMPLE

1 Questions

Be prepared that the actual mid-term may have different type/number of questions.

1.1 Question 1

Please briefly answer each of the following questions.

a) List and explain the four necessary conditions for a deadlock.

Answer Key:

1. Mutual exclusion: At most one process can access that resource at any instant
2. hold and wait: A process holding some recources can still request new recources
3. no preemption condition: Resources must be explicitly released by the process holding them
4. circular wait: A circular chain of processes, each of which is waiting for a recource held by the next member of the chain

b)Is it sufficient to disable all interrupts in order to achieve mutual exclusion? Why or why not?

Answer Key: No, e.g., multi-processor system.

1.2 Question 2

To keep the system from being attacked by harmful processes, OS needs helps from hardware. Please describe how each of the following hardware can be employed to guard the system.

a)mode bit

b)timer

c)base and limit registers

Answer Key
a) The mode bit specifies user mode or kernel mode. User processes run in user mode, and privileged instructions can only run in kernel mode. Since only OS can set this bit to kernel mode, it protects these instructions from being used by harmful user processes.
b) Without the timer, user process may run forever, that is, OS loses the control of system.
c) The base and limit registers for a process indicate the range of memory that process can access. Any attempt to access memory outside that range will cause an error.

1.3 Question 3

Process	Arrival Time	Run Time
A	0.0	10
B	0.2	6
C	0.8	2
D	1.2	4
E	2.2	8

Table 1: Table for processes' arrival and run time

Suppose that each of the processes in the above table arrives for execution at the times indicated. Each process will run the listed amount of time. Please calculate the average turnaround time for these processes with the shortest remaining time next scheduling algorithm. Ignore process switching overhead. And all jobs are completely CPU bound.
Answer Key:
Following is the sequence of execution. Each pair *(P,st,et)* contains the process *P*, the staring time *st* and the ending time *et*.
(A,0,0.2),(B,0.2,0.8),(C,0.8,2.8),(D,2.8,6.8),(B,6.8,12.2),(E,12.2,20.2),(A,20.2,30).
Thus, the turnaround time for process A through E are 30, 12, 2, 5.6 and 18. The mean turnaround time is 13.52.

1.4 Question 4

Suppose we have already implemented the *mutex_lock* and *mutex_unlock* operations for mutexes. Please write the pseudocode to implement the *up* and *down* operations for a semaphore s using two mutexes $m1$ and $m2$. Notice that both operations are atomic actions, that is, once one of operations has started, no other processes can access this semaphore until the operation has completed or blocked. You are NOT allowed to use any other mutual exclusion approaches except the mutexes.

Answer Key:

```
mutex m1 = 1;
mutex m2 = 0;
int count = N; //N is the initial value of semaphore
```

```
void down(&s)
{
  mutex_lock(&m1);
  count--;
  if ( count < 0 )
  {
     mutex_unlock(&m1);
     mutex_lock(&m2);
  }
  mutex_unlock(&m1);
}
```

```
void up(&s)
{
    mutex_lock(&m1);
    count++;
    if ( count <= 0 )
       mutex_unlock(&m2);
    else
       mutex_unlock(&m1);
}
```