1) Shortest Job First Schedulers
   a. ensure fairness
   b. avoid Starvation
   c. minimize average waiting time
   d. both a and b
   e. none of the above

2) For a round-robin scheduler
   a. average waiting time is longer than in preemptive SJF
   b. context-switch overheads favour short time quantum
   c. context-switch overheads favour long time quantum
   d. both a and c
   e. none of the above

3) Initializing a semaphore $S$ with a negative value $N$ may result in a situation where
   a. $N$ processes will be forced to wait before passing a wait call on $S$
   b. if any process is forced to wait, any subsequent signal on $S$ will restart it
   c. $N$ processes can pass a wait call before any process is forced to wait
   d. none of the above

4) A simple spinlock (loop testing a variable, while attempting to set it atomically)
   a. is efficient for single processor systems
   b. wastes CPU cycles
   c. maybe useful for a very short critical section with a low probability of contention
   d. both b and c
   e. all of the above

5) SJF is difficult to implement in real Operating Systems because
   a. it requires knowledge of future CPU bursts
   b. it has large switching overheads
   c. is not fair to all processes
   d. all of the above
6) Draw the state diagram of a process from its creation to termination, including all transitions and briefly elaborate each state and transition?

7) A solution to the critical section problem must satisfy three requirements. Explain briefly the three requirements?

8) What is the difference between preemptive and non-preemptive SJF scheduling?

9) Five processes A, B, C, D, E arrive in this order at the same time with the following CPU burst and priority values. A smaller value means a higher priority.

<table>
<thead>
<tr>
<th></th>
<th>CPU Burst</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>C</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>D</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>E</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

Draw the Gantt chart for the following scheduling schemes and calculate the average waiting time?

- a) FCFS
- b) Non-preemptive SJF
- c) Priority scheduling
- d) Round-robin (time quantum = 2)

10) What are the possible outputs when the processes A and B run concurrently. Assume that the shared variables X and Y are initialized to 0.

<table>
<thead>
<tr>
<th>Process A</th>
<th>Process B</th>
</tr>
</thead>
<tbody>
<tr>
<td>while (X == 0) { // do nothing } printf(“a”); Y = 1; Y = 0; printf(“d”); Y = 1;</td>
<td>printf(“b”); X = 1; while (Y == 0) { // do nothing } printf(“c”);</td>
</tr>
</tbody>
</table>