**CS 6025 Operating Systems**

**Homework 1**

**1. What are the three themes of an operating system? Explain each of the function briefly. (5 point)**

**2. What are the differences of orphan processes and zombie processes? (5 point)**

**3. What are the differences between a monolithic kernel and a microkernel? (5 point)**

**4. What is system call used for? (5 point)**

**5. What is a process? What are the two essential parts of a process? How is a process different from a program? (5 point)**

**6. Given the five-state process model, explain how does a process transit among these states and on what events? (5 point)**

**7. What are the differences of threads and processes? (5 point)**

**8. Discuss the advantages and disadvantages of user-level threads and kernel-level threads. (15 point)**

**9. What is the deadlock? (5 point)**

**10. What are the commonalities and differences between semaphore and mutex? (10 point)**

**11. List different ways to avoid race conditions. (5 point)**

**12. What are the advantages and disadvantages of busy-waiting and sleep-and-wake approaches for mutual exclusion? (10 point)**

**13. Discuss the goals of CPU scheduling on different computer systems, e.g., batch systems, interactive systems and real-time systems. (5 point)**

**14. Assume that the following processes are to be executed on a uniprocessor system.**

**Based on their arrival time and CPU burst, calculate the average turnaround time and average response time under the following scheduling policies: (15 point)**

**a. FCFS**

**b. Round Robin (quantum = 4 and 6)**

**c. Shortest Job First (preemptive and non-preemptive)**

**Process Arrival Time CPU burst**

**P1 0 12**

**P2 0 3**

**P3 2 7**

**P4 3 5**

**Compare the performance of above policies.**

(PS: for P1 and P2 in FCFS, we might have two cases: P1 scheduled first; P2 scheduled first)

Please show your calculation steps and fill in the following table:

|  |  |  |
| --- | --- | --- |
| FCFS | P1 first | P2 first |
| Avg Turnaround |  |  |
| Avg response |  |  |

|  |  |  |
| --- | --- | --- |
| RR | Q=4 | Q=6 |
| Avg Turnaround |  |  |
| Avg response |  |  |

|  |  |  |
| --- | --- | --- |
| SJF | Preemptive | Non-preemptive |
| Avg Turnaround |  |  |
| Avg response |  |  |