EE 536: IoT Systems
Assignment No: 2

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Related topics:

- **OSs for IoT devices**
- **Computer networks**

Comparing different task scheduling strategies (OS)

Table 1 shows the arrival time, execution time[1] and priority (larger the value higher the priority) of 5 processes whose PID (process ID) are listed in the first column. These processes are going to be executed in a single-processor system.

PID	Arrival time	Exec time	Priority
03	5	8	2
07	7	4	5
11	8	2	3
09	15	19	2
15	17	3	4

Table 1: Arrival and execution time of various processes

1. Using Gantt charts illustrate the execution of the above processes when the following scheduling algorithms are employed
   (a) First come first served
   (b) Round robin with quantum 2
   (c) Nonpreemptive shortest job first
   (d) Preemptive shortest job first.
2. Find the *turnaround time* and *waiting time* of the each processes for each of the above scheduling algorithms. Which one of the above algorithms results in least average waiting time?
3. Let us assume that interrupt occurred twice while the processes mentioned in the table 1 were getting executed/waiting in the queue. The first interrupt occurred at 10th time unit and the second one at 20th. Both the times, 5 time units were spent to complete the tasks associated with the interrupt. Recalculate the turnaround time and waiting time of each of the processes for all the four scheduling algorithms.

[1] the time needed to complete the task by a processor

4. When a process needs access to additional resources, e.g., I/O, during its execution, it, typically, puts a lock on such resources to avoid any possible alteration of data to be read/written by some other processes. Such locks are removed only after the locking process has run to its completion. If the processes with PID 03 and 11 need to access the same set of I/O pins and they lock the I/O pins the moment they get scheduled, what change you will notice in the execution of the processes for all the five scheduling algorithms.

Computer networks

1. Describe an application-layer message, a transport layer segment, a network layer datagram, and a link-layer frame in detail and point out the difference between each.

2. Explain hand-shaking protocol. Why do HTTP, FTP, SMTP run on TCP rather than on UDP. In addition, explain the advantages of UDP.

   (a) Suppose a transaction needs to be done from a remote client to a server as fast as possible. Would you use UDP or TCP? Why?

   (b) Consider an HTTP client that wants to receive a web document from a given URL. IP address of HTTP server is initially unknown. Which transport and application-layer protocol are needed in this scenario?

3. Suppose *Host A* sends two TCP segments back to back to *Host B* over a TCP connection. The first segment has sequence number 90; the second has sequence number 110.

   (a) How much data is in the first segment?

   (b) Suppose that the first segment is lost but the second segment arrives at B. In the acknowledgement that Host B sends to Host A, what will be the acknowledgement number?

4. Consider a reliable data transfer protocol that uses only negative acknowledgements. Suppose the sender sends data only infrequently. Would a NAK-only protocol be preferable to a protocol that uses ACKs? Why? Now suppose the sender has a lot of data to send and the end-to-end connection experiences few losses. In this second case, would a NAK-only protocol be preferable to a protocol that uses ACKs? Why?

Hints and reading materials

Check the OS-ref pdf located inside the same folder.