CG2271 Real Time Operating Systems

Tutorial 6

Question 1

a. Explain why a process using DMA does not require the CPU when it is waiting for I/O, and is therefore safe to put into a blocked state.

b. Suppose we have a device that requires the process to transfer data on its own, byte by byte, using an algorithm like this:

   i.   Initiate read on device.
   ii.   Wait for byte or END signal.
   iii.   if END signal received, goto step vi.
   iv.   Transfer byte to buffer.
   v.   Goto step ii.
   vi.   Exit.

Explain the impact of such a device on a system that has to run multiple processes. In particular, what further impact is there on the system if each byte of data must be read within a limited time span?

Question 2

a. Given that the probability of a process accessing an I/O device (via DMA or other similar mechanism) is p, explain why the probability of n processes accessing an I/O device is p^n.

b. Now explain why the CPU utilization would be given by $1-p^n$.

Question 3

a. Using Excel or any similar software, plot the CPU utilization chart for $n=1..10$, for $p=0.2$ using the formula $Utilization=1-p^n$. Similarly plot charts for $p=0.4, p=0.8$ on different charts.

b. Based on the charts that you obtain, explain how n and p affect the CPU utilization.