



G51CSA Homework/Tutorial problems – #7

1. Suppose that we have a multiprogrammed computer in which each job has identical characteristics. In one computation period, T , for a job, half the time is spent in I/O and the other half in processor activity. Each job runs for a total of N periods. Assume that a simple round-robin priority is used, and that I/O operation can overlap with processor operation. Define the following quantities:

- Turnaround time = actual time to complete a job
- Throughput = average number of jobs completed per time period T
- Processor utilisation = percentage of time that the processor is active (not waiting)

Compute these quantities for one, two, and four simultaneous jobs, assuming that the period T is distributed in each of the following ways:

- (a) I/O first half, processor second half
(b) I/O first and fourth quarters, processor second and third quarters

2. A program computes the row sums

$$C_i = \sum_{j=1}^n a_{ij}$$

of an array A that is 100 by 100. Assume that the computer uses demand paging with a page size of 1000 words, and that the amount of main memory allotted for data is five page frames. Is there any difference in the page fault rate if A were stored in virtual memory by rows or columns? Explain.

3. Suppose the page table for the process currently executing on the processor looks like the following. All numbers are decimal, everything is numbered starting from zero, and all addresses are memory bytes addresses. The page size is 1024 bytes.

Virtual Page Number	Valid bit	Page frame number
0	1	4
1	1	7
2	0	--
3	1	2
4	0	--
5	1	0

What physical address, if any, would each of the following virtual addresses correspond to?

- (i) 1052 (ii) 2221 (iii) 5499

4. The following sequence of virtual page number is encountered in the course of execution on a computer with virtual memory:

3, 4, 2, 6, 7, 1, 3, 2, 6, 3, 5, 1, 2, 3

Assume that least recently used (LRU) page replacement policy is adopted. Plot a graph of page hit rate (fraction of page references in which the page is in main memory) as a function of main memory page capacity n for $1 \leq n \leq 8$. Assume that main memory is initially empty.