

## Tutorial 9

### Virtual Memory

Attempt the following questions before you attend tutorial.

1. In your own words, explain what is meant by code and data locality?
2. Assume we have a demand-paged memory. The page table is held in registers. It takes 16 milliseconds to service a page fault. Memory access time is 100 nanoseconds. Assume that page-fault rate is 0.001. What is the effective access time for this memory system? (Note: 1 millisecond = 1,000 microseconds = 1,000,000 nanoseconds)
3. What is the cause of thrashing? How does the system detect thrashing? Once it detects thrashing, what can the system do to eliminate this problem?
4. Given the following demand paging system, fill in the entries in the page table by writing the appropriate frame number. Enter i or v in the valid/invalid bit. Assuming that each page is 1024 words, write the physical address of the following logical address of the process, in the form (page frame no, offset) format.
  - (i) 2056
  - (ii) 4500

|   |   |
|---|---|
| 0 | A |
| 1 | B |
| 2 | C |
| 3 | D |
| 4 | E |

logical  
memory

|   |  |  |
|---|--|--|
| 0 |  |  |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |

page  
table

|    |   |
|----|---|
| 0  |   |
| 1  | C |
| 2  |   |
| 3  |   |
| 4  | A |
| 5  | D |
| 6  |   |
| 7  |   |
| 8  |   |
| 9  | E |
| 10 |   |

physical  
memory