Santa Clara University

Department of Computer Engineering

Advanced Operating Systems (COEN 383)

Project-4 Preview (10 pts)

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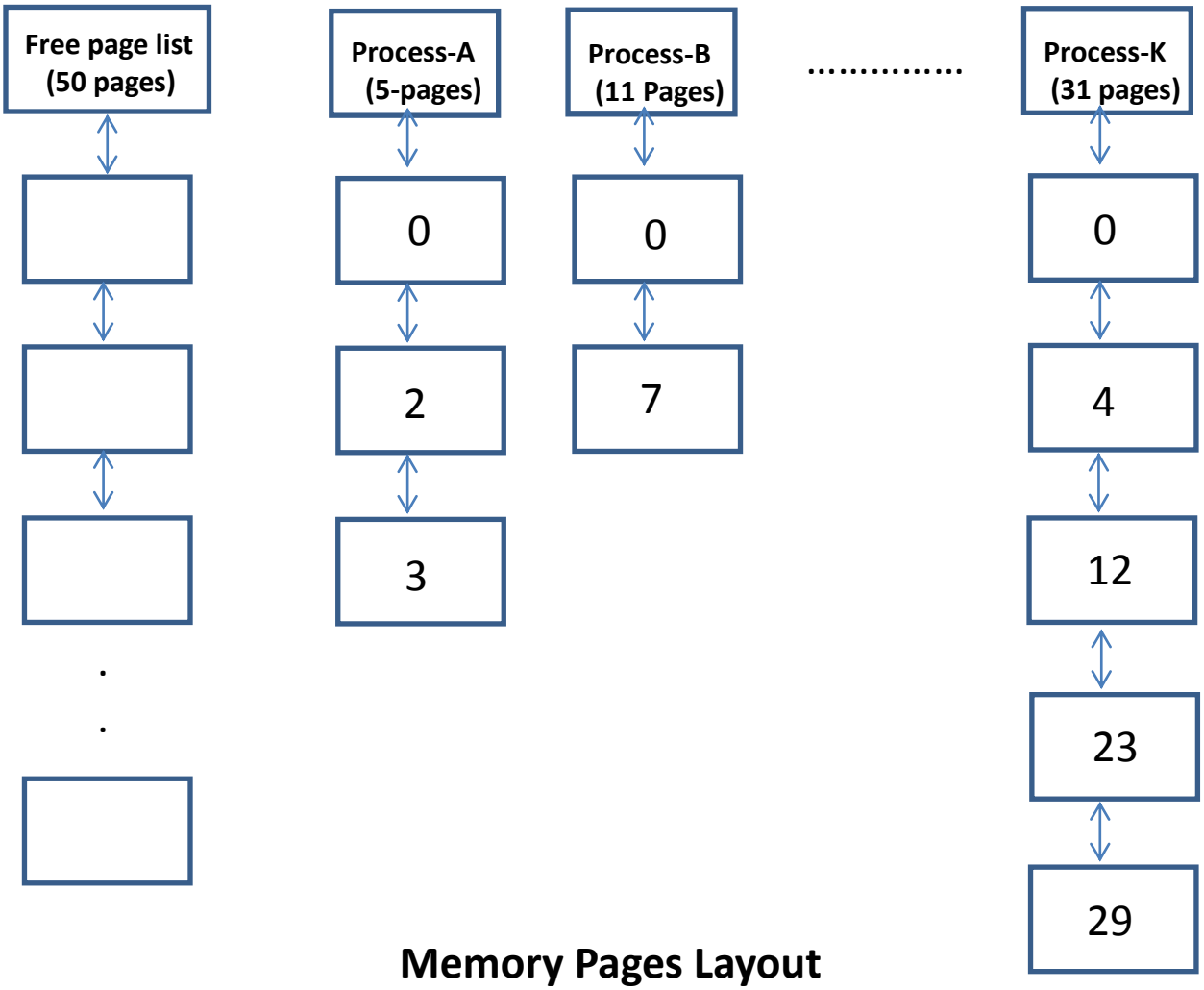
Page Replacement Algorithms Simulator

We will build simulation written in Java, C or C++ programming language that experiment with multiple processes running concurrently, each process do start at page-0 then every 100 msec it references random page from its own address space taking into consideration the locality of reference algorithm as described in the Homework assignment.



Memory Pages Layout

P.S. L**ocality of reference**, after referencing a page i, there is a 70% probability that the next reference will be to page i, i-1, or i+1. i wraps around from 10 to 0. In other words, there is a 70% probability that for a given i, Δi will be -1, 0, or +1. Otherwise, $|\Delta i| > 1$.

Workload Generation

We will generate 150 jobs <process Name, Process size in pages, Arrival time, Service Duration>. Sort the random jobs generation based on arrival time and having them structured as linked list. Processes have randomly and evenly distributed sizes of **5, 11, 17, and 31** MB. Processes have randomly and evenly distributed service durations of **1, 2, 3, 4, or 5** seconds.

Simulator:

1. Generate the workload and represent it as sorted queue based on arrival time
2. Create and initialize the free page list, initially with 100 pages, each is 1 MB.
3. Pick up one job at a time from the Job queue and if there are 4 free pages in the free page list then start running that process, otherwise wait till one of the existing processes complete. Each process is represented by a header and linked list of its memory resident pages.
4. Generate the appropriate record whenever starting or completing a job <time stamp, process name, Enter/exit, Size in Pages, Service Duration, Memory-map>.
5. Once a job start execution, it generates a memory reference every 100 msec to a random page from its own virtual address space; need to generate an appropriate record <time-stamp in seconds, process Name, page-referenced, Page-in-memory, which process/page number will be evicted if needed>.
6. If memory is all used and process reference a page that is not currently in memory then we need to apply the chosen "page replacement Algorithm" to select a victim page to evict so you can bring to memory the needed page.

7. Run the simulator 5 times, each is 1 minute, and each time using different replacement algorithm (algorithms **FIFO**, **LRU**, **LFU** (Least Frequently Used), **MFU**, and **random pick**).
8. Continue running until the 1 minute expires, collect and save the requested statistics and exits.
9. Run simulator 5 times, each to complete the one minutes, and compute the hit/miss ratio of pages referenced by the running jobs for each run. Then get average of 5 runs.
10. Run the simulator for 100 page references, and for each reference, print the <time-stamp in seconds, process Name, page-referenced, if-Page-in-memory, which process/page number will be evicted if needed>.
11. For each replacement algorithm, print the average number of processes (over the 5 runs) that were successfully swapped-in.