COSC 3360 - Operating Systems Spring 2025

Programming Assignment 3 - Page Replacement

Due Date: April 25, 2025, 11:59pm CDT

Objective

You are to write a short program simulating several page replacement policies for a mobile operating system found in cellular phones and other wireless information devices. An additional constraint on a mobile OS is that page replacement can only be performed when airtime (bandwidth or channel) is available. The main memory is local in the cellphone, and the "secondary storage" is in the cloud. To give you more time to prepare for the exams, this programming assignment is designed to be very simple. No Unix/Linux processes, semaphores, or pipes are needed.

Specifications

Your program should be able to simulate the following page replacement policies:

1. FIFO (first-in-first-out) page replacement policy (the replaced page is the one which came in first).
2. LRU (least-recently-used) page replacement policy (the replaced page is the one which was least recently used).
3. LIFO (last-in-first-out or stack).
4. MRU (most recently used), the replaced page is the most recently used.
5. LFU (least frequently used), the replaced page is the least frequently used.
6. Optimum (OPT) page replacement policy with x pages of look-ahead (minimizes the number of page faults by looking-ahead at the memory references).

All parameters are to be passed through the program argument vector:

```
assign3 memory_size x
```

where memory_size is the total number of page frames in the physical memory and x is the number of pages of look-ahead.

Your input data will be a sequence of page references such as:

```
1:a 1:a 1:n 1:a 2:n 3:a 3:n 3:n 4:a 4:a 4:n  ...
```

Each page number is followed by : and either a (means air bandwidth is available for page replacement if needed) or n (means air bandwidth is NOT available for page replacement). If air bandwidth is not available for page replacement when needed, then this page reference is queued until air bandwidth becomes available, at which time the page replacement is performed. In a real scenario, this means delayed service.

Optional Bonus Part (20 points):

Implement a look-ahead OPT-MOBILE technique (examine x page references ahead) that will minimize the number of delayed page replacements.

Your program should print for each replacement policy the total number of page references in the input data, the number of page faults, and the number of delayed page replacements due to unavailable air bandwidth.