SFWRENG 3SH3 Operating Systems

by Dr. Anwar M. Mirza
Lab Demo: **During Lab time of week starting from March 28th, 2022**
Lab Report: **Due before April 6th, 2022 Midnight.**

Lab Assignment 04

Date: March 20th, 2022

Virtual Memory Management

1. Background

In this assignment you will explore and test various virtual memory paging schemes. The lab assignment is based on the material covered in Lectures 22 to 24, and section 10.4 (Chapter 10) of the textbook.

2. Assignment

Q.No. 1. Consider a virtual memory paging system with N pages and M page-frames. Given a page reference string (of size greater than 10 and terminated by a value of -1), write a C/C++ program that simulates the following page replacemen algorithms:

    I.   FIFO Page Replacement (section 10.4.2)
    II.   Optimal Page Replacement (section 10.4.3)
    III.   Least Recently Used (LRU) Page Replacement (section 10.4.4)

Your program should read the input (N, M, and the reference string) from a text/data file. It should print the number of page faults for each of the page repalcement algorithms given above.

Sample Input: (Save the following in a text file called "sample.dat")

```
8 3
7 0 1 2 0 3 0 4 2 3 0 3 2 1 2 0 1 7 0 1 -1
```

Here 8 is N and 3 is M in the first line. The second line is the reference string (-1 indicating the end of the string). You should test for this sample input and one or more of your own input data. For example, you can use the same reference string and number of pages, but with 4 page-frames and compare the number of faults obtained with 3 page-frame case (to check for Belady's anomaly).

Output: Your output for the given sample.dat data file should look like:

```
Number of pages: 8
Number of frames: 3
Size of the reference string: 20
Reference String:
 7 0 1 2 0 3 0 4 2 3 0 3 2 1 2 0 1 7 0 1

FIFO
  7  0  1  2  0  3  0  4  2  3  0  3  2  1  2  0  1  7  0  1
 -----------------------------------------------------------
  7  0  1  2  2  3  0  4  2  3  0  0  0  1  2  2  2  7  0  1
 -1  7  0  1  1  2  3  0  4  2  3  3  3  0  1  1  1  2  7  0
 -1 -1  7  0  0  1  2  3  0  4  2  2  2  3  0  0  0  1  2  7
  p  p  p  p     p  p  p  p  p  p        p  p        p  p  p
 -----------------------------------------------------------
15 page-faults
```

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```
Optimal
  7  0  1  2  0  3  0  4  2  3  0  3  2  1  2  0  1  7  0  1
 ----------------------------------------------------------------
  7  7  7  2  2  2  2  2  2  2  2  2  2  2  2  2  2  7  7  7
 -1  0  0  0  0  0  0  4  4  4  0  0  0  0  0  0  0  0  0  0
 -1 -1  1  1  1  3  3  3  3  3  3  3  3  1  1  1  1  1  1  1
  p  p  p  p     p     p           p           p           p
 ----------------------------------------------------------------
9 page-faults

LRU
  7  0  1  2  0  3  0  4  2  3  0  3  2  1  2  0  1  7  0  1
 ----------------------------------------------------------------
  7  7  7  2  2  2  2  4  4  4  0  0  0  1  1  1  1  1  1  1
 -1  0  0  0  0  0  0  0  0  3  3  3  3  3  3  0  0  0  0  0
 -1 -1  1  1  1  3  3  3  2  2  2  2  2  2  2  2  2  7  7  7
  p  p  p  p     p     p  p  p  p           p        p     p
 ----------------------------------------------------------------
12 page-faults
```

3. Guideline

- Work in your already allocated teams.
- You are recommended to use the Lab hours to carry out this work. TAs will be available during their respective Lab sessions for your in-person / online help.
- For this lab, you need to
    a. Give a lab demo during the time slot allocated to your Lab group by the TA, during the week starting from March 28th, 2022.
    b. You report should contain a copy of your final program/code along with input data file(s), and corresponding program output(s). The due date for report submission is April 6th, 2022 (before Midnight).
- Copying/reproduction of (all or parts of) reports from other groups will lead to zero marks for the whole team.

Please use MS Teams Lab Q&A and Lab Section channels to coordinate your work with your team members and with the TAs.

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