

## CSE306: Spring 2019

### Project 2 – Memory Management

**Out: March 12**

**Due: April 11**

**What to do.** Implement the *Memory* module of OSP2.

The project files are found on the Blackboard in the Assignments section.

Details of what you are supposed to do are given in the OSP2 manual (the chapter on memory management). The additional requirements are:

1. You have to implement a *modified* 2-handed clock (M2HC) page replacement algorithm similar to (but not exactly) the one described on pages 380-381 in the textbook. You also have to use the dirty-bit optimization (if you do not optimize for clean frames, OSP2 issues warnings, which is *not* OK and you will lose points).
2. The M2HC page replacement algorithm works as follows.
  - (a) The *first hand*, called the *cleaner*, sweeps all eligible (for replacement) frames<sup>1</sup> at regular intervals of 4000 clock ticks and sets the use bits of these frames to 0.<sup>2</sup> To arrange for an asynchronous process to run at regular intervals, use the OSP2 feature called *daemon*. Read about daemons in the OSP2 manual.
  - (b) At page faults, if no free frame is available, the *second hand*, called the *chooser*, sweeps the eligible frames and selects one with the use bit of 0 for replacement. If no such frame exists, choose some eligible frame at will.
  - (c) In addition, the daemon (that runs on behalf of the cleaner hand) should swap out approximately every 10th *dirty* page it finds.

Your objective in this project is to get your implementation to run under OSP2 without errors and warnings with the parameter files that appear in the `Misc` subdirectory (the files with the `.osp` extension). As explained earlier, occasional errors (every 7-10<sup>th</sup> run) should not be a cause of concern, if they are unrelated to memory management.

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<sup>1</sup> You have to figure out which pages are eligible based on your studying of the subject of memory management.

<sup>2</sup> You should be able to use the *referenced* flag of OSP2 frames as the use bit. Or create your own.

**Statistics.** Compare and explain your statistics with respect to those produced by Demo.jar. (Demo.jar uses a very simplistic algorithm for page replacement: it scans the entire frame table and chooses the first replaceable frame.) The statistics of interest are:

- The number of pages swapped in and out
- CPU utilization
- Service time per thread (avg turnaround time)
- Normalized service time per thread (avg normalized turnaround time)

These statistics are part of the snapshots in the file OSP.log, which is produced during the runs. The meaning of these statistics is explained both in the textbook and in the OSP2 manual.

**Important notice on the use of Git.** You **must** use Git to maintain your project files **and** you must make frequent commits to your repository. The Git repository must be in *Github classroom*. Follow this link to create a repository in this course's classroom for Project 2:

<https://classroom.github.com/a/iZyWoeL2>

After a few clicks you will get a repository named `cse306-project-2-YourGithubId`. The repository will automatically become private and you should not attempt to change that. Note: this repository is different from that of Project 1.

We will be checking your repository and your commit logs to make sure that substantial activity has been taking place over a period of time. If there are less than 5 **nontrivial** commits, significant penalty will apply. Other than that, same requirements to your code as in Project 1.

**How to submit.** Zip-up your main branch and submit the zip file via Blackboard. Github has a button for that: *Clone or download/Download ZIP*. Normally, the zip file will have a top folder with a name like `cse306-project-2-YourGithubId-master`, but if not then make sure that your submitted zip file has a top folder with such a name. Do not forget to include your **name** and **Student Id** in the program source-files. Do **not** submit paper-based material.

This project is to be done **individually**. **Each** source file **must** include the following pledge:

**I pledge my honor that all parts of this project were done by me individually, without collaboration with anyone, and without consulting external sources that help with similar projects.**

GOOD LUCK!