COMPUTER ARCHITECTURE
2020 - 2021

TD n°5 - Correction

Exercise 1: manipulate the page table.

The physical memory of a computer is 1 KB. It is divided into four pages (from 0 to 3) of 256 bytes.

A process has a virtual space of 2 KB (i.e., eight pages, from 0 to 7) and successively refers to virtual addresses 240, 546, 600, 547, 10, 1578, 2022, 1100, 56, 1300.

1. Indicate, for each virtual address, the virtual page number and the value of the offset.
2. Indicate, for each reference, the physical address that is accessed. Give the page table and the inverse table after each access for the FIFO replacement algorithm. How many page faults are there? The tables are empty at the beginning.

Exercise 2: overload the processor.

A computer has a main memory of five pages (from 0 to 4) and offers processes a virtual memory of ten pages, managed by the LRU algorithm.

1. Five processes are started. The one with the number 0 works only with page 0, the one with page 1, and so on. How many page faults are there?
2. A sixth process with identical characteristics is started. How many page faults are there? What do you think about it?

Exercise 3: translate virtual addresses into physical addresses.

The virtual address translation simulator **SIMAV** is a program developed at the Ecole Polytechnique de Montréal that helps to understand the phenomenon of translating virtual addresses into physical addresses.

Using a simplified and imaginary schema of an architecture, composed of a virtual memory with 8-bit addresses and a physical memory addressed on 7 bits, students will be able to understand the principle on a simple basis and then extrapolate to more realistic systems.

It has two simulation modes: a single level of pages simulation or a two levels one.

Some guidance on how to use **SIMAV** is available at https://cours.polymtl.ca/inf2610/simulateurs/Simav/HTML/aide.html.

After installing the **SIMAV** simulator on your machine (file to be copied available on Moodle), launch it, and answer the following questions with a level 1:

1. What is the number of virtual pages?
2. What is the number of physical frames?
3. What is the size of the page table?
4. How big is a page and frame?
5. Do the processes share the same page table?
6. What is the largest virtual address that can be used?
7. What is the largest physical address that can be used?
8. Converting address **102** without using the simulator:
   a. Give its value in binary:
   b. What is the value of the offset?
   c. What is the corresponding virtual page?
   d. What would be the physical address if physical page number **2** is selected?
9. Calculate by the simulator the addresses:
   a. Processor 1: 200 = 56 = 65 =
   b. Processor 2: 200 = 168 = 260 =
   c. Processor 3: 200 = 158 = 22 =

Repeat the conversions of the addresses of the different processes (1, 2 and 3) carried out in question 8 with a level 2.