Fundamentos de los Sistemas Operativos (FSO)

Departamento de Informática de Sistemas y Computadoras (DISCA)
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Part 3: Memory management

Seminar 10

Virtual memory exercises (II)

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- **Exercise S10-1: 2nd chance replacement algorithm**
  - Exercise S10-1.1: 2nd chance basic
  - Exercise S10-1.2: 2nd chance complete
- Exercise S10-2: Working set
  - Exercise S10-2.1: Getting the working set

Exercise S10-1.1

- In a **demand paging** system with **local replacement** policy, **4 frames** are allocated to **every process**. The **maximum logical size** of a process is de **4K pages** (3 hexadecimal digits), page size is **64Kbyte**. Suppose that the following table contains all the information related to process Pr_3 at a given time t.

Process Pr_3 information at time t					
Frame (Hexadecimal)	**Page (Hexadecimal)**	**Loading time**	**Last reference time**	**Reference bit**	**Modified bit**
E7	**B72**	**60**	**161**	**1**	**0**
E8	**B71**	**130**	**160**	**1**	**1**
E9	**B70**	**26**	**162**	**0**	**0**
EA	**B73**	**20**	**163**	**1**	**1**

Then process Pr_3 generates the logical address **B745A7C**. Obtain **the physical address** corresponding to this logical address supposing a replacement policy based on 2nd chance replacement algorithm

Exercise S10-1.2

- Suppose a **virtual memory system** based on **demand paging**, where **logical addresses are 24 bit wide** and **page size is 1 KByte**. The system can handle up to **1MB of main memory**. The replacement algorithm used is **local second chance**
  a) Get the **physical and logical address formats** in this system, indicating the bit number and name of every field
  b) Suppose that at time t = 0 a user requests the execution of process A and the system allocates to it frames 0, 1, 2 and 3. The frames are initially empty and they are allocated in increasing order. Show the **evolution of the physical memory content and how many page faults** would generate the following sequence of logical addresses:

  1000, 3000, 5000, 6000, 7000, 2900, 4900, 900

- Exercise S10-1: 2nd chance replacement algorithm
  - Exercise S10-1.1: 2nd chance basic
  - Exercise S10-1.2: 2nd chance complete
- **Exercise S10-2: Working set**
  - Exercise S10-2.1: Getting the working set

Exercise S10-2.1

- In a virtual memory system has been decided to use a **working set model** to control physical memory allocation. There are **3 processes A, B y C** in execution. Every memory access is encoded in two characters that represent the process and the page accessed, respectively.

  a) Supposing that the **working set window size (Δ) is 4**, obtain the **working set for every process** at the instant when the last reference happens in the following reference string:

  A0,B2,C3,A0,A1,A5,B2,C4,C2,A2,B1,B3,C0,A1

  C1,B0,A1,C0,B1,B2,C4,A0,B3,B3, C3,A1,C4

  b) Considering that the system has **6 frames**, are they enough to allocate the working sets of all processes till the end?