UMKB
Faculty: SESNV
Department of Computer Science

Level: 2LMD
Module: Operating Systems 1
Date: 27/05/2023 from 12:00 to 13:30

Exam

Exercise 1 (4 marks)

Consider a paging system with a page size of 1KB, the user memory (physical memory) is 4KB.

1- How many frames (physical pages) are initially available for the execution of processes?

2- Suppose a program of size 8KB, which refers to the logical addresses:

1, 2076, 85, 1500, 3648, 100, 4314, 1025, 89, 5741, 1219, 4500, 7658, 4096, 6999, 7191, 5140, 128

- Give the number of pages that contains this program
- Calculate the couple (p, offset) associated with each memory reference, deduce the associated references sequence?

3- Give the page faults rate induced by a replacement FIFO, LRU, LFU, what is the best algorithm?

Exercise 2 (8 marks)

Consider a system where the memory adopts the paged segmentation method. The page size is 400 B and the segment size is maximum 1200 B. A process, of size 5600 B, needs to execute on the system. This process contains 2000 B as the main program, 1100 B as libraries, 1500 B as functions and 1000 B as data.

1. Say how this process will be partitioned in order to be loaded in the memory (i.e. division in to segments and pages).
2. Was there any internal fragmentation? How many bytes?
3. Construct the segments and pages tables of this process, in the case knowing that the list of free frames is the following: {22, 40, 6, 51, 52, 7, 9, 11, 402, 223, 17, 30, 100, 31, 36, 55, 77, 78, 79, …}

PS: the process is loaded in the order: main program, libraries, functions then data.

4. If the memory word size is 1 byte, how many bits do we need to code the offset?
5. Suppose that the logical address is coded on 16 bits, the segment number takes 3 bits.
   How many bits remain for the page number?
6. Give the physical addresses corresponding to the following binary logical addresses, and say what type is this word (code in main program or data …)?

a) 00000101 10001111
b) 01100010 00001110
c) 01000000 11110000
d) 10100011 10001100

Exercise 3 (5 marks)

1. A CPU-scheduling algorithm determines an order for the execution of its scheduled processes. Given *n* processes to be scheduled on one processor, how many different schedules are possible? Give a formula in terms of *n.*
2. What are the advantages and disadvantages of choosing a small quantum for the Round Robin scheduling algorithm?
3. What is the interest of multi-level scheduling?

4. Consider the following processes:

Process	Arrival time	Burst time	Priority
P1	0	10	2
P2	0	15	3
P3	3	8	4
P4	10	18	5

It is assumed that a scheduling with priority algorithm is used (priorities are increasing: 5 is the highest priority).
a- Draw the Gantt chart for the priorities given in the table.
b- We would like the priority of processes to be dynamic over time. Thus, to calculate the priority of a process, we use the following formula: Priority= (Waiting Time + CPU Remaining Time)/ CPU Time
- Give the Gantt chart knowing that the priority is recalculated every 5 minutes.
c- Calculate the average wait time as well as the average turnaround time.
d- Compare the results obtained with those obtained with the classic priority algorithm.
Note: When calculating, the following example will be rounded: 3.5 or 3.6 → 4, 3.1 or 3.4 →3.

Exercise 4 (3 marks)
1. Classify in a table the following operations according to their interrupt type:
Overflow, failures, dividing by zero, moving a mouse, invalid memory accesses, Page fault, input-output requests, key pressed, access to a privilege memory area.
2. What are the components of the device controller?
3. What is the disadvantage of the programmed I/O mode?
4. What are the differences between synchronous and asynchronous input-output?

Good Luck