

İstanbul Bilgi University
Department of Computer Engineering

SPRING, 2021
Campus: Santral

CMPE 312: OPERATING SYSTEMS

Question on Paging and Virtual Memory

(Duration: minutes)

Name :

Student ID :

NOTE: WRITE NEATLY. MARKS WILL BE GIVEN FOR PARTIAL ANSWERS. THEREFORE, SHOW YOUR WORK AND YOUR REASONING. YOU MAY GET EXTRA POINTS FOR AN APPROPRIATE OBSERVATION OR YOU MAY LOSE SOME MARKS DUE TO AN OBSCURE SOLUTION.

1. {50 points} Virtual memory is a memory management technique based on the idea that the entire program does not really need to reside in main memory. That is, the operating system (OS), in conjunction with the hardware, gives to the users the illusion to reside completely in main memory (MM). When a running program refers to a page, which is not in MM, it makes page fault. The OS handles page fault by finding a free frame and loading the missing page. Explain the following slides:
 - (a) {10 points} 'Steps in Handling page fault' (slide 7 of the presentation uploaded on BilgiLearn)
 - (b) {10 points} 'First-In-First-Out Algorithm' (slide 13 of the same presentation)
 - (c) {10 points} 'Optimal Page Replacement Algorithm' (slide 17)
 - (d) {10 points} 'Least Recently Used Algorithm' (slide 18)
 - (e) {10 points} 'Fixed Allocation' (slide 21)

2. {50 points} 'Paging' is a memory management scheme that permits the physical address space of a process to be non continuous. The basic method for implementing paging involves breaking physical memory into fixed-sized blocks called frames and breaking logical memory into blocks of the same size called pages. When a process is to be executed, all of its pages are loaded into any available memory frame. Figure 1 shows the logical memory of process P_i allocated in several frames in MM. Assuming that 1 byte holds 1 character, looking at Figure 1:

- {5 points} What is the size of a page?
- {5 points} What is the size of a frame?
- {5 points} How big is the logical memory of the process?
- {5 points} How big is the MM?
- {5 points} Give the list of free frames.
- {5 points} Draw the page table of process P_i .
- {5+5 points} Give the logical address (page number, offset) of letter "e", and explain how to convert it into its corresponding physical address (frame number, offset).
- {5 points} Is the problem of internal fragmentation still present? Explain (no point without a valid explanation).
- {5 points} Is the problem of external fragmentation still present? Explain (no point without a valid explanation).

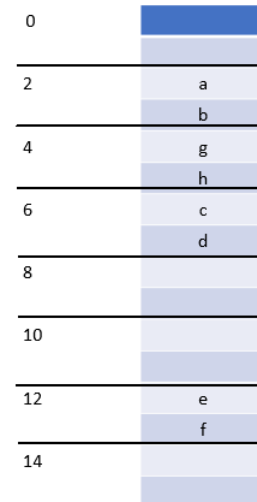
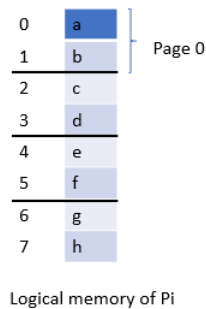


Figure 1: Paging Example