

COMP 3500: Introduction to Operating Systems

Project 5

Points Possible: 100 due: 11:59 pm Nov 17th, 2023

There should be no collaboration among students. A student shouldn't share any project code with any other student. Collaborations among students in any form will be treated as a serious violation of the University's academic integrity code.

Goals:

- To understand the memory in OS.
- To learn how to use memory efficiently.
- To learn the logical address space and physical memory.

Questions:

1. [20 points]

Given five memory partitions of 100Kb, 500Kb, 200Kb, 300Kb, and 600Kb (in order).

- a. How would the first-fit, best-fit, and worst-fit algorithms place processes of 212Kb, 417Kb, 112Kb, and 426Kb (in order)?
- b. Which algorithm makes the most efficient use of memory?

2. [15 points]

Assuming a 1 KB page size, what are the page numbers and offsets for the following address references (provided as decimal numbers):

- a. 30000
- b. 256
- c. 16385

3. [10 points]

Consider a logical address space of 32 pages with 1024 words per page; mapped onto a physical memory of 16 frames.

- a. How many bits are required in the logical address?
- b. How many bits are required in the physical address?

4. [15 points]

Consider the following segment table

Segment	Base	Length
0	219	600
1	2300	14
2	90	100
3	1327	580
4	1952	96

What are the physical addresses for the following logical addresses?

- a. 1, 10
- b. 3, 400
- c. 4, 112

5. [15 points]

Suppose we have free segments with sizes: 6 KB, 17 KB, 25 KB, 14 KB, and 19 KB.

OS
6
In use
17
In use
25
In use
14
In use
19

Place a program with size 13KB in the free segment using first-fit, best-fit, and worst-fit.

6. [25 points]

Consider a user program of a logical address of size 6 pages and page size is 4 bytes. The physical address contains 300 frames. The user program consists of 22 instructions a, b, c, . . . u, v. Each instruction takes 1 byte. Assume that at that time, the free frames are 7, 26, 52, 20, 55, 6, 18, 21, 70, and 90.

Find the following:

- a. Draw the logical and physical maps and page tables with Best-Fit. (I would suggest drawing the tables with software to make them clear.)
- b. Allocate each page in the corresponding frame.
- c. Find the physical addresses for the instructions m, d, v, r (The physical address = page size * frame number + offset).
- d. Specify the fragmentation if it exists.

Submission:

- Submit your solution as a PDF file named "<First Name>_<Last Name>_project5.pdf" through Canvas (for example, mine might read "Tianshi_Che_project5.pdf")
- You must submit a single PDF file that contains your answers.

Rebuttal period:

You will be given **TWO business days** to read and respond to the comments and grades of your homework or project assignment. The TA may use this opportunity to address any concerns and questions you have. The TA also may ask for additional information from you regarding your homework or project.