

# El338 Computer System Engineering Homework 12

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**Exercise 1** Given six memory partitions of 300 KB, 600 KB, 350 KB, 200 KB, 750 KB, and 125 KB (in order), how would the first-fit, best-fit, and worst-fit algorithms place processes of size 115 KB, 500 KB, 358 KB, 200 KB, and 375 KB (in order)?

*Solution.* See Table 1, for every entry, the first number indicates the remaining space of partition and the second number indicates the original size of partition.  $\square$

	115 KB	500 KB	358 KB	200 KB	375 KB
First-fit	185/300 KB	100/600 KB	392/750 KB	150/350 KB	17/750 KB
Best-fit	10/115KB	100/600 KB	392/750 KB	0/200 KB	17/750 KB
Worst-fit	635/750 KB	135/750 KB	242/600 KB	150/350 KB	FAIL

Table 1: Exercise 1

**Exercise 2** Assuming a 1-KB page size, what are the page numbers and offsets for the following address references (provided as decimal numbers):

- a. 3085
- b. 42095
- c. 215201
- d. 650000
- e. 2000001

*Solution.* Assume that the addresses are given in terms of bytes. The results are given in decimal number.

- a. Page number: 3, Offset: 13
- b. Page number: 41, Offset: 111
- c. Page number: 210, Offset: 161
- d. Page number: 634, Offset: 784
- e. Page number: 1953, Offset: 129

$\square$

**Exercise 3** Consider a logical address space of 256 pages with a 4-KB page size, mapped onto a physical memory of 64 frames.

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

*Solution.*

1. Logical address requires  $\log 256 + \log(4 \cdot 1024) = 20$  bits.
2. Physical address requires  $\log 64 + \log(4 \cdot 1024) = 18$  bits.

□

**Exercise 4** Consider a computer system with a 32-bit logical address and 4-KB page size. The system supports up to 512 MB of physical memory. How many entries are there in each of the following?

- a. A conventional, single-level page table
- b. An inverted page table

*Solution.* Number of pages is  $2^{32-\log(4 \cdot 1024)} = 2^{20}$ , and the number of frames is  $512MB/4KB = 2^{17}$ .

1. Number of entries are equal to number of pages  $2^{20}$
2. Number of entries are equal to number of frames  $2^{17}$ .

□