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# ECSE 427, Winter 2020– Assignment 3

**p.254 #4.**

Question**:** Consider a swapping system in which memory consists of the following hole sizes in memory order: 10 MB, 4 MB, 20 MB, 18 MB, 7 MB, 9 MB, 12 MB, and 15 MB. Which hole is taken for successive segment requests of
(a) 12 MB
(b) 10 MB
(c) 9 MB
for first fit? Now repeat the question for best fit, worst fit, and next fit.

**Answer:**

| | a) 12MB | b) 10MB | c) 9MB |
|---|---|---|---|
| first fit | 20MB | 10MB | 18MB |
| best fit | 12MB | 10MB | 9MB |
| worst fit | 20MB | 18MB | 15MB |
| next fit | 20MB | 18MB | 9MB |

**p.254 #7.** Using the page table of Fig. 3-9, give the physical address corresponding to each of the following virtual addresses:
(a) 20
(b) 4100
(c) 8300

**Answer:**

(a) 20 has the physical address: 8192+20 = 8212
(b) 4100 has the physical address: 4100
(c) 8300 has the physical address: 24576+(8300-8191)=24684

**p. 258 #28.** If FIFO page replacement is used with four-page frames and eight pages, how many page faults will occur with the reference string 0172327103 if the four frames are initially empty? Now repeat this problem for LRU.

**Answer:**

- Using FIFO, six page faults occur.
- Using LRU, seven page faults occur.

**p. 258 #38.** Consider the following two-dimensional array:
int X[64][64];
Suppose that a system has four page frames and each frame is 128 words (an integer occupies one word). Programs that manipulate the *X* array fit into exactly one page

and always occupy page 0. The data are swapped in and out of the other three frames. The *X* array is stored in row-major order (i.e., *X*[0][1] follows *X*[0][0] in memory). Which of the two code fragments shown below will generate the lowest number of page faults? Explain and compute the total number of page faults.

*Fragment A*

```
for (int j = 0; j < 64; j++)
for (int i = 0; i < 64; i++) X[i][j] = 0;
```

*Fragment B*

```
for (int i = 0; i < 64; i++)
for (int j = 0; j < 64; j++) X[i][j] = 0;
```

**Answer:**

Fragment B, because it follows the row-major order (goes through all the columns j then increments the rows i, repeats). Since each frame occupies 2 rows, there will be a page fault every 2 rows traversed (outer loop), so 64/2=32 page faults.