**Written Assignment 4**

**CS4352 Operating Systems**

Fall 2018

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Due Date: 12/02, 11:59 pm, soft copy via Blackboard.

Late submissions are accepted till 12/05, 11:59 pm, with 10% penalty each day.

No submissions accepted after 12/05, 11:59 pm

*Question 1:* **(20 points)** What is contiguous allocation for files? (10 points) Contiguous allocation can lead to disk external fragmentation. Please explain why. (10 points)

*Question 2:* **(30 points)** The beginning of a free space bitmap looks like this after the disk partition is first formatted: 1100 0000 0000 0000 0000 (the first block is used by the root directory). The system always searches for free blocks starting at the lowest-numbered block, so after writing file A, which uses 6 blocks, the bitmap looks like this: 1111 1111 0000 0000 0000. Assume that we use **first fit** and **contiguous** **allocation** Show the bitmap after each of the following additional actions (one after another):(5 points for each question)

(a) File B is written, using 4 blocks

(b) File A is deleted

(c) File C is written, using 7 blocks

(d) File B is deleted.

(e) File D is written, using 1 block

(f) File E is written, using 5 blocks

*Question 3:* **(15 points)** Cache hit rate (r) is fraction of blocks found in the cache. If it takes 50 msec to satisfy a request from the cache, but 200 msec to satisfy a request if a disk read is needed.

1. Assume that r = 0.5. What is the mean time required to satisfy a request. (5 points)
2. Give a formula for the mean time required to satisfy a request (mean time is a function of r, called f(r)) (5 points)
3. Plot this f(r) for values of r varying from 0 to 1.0. (5 points)

*Question 4:* **(20 points)** A certain file system uses 4-KB disk blocks. Assume that we have 12 files of from 1-KB to 12KB.

1. What is the total waste of disk space on these files.
2. To reduce the waste of disk space, should we increase the sizes of disk block double, or decrease them to 2-KB? Please explain.

*Question 5:* **(15 points)** What are the typical techniques used for optimizing file system performance? Please briefly describe each of them.

Total points: 20+30+15+20+15 = 100 points

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