**Homework Assignment #4**

***Due Date: 4/1, 11:59 p.m. Please submit via Blackboard. Late submissions are accepted till 4/6, 11:59 p.m., with 10% penalty each day.***

***Please name your submission file starting with “LastName\_FirstName\_HW4”.***

**Q1. (Problem 10)** Consider the directory tree of Fig. 4-8. If /usr/jim is the working directory, what is the absolute path name for the file whose relative path name is ../ast/x?

Answer:

..goes to outer directory, so if user at /user/jim, ../ast/x will result in /usr/ast/x

**Q2.** Contiguous allocation can lead to disk external fragmentation, as mentioned in the text. Please explain why.

Answer:

The total free space between each files may enough to satisfy an allocation request, but since they are not contiguous, that’s called an external fragmentation.

**Q3. (Modified Problem 16)** Consider the i-node shown in Fig. 4-13. If it contains 10 direct addresses of 4 bytes each and one single indirect block. All disk blocks are 1024B (1KB). What is the largest possible file?

Answer:

The indirect block can hold 256\*1024, and direct address has 10, thus the total amount is 262154KB, since the block is 1024B, so the largest file could be 262MB.

**Q4. (Problem 21)** Name one advantage of hard links over symbolic links and one advantage of symbolic links over hard links.

Answer:

The hard links save the space and have better performance due to the inflexible.

On the other hand, symbolic links can point to other system or computer, even resource on internet that brings flexibility to it.

**Q5. (Problem 25)** The beginning of a free space bitmap looks like this after the disk partition is first formatted: 1000 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 six blocks, the bitmap looks like this: 1111 1110 0000 0000. Show the bitmap after each of the following additional actions:

1. File B is written, using five blocks

1111 1111 1111 0000

1. File A is deleted

1000 0001 1111 0000

1. File C is written, using eight blocks

1111 1111 1111 1100

1. File B is deleted.

1111 1110 0000 1100

**Q6. (Problem 29)** Suppose that file 21 in Fig. 4-25 was not modified since the last dump. In what way would the four bitmaps of Fig. 4-26 be different?

Answer:

21 marked in a, b, and d

No change in c

**Q7. (Problem 30)** It has been suggested that the first part of each UNIX file be kept in the same disk block as its i-node. What good would this do?

Answer:

If file fits in the same block as the i-node, only one disk access would be needed to read file rather than two, also has benefits for large files. This is known as i-node stuffing.

**Q8. (Problem 32)** The performance of a file system depends upon the cache hit rate (fraction of blocks found in the cache). If it takes 1 msec to satisfy a request from the cache, but 40 msec to satisfy a request if a disk read is needed, give a formula for the mean time required to satisfy a request if the hit rate is h. Plot this function for values of h varying from 0 to 1.0.

Answer:

Time need: h+40(1-h), therefore, the plot is a line.

**Q9. (Problem 37)** A certain file system uses 4-KB disk blocks. The median file size is 1 KB. If all files were exactly 1 KB, what fraction of the disk space would be wasted? Do you think the wastage for a real file system will be higher than this number or lower than it? Explain your answer.

Answer:

Since each block has one file and 1KB space, so there is 75% wasted space.

In real file system, there are many large files, and those files could use disk more efficiently, thus less wasted space.

**Q10. (Problem 41)** How many disk operations are needed to fetch the i-node for a file with the path name /usr/ast/courses/os/handout.t? Assume that the i-node for the root directory is in memory, but nothing else along the path is in memory. Also assume that all directories fit in one disk block.

Answer:

Directory:

/

/usr

/usr/ast

/usr/ast/courses

/usr/ast/course/os

I-node:

/usr

/usr/ast

/usr/ast/courses

/usr/ast/courses/os

/usr/ast/courses/os/handout.t

So, 10disk reads in total.

THE END.