CSSE 332 – Operating Systems
Rose-Hulman Institute of Technology
Computer Science and Software Engineering Department

File System Exercise

Name:_____ Section:_____ CM:_____

Instructions: You should do this exercise individually. Turn in this exercise at the start of the class session when it is due.

Problems	Points available	Your marks
1	4	
2	9	
3	9	

Total	22	

Problem 1 (4 points) Consider a UNIX file system which uses index nodes (i-nodes) to hold the attributes of a file along with pointers to its data blocks. Assume that an i-node entry is the same size as a data block (unrealistically big). Also, there is no indirect pointer used in this file system. If on average, the data content of a typical file occupies 7680 Bytes.

(a) (2 points) Determine what percent of the total occupied space is actually occupied by data if the size of a data block is 2 KB (2^{11} Bytes).

(b) (2 points) Determine what percent of the total occupied space is actually occupied by data if the size of a data block is 8 KB (2^{13} Bytes).

Problem 2 (9 points) Suppose the UNIX file system has i-nodes that each contain 12 direct block pointers, 9 single-indirect pointers, 3 double-indirect pointers, and 1 triple-indirect pointers. Assume that each 64-bit pointer references a 4 KB (2^{12} Bytes) block.

Using the information above, answer the following questions.

(a) (2 points) How many pointers (block addresses) can each block accommodate?

(b) (4 points) complete the table below for the modified system. Show your working in the space below to receive partial credit.

Level	Number of Data blocks	Number of Data Bytes (2^n)
Direct blocks		
Single-indirect blocks		
Double-indirect blocks		
Triple-indirect blocks		

(c) (3 points) What is the maximum file size supported?

Problem 3 (9 points) Assuming that no information other than the directory entry for a file is already in main memory, how many disk accesses are required to access the 14,319,617-th byte (= 1748 * 8192 + 1) in the file?

Assume the size of a disk block is 8 KB (8192 Bytes).

(a) (3 points) For indexed file allocation as described in Problem 2?

(b) (3 points) For chained allocation? Assume that disk pointers are 4 Bytes.

(c) (3 points) For contiguous allocation?