

5. Consider a file currently consisting of 100 blocks. Calculate how many disk I/O operations are required for the following techniques to perform each of the tasks below: contiguous (assume no room to grow in the beginning, but there is room to grow at the end), linked-list (without an in-memory table), and indexed allocation (assume that the inodes are single-level and in memory). Assume that in the tasks below, any blocks added to the file are in memory.

(a) The block is added at the beginning.

(b) The block is added in the middle.

(c) The block is added at the end.

(d) The block is removed from the beginning.

(e) The block is removed from the middle.

(f) The block is removed from the end.

6. Consider a system where free space is kept in a free-space list.
 - (a) Suppose that the pointer to the free-space list is lost. Can the system reconstruct the free-space list? Explain your answer.

 - (b) Suggest a scheme to ensure that the pointer is never lost as a result of memory failure.

7. Consider a UNIX file represented as an Inode. Assume that there are 12 direct block pointers, and a singly, doubly, and triply indirect pointer in each Inode. Further assume that the disk block size is 8K and the disk block pointer is 32 bits (with 8 bits to identify the physical disk and 24 bits to identify the physical disk block).
 - (a) Summarize the major advantages of organizing file storage using a combination of direct, and singly, doubly and triply indirect blocks.

 - (b) What is the maximum file size supported by this system?

 - (c) Assuming the only block in main memory is the file's Inode (not any indirect blocks or data blocks), how many disk accesses are required to access the byte in position 13,423,956?

8. A certain operating system deletes files by first deleting the file control block which contains pointers to the disk blocks making up the file. The file's disk blocks are then added to a free list maintained by the operating system. When a new file is created, disk blocks sufficient to accommodate the file size specified by the programmer are allocated from the same free list. Assuming that the operating system performs no other operations on the blocks save addition to, removal from, the free list for file deletion and creation, describe a potential security flaw in this design.