Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

Each answer shows the steps, then the **result**.

2.1

$100/4 =$ **25** data blocks

12 through direct pointers, 13 through the single indirect

1 index block

2.2

`copy` opens the data as before

`short` fails: the name it holds no longer exists

2.3

$2^{40}/2^{12} = 2^{28}$ blocks, so 2^{28} bits

2^{25} B = **32 MiB**

2.4

root inode, root directory block

`home` inode and block; `ana` inode and block

`notes.txt` inode: **7** reads

3.1

(a) $4096/4 =$ **1024**

(b) blocks $12 + 1024 + 1024^2 = 1\,049\,612$; $\times 4$ KiB $\approx$ **4 GiB**

(c) block $10 \times 1024/4 = 2560$, past $12 + 1024 = 1036$, so it is in the double-indirect range; double-indirect block, single-indirect block, data block: **3** reads

(d) their blocks are all reached by direct pointers in the inode, with no index blocks

3.2

(a) the inode points at a block that the bitmap still marks free; another file may be given that block, and the two files will overwrite each other

(b) write all three changes to the journal and then a commit record; only then write them in place; after a crash, replay committed entries and ignore uncommitted ones

(c) faster, since data is written once, but after a crash a file's data block may hold old contents

3.3

(a) $50 \times 2^{30}/2^{12} =$ **13 107 200** blocks; the chain must be followed from the start, about 6.5 million steps on average

(b) a 50 GiB file may need only a few dozen extents; a binary search on them finds block k in a few steps

(c) the file breaks into many small extents, so the list grows long and reading needs many seeks

(d) extents: random access is fast and the index stays small; keep enough free space and pre-allocate the file so that it stays contiguous

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