UNIVERSITY COMPUTER SCIENCE • EXERCISE SHEET

7.5 File systems

Name: _____ Class: _____ Date: _____ **Total: 24 marks**

KEY WORDS inode • journaling

Objective

Follow the pointers, price the reads, and order the crash writes.

1 Key knowledge and worked examples

■ The layout

The inode holds 4 direct pointers and one indirect (256 pointers, 1 KiB blocks): max file $(4 + 256) \times 1$ KiB $= 260$ KiB ✓. The directory is a file of name → inode entries ✓.

■ Worked example: block 6

Beyond the four direct pointers: read the indirect block (pointer 2), then the data – two disk reads for one logical block ✓. A 100-block file reads sequentially in $100 + 1$ reads ✓.

2 Practice

2.1 With 2 KiB blocks and 512 pointers per indirect block, compute the max file with 4 direct pointers. [3]

2.2 Reading block 9 (4 direct pointers): how many disk reads, and why? [3]

2.3 Does deletion erase the data? Answer and explain in one line. [3]

3 Exam-style questions

3.1 A file system uses 4 KiB blocks, 8 direct pointers, and one indirect block holding 1024 pointers.

Compute the maximum file size. Compute the reads for block 12 with a cached inode (name the pointer index). Compute the total reads for a sequentially read 3000-block file (indirect block read once). State what changes if the indirect block is evicted mid-read. [8]

3.2 An append writes three things: the data block, then the free-list bit, then the inode size.

State what is lost if the crash lands between data and free-list, and between free-list and inode. Name the write order rule that never loses user data (only space). Explain how journaling removes the ordering constraint, and its per-write cost in one line. [7]