Name	Signature	Student Id Nr	Points

Operating Systems, mini exam 4, 26.2.2020 (12p)

Write your answer on this exam paper in the space given. Please notice, that the exam paper is 2-sided.

a) [4 p] RAID. We have 4-disk RAID-5 system. Each disk has capacity 1 TB.
   What is the overall data capacity of this RAID-5 system. Explain.

   One record in certain file (in this RAID-system) must be updated, and the record is stored within one memory block. How many disk-I/O's are needed to do this update, what they are, and which of them can be done concurrently? (2 p)

   If one of the four disk drives becomes faulty, can the data in the RAID-system still be read or written? Explain.

b) [2 p] Disk Scheduling.
   Which problem in SCAN algorithm is solved by FSCAN algorithm? How is it solved?

   Which problem in SCAN algorithm is solved by Linux Deadline I/O Scheduler (LDS)? How is it solved?
   Why does LDS slow down the overall efficiency of the system?

TURN

c) [3 p] Direct and symbolic links. File A is created first. Files hB and hC are then created as direct links (hard links) to file A. File sD is created as symbolic link to the same file A.
File hC is deleted first. What happens in the file system? Are files A, hB and sD still usable? Explain.

File A is deleted next. What happens in the file system? Are files hB and sD still usable? Explain.

File hB is deleted next. What happens in the file system? Is file sD still usable? Explain.

d) [3 p] Indexed file *Employees* has some 10 000 records and it is stored in hard disk. Each personnel record contains all information for one employee. You can search the file based on two different keys. Key *PersId* has value range 01011900000-31122100999. Key *StaffId* has value range 0-99 999. All indexes are implemented with B-trees.
In which order are the records on disk?

How many indexes are needed and how large (number of nodes in B-tree) are they?

How do you in practice read the record R with *StaffId* 11222? How many disk I/O:s are needed?