Solution to the First COSC 6360 Quiz for Fall 2013

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First question

- What is the purpose of the UNIX mount system call ? (10 points)

Answer

- The mount() system call makes a file system appear as a subdirectory of another file system.

or

- It glues together the directory trees of the system disk partitions to form a single directory hierarchy.

Second question

- In a 32-bit UNIX file system, what is the ***minimum block size*** that lets users access the whole contents of a file using **two *levels of indirection***? (10 points)

Answer

- With two levels of indirection and a block size *b*, we can address
  - $(b/4)^2 \times b$ bytes
- We must have $(b/4)^2 \times b \geq 2^{32}$
  - $b^3/2^4 \geq 2^{32}$
  - $b^3 \geq 2^4 \times 2^{32} = 2^{36}$
  - $b \geq 2^{36/3} = 2^{12} =$ <u>4K</u>

Third Question

- Why does the Fast File System subdivide each disk partition into ***cylinder groups***? (20 points)

Answer

- It minimizes disk arm motions because each cylinder group has its own fragment of the i-node table. As a result most file blocks reside closer to the file i-node.
  - (*This is not true for large files but remains true for most file blocks in the cylinder group.*)

Fourth question (Part I)

- What is the main advantage of ***copy-on-write***? (10 points)

Answer

- Copy-on-write reduces the cost of the UNIX fork() system call by letting the parent and child process share their data segment and only duplicating pages that are modified by one of them.
  - *Can also mention its use for implementing efficient message passing.*

Fourth question (Part II)

- Can you think of a case where this advantage would not hold?
  (10 points)

Answer

- Copy-on-write will not work as well is one of the two processes modifies most of the contents of its address space between the fork() and the exec().

Fifth question

- Why did Babaoğlu and Joy decide not to use the VMS page replacement policy? (2×10 points)

A sure indication that a two-part answer is expected

Answer

- Estimating the right size for the policy resident set of each new process was very difficult under UNIX.
- Supporting real-time processes was not an objective (*in the paper*)

Sixth question

- In the Mach virtual memory system, which should be the protection attributes for the address range containing the data segment? (10 points)

Answer

- Read and write but ***never*** execute
  - *You were asked the access rights not the inheritance attributes!*