Name: _____ (First name first)   **Score:** ____

Closed book. *You can have with you one single-sided 8½ by 11 sheet of notes. UH expels cheaters.*

1. Why is it impossible to evaluate the memory requirements of a UNIX process **at creation time**? When does it become possible? (2×10 pts)

    When UNIX forks a process, it creates an exact clone of its parent process. The memory requirements of that clone are completely unrelated of those of the process that will replace it after the exec() call.

    Hence we have to wait until the exec() call takes place, to evaluate the true memory requirements of a UNIX process.

2. What is the main function of the UNIX **mount** system call? (10 points) How does it make easier to move directories and data among disk drives? (10 points)

    The mount system call attaches the directory tree of a given disk partition to some branch of the directory tree of another partition. As a result, it allows system administrators to build a single directory tree that crosses disk partition boundaries and to move branches of that tree from one partition to another <u>without changing their pathnames</u>.

3. Consider a UNIX system running the Berkeley Fast File System with a block size of 4 KB. How many disk accesses does it take to access the first megabyte of a file that is **already opened**? (10 points**)**

    Answer: It will take exactly _____ disk accesses.

    <u>Explanation:</u> Since the page size is 4KB, the file will consist of 256 blocks. Observe that the 12 first blocks of the file can be accessed directly from the file i-node, which already is cached in main memory while the remaining 244 blocks can be accessed through one level of indirection. The total number of disk accesses is thus 12 + 1 + 244 = 257 disk accesses.

4. Give an example of a **capability/ticket** in the UNIX file system. (10 points)

    Answer: ___a file descriptor_____.

5. Rather than using a clock policy with **two hands**, we could reclaim old pages as quickly by using a single-handed clock and make its hand rotate much faster. What would be the main disadvantage of this policy? (20 points**)**

    It would cause too many resets of the simulated page-referenced bits of the pages being inspected by the hand of the clock policy. On architectures that lack a page referenced bit, this is done by marking the page invalid. This would in too many context switches when these pages are accessed again.

6. Explain why the **Sampled Working Set** page replacement cannot be efficiently implemented on an architecture that lacks a page referenced bit. (20 points)

    The Sample Working Set resets the page-referenced bit of all valid pages of a process at each sampling interval. On architectures that lack a page referenced bit, this is done by marking the page invalid. This would in too many context switches when these pages are accessed again.