COSC 6360	FIRST MIDTERM	FEBRUARY 15, 2007

This exam is **closed book**. You can have **one sheet** (i.e., **two pages**) of notes.
Please answer every part of every question

1. Describe the contents of a Mach *address map entry*. (6×5 points plus 5 points for a drawing)

   a) Start of address range.

   b) End of address range.

   c) Memory object responsible for the addresses range.

   d) Offset in the memory object responsible for the addresses range.

   e) Protection (read, write, execute).

   f) Inheritance attribute(copy, share, do nothing): A copy inheritance attribute specifies that the child process should get a copy of the contents of the address range; a shared inheritance attribute specifies that the child process will share the range with its parent and a do nothing attribute specifies that the address range will not be inherited by the child process

   g) *Address of next address map entry.*

   h) *Address of previous address map entry.*

2. Consider a clustered page table interacting with a TLB implementing subblocking. Assuming a *subblocking factor of* **4** and **64 bit addresses,** what would be the size of the page table entry assuming that:

   a) the TLB implements *full subblocking?* (5 points)   __6×8 = 48 bytes___ **bytes**
   (one VPN, four PPN's and one pointer to next entry).

   b) the TLB implements *partial subblocking?* (5 points)   __3×8 = 24 bytes __ **bytes**
   (one VPN, one PPN' and one pointer to next entry)

3. What is the difference between a *superpage* and a *subblock*? (10 points)   (Hint: be brief.)

All the pages of a superpage are brought together in main memory and expelled together from main memory while pages in a subblock do not have to be simultaneously present in main memory.

4. *Advantage and disadvantages: you will get **no credit** if you answer mentions a disadvantage when an advantage is asked and vice versa.* (4×5 points)

    a) What is the major advantage of subdividing each disk partition into ***cylinder groups***?

    It speeds up disk accesses by reducing seek times.

    b) What is the major disadvantage of ***large block sizes***?

    It increases internal fragmentation: this is especially important because most file system includes many more small files than large files.

    c) What is the major advantage of ***clustered page tables***?

    They are the best solution for very large address spaces.

    d) What is the major disadvantage of simulating ***by software*** a ***page-referenced bit***?

    The next access to any page that has its simulated page-referenced bit turned off will occasion two context switches.

5. What is the purpose of the UNIX ***set-user-id bit***? (5 points) (Hint: be brief.)

The UNIX set-user-id bit allows users to execute programs accessing data whose access needs to be controlled: any file that has its set user ID flag set will execute as if it was executed by its owner.

6. What is the purpose of Munin ***write shared*** consistency protocol? (5 points) To which DSM pages does it apply? (5 points) How can Munin detect if the protocol was used in an incorrect fashion? (5 points) What should it do then? (5 points) (***Hint:** Answer each part of the question in order.*)

    – The Munin write-shared protocol was designed to reduce the amount of data communication occasioned by <u>false sharing</u>.

    – It applies to DSM pages that contain variables that are concurrently updated by different processes in such a way that each process accesses a disjoint subset of these variables.

    – A runtime switch can be set to check for conflicting updates to write-shared data.

    – The computation should be aborted whenever conflicting updates are detected, as its results are likely to be incorrect.