ASSIGNMENT 2-3 **OPERATING SYSTEMS, SPRING 2018**

Instructions:

- *Do not copy material from other sources, if it is necessary, then provide the references. In case of plagiarism, negative marks will be given to the plagiarizing person.*
- *Submission deadline is 9th May 6.00 PM sharp.*
- *Submit your assignment via SLATE ONLY on the thread provided.*

1. *Threads matrix multiplication*

Develop a program to multiply two large matrices, using multiple threads. As each entry of the resultant matrix can be computed independent of the other, we can use multithreading to speed up the calculations. However, creating too many threads is inefficient; we shall rather deploy only as many threads as there are number of processors in the system (see get_nprocs() system call).

The task shall be evenly divided among the threads. If there are 100 entries in the resultant matrix for example, and we have four processors (and hence four threads), each thread shall compute 25 entries.

Use files for input and output. The program shall take two files as input, each containing a matrix. The program shall read the files, perform the multiplication, and shall store the result into a third file. Each file shall also contain order of the matrix. The program shall check whether the multiplication is possible or not.

2. *Memory management (Paging):*

The PowerPC uses a hardware managed TLB with an inverted page table. Discuss its advantages and disadvantages. i.e.,

(a) What are the implications of the inverted page table on the size of each page table entry?
(b) How many memory references are potentially required on a TLB miss *(also known as a page table walk)*?
(c) Are per-process page tables necessary or can they be eliminated?

3. ***Memory management (Paging):***

For each configuration (a-c), state how many bits are needed for each of the following:

- Physical address
- Virtual address
- Physical page number
- Virtual page number
- Offset

a. 32-bit operating system, 4-KB pages, 1 GB of RAM
b. 32-bit operating system, 16-KB pages, 2 GB of RAM
c. 64-bit operating system, 16-KB pages, 16 GB of RAM