3 problems. 40 points. 30 minutes *Closed book. Closed notes. No electronic device.* *Write your name above.*

1. [20 points] A byte-addressable segmentation system has 46-bit virtual address, 32-bit physical address, and 16-bit segment number. A segment's size can be any number of bytes upto its maximum. A segment in physical memory always starts at a 4 KB-aligned addresss (i.e., the least significant 12 bits are zero). Each segment table entry includes 8 bits for access and usage.

a. Draw the segment table for a process. Give the number of rows in the table and the label and size of each field.

b. The hardware has a TLB of 6 entries managed with LRU replacement. Draw the TLB, showing its fields and their sizes. Indicate which part of the TLB is asociatively searched.

2. [10 points] A process with 3 physical pages initially empty issues the following string of virtual page references. What is the smallest possible number of page faults. Justify your answer.

	0	1	3	4	8	2	3	4	0	1	2	3	4	2
virtual pages in memory														

3. [10 points] A demand-paging system uses page-fault frequency to adjust the physical page allocation and swap state of processes. Specifically, each pcb has a variable x that is zero when the pcb is created or swapped in, and is incremented by 1 at each page fault of its process.

A thread periodically reads and zeros the x values of all swapped-in processes and then "adjusts" the allocations and swap state. The goal is to keep the x values it reads close to 20.

Give an appropriate "adjustment" rule (i.e., that selects processes and changes their allocation or swap state)