CSCE 311 SPRING 2017

Memory

Name:_____ **Due: 28 Nov 2017**

1.) Given the following process's four-entry page table, four-entry frame set, and instructions,

a) Determine the minimum bits necessary to represent logical addresses in this system. List the size of each portion (frame and offset) of a logical address, in bits. Note pages are 4 bytes in size.

b) Update the values in physical memory to reflect the values after the following instructions are carried out. Show the updated values in physical memory. Also, list which pages hold values for this process and how this is determined.

Instructions:

```
mov r1, 0000    ; copy memory to register, r1
mov r2, 0010    ; copy memory to register, r2
add r2, r1      ; add r1 to r2 and store in r2
mov r1, 1010    ; copy memory to register, r1
add r2, r1      ; add r1 to r2 and store in r2
mov 0111, r2    ; copy to memory 13
```

00	11	v
01	00	v
10	01	v
11	10	i

Page Table

00	17
	'a'
	'r'
	'r'
04	'a'
	'y'
	8
08	
12	-10
	8
	15
	31

Physical Memory

2) Consider a 64-bit machine where physical memory is 64GB.
   a) If we would like to run processes as large as 64 GB, how many bits would be required for the logical address?

   b) If we are using page sizes of 8KB, how many bits are needed for displacement, or indexing, into a page?

   c) If a single-level page table is used, what is the maximum number of entries in this table?

   d) How many frames of physical memory are required to store a page table?

   e) If a two-level page table is used and the outer page table is an 8KB page, how many entries does it contain, maximally?

   f) How many bits of the logical address are used to specify an index into the inner page of the page table?

3) Given a system with a memory access time of 100ns and a disk read access time of 1ms and write access time of 4s,
   a) To keep effective access time within 15% of memory access time, how successful must pager algorithm be—that is what is the largest tolerable page-fault rate where disk read access time dominates page-faults?

   b) For a translation look aside buffer, considering only swap-in/swap-out time with swap-in time of 25 ms and swap-out time of 20 ms, what is the effective page fault service time for a page replacement when 70% of pages are dirty?