

CS 2200 - Introduction to Systems

Fall 2016

Homework 8

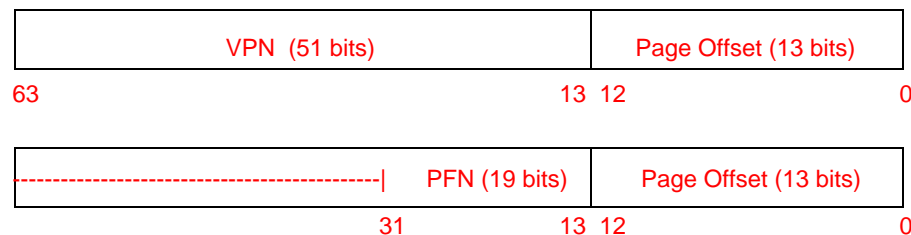
Rules:

- Please print a copy of the assignment and handwrite your answers. No electronic submissions are allowed. **Please print as one double-sided page.**
- This is an individual assignment. No collaboration is permitted.
- Due Date: 8th November 2016 – 6:05 PM . Bring your BuzzCard.

Name(print) CS 2200 TAs GT Login: cs2200 Section A2200

1) Consider a virtual memory system with **64-bit** virtual addresses, and **32-bit** physical address. The page size is **8 KB** (i.e. Kilo bytes).

- a. Draw a picture showing the layout of the **virtual** and **physical** addresses. Make sure to label each part of the addresses, and write the correct size in bits.



- b. How many entries are there in the:

i. Page Table of each Process:

Number of page table entries is determined by amount of VPN bits.

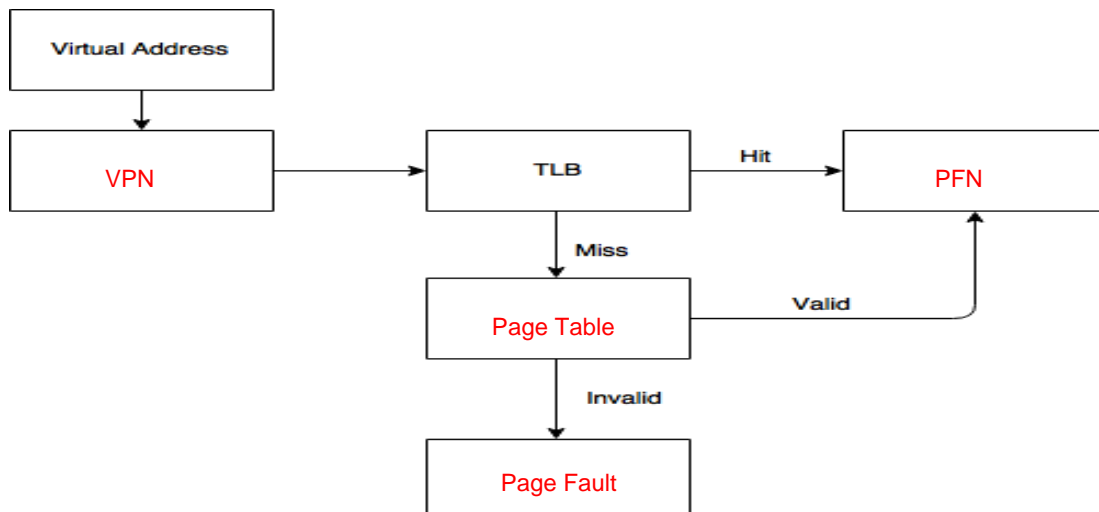
$$2^{(\# \text{ VPN bits})} = 2^{51} \text{ entries}$$

ii. Frame Table (Aka Reverse Lookup Table):

Number of frame table entries is determined by amount of PFN bits.

$$2^{(\# \text{ PFN bits})} = 2^{19} \text{ entries}$$

2) Fill in the missing pieces in this address translation diagram:



3) The following picture is the current state of the frame table and the page table of processes P1 and P2 in a machine with **16-bit** virtual addresses, and a page size of 4KB. **P1** encounters a page fault while attempting to write to virtual address **0x1342**. The victim page chosen is **PFN = 34**.

- a. Show the contents of the data structure after the page fault is resolved. Directly mark your changes in the diagram below to show your answer.

VPN	PFN	V	D
0	42	1	0
1	50 34	0 1	0 1
2	51	1	0
3	51	0	0

P1 Page Table

VPN	PFN	V	D
0	30	1	0
1	50	1	0
2	34	1 0	1
3	30	0	0

P2 Page Table

PFN	<Process, VPN>
0

30	<P2, 0>
31	<P2, 1>
32	<P1, 3>
33	<P1, 2>
34	<P2, 2>
35
36

<P1, 1>

Frame Table

- b. Will the data, stored on the disk change after the page fault is handled? Why or why not?

Yes, the data stored on the disk will change since the frame that was chosen for eviction (PFN = 34) contained a dirty page (as seen in P2's page table where the dirty bit was set).