16.482 / 16.561: Computer Architecture and Design Spring 2014

Lecture 9: Key Questions

	April 17, 2014				
1.	What are the benefits of virtual memory?				
2.	Four questions for virtual memory:				
a.	Where can a page be placed in main memory?				
b.	How is a page found if it is in main memory?				

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e. Which page should be replaced on a page fault?	

3. Describe the purpose and operation of a translation lookaside buffer (TLB).

d. What happens on a write?

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4. **Example:** Assume the current process uses the page table below:

Virtual page #	Valid bit	Reference bit	Dirty bit	Frame #
0	1	1	0	4
1	1	1	1	7
2	0	0	0	
3	1	0	0	2
4	0	0	0	
5	1	0	1	0

a. Which virtual pages are present in physical memory?

- b. Assuming 1 KB pages and 16-bit addresses, what physical addresses would the virtual addresses below map to?
- i. 0x041C

ii. 0x08AD

iii. 0x157B

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	Explain each of the following advanced cache optimic Way prediction	izations:
b.	Trace caches	
c.	Non-blocking caches	
d.	Multi-banked caches	

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e.	Critical word first and early restart	
f.	Merging write buffers	
g.	Software optimizations: array merging, loop interchange, lo	op fusion, blocking
h.	Prefetching (both hardware and software)	