## ECE 3055 Quiz - October 20, 2011

1. Why would you expect that even a very small TLB will have a high hit rate?

a single entry is for a page.
A page has several thousand memory
locations.

2. Assume a 16-line 2-way set associative TLB (i.e, 32 total data entries) is used in a system with 40-bit virtual byte addresses, 36-bit physical memory byte addresses, and 4K byte pages. For the sequence of virtual addresses shown below in hex, state whether each address causes a TLB hit or miss and show the physical address generated. The TLB is initially empty after power on and the set on the left gets the first entry in each line. A LRU replacement policy is used. A portion of the page table entries and TLB are listed below. Show the final contents of the TLB after this sequence of addresses is accessed.

**Virtual address sequence**

| Virtual Address | Hit/Miss | Physical Address |
|---|---|---|
| 00000303E2 | M | 0FFFF03E2 |
| 000003 11E3 | M | 0D0D00 1E3 |
| 0000030012 | H | 0FFFF0012 |
| 0000000171 | M | 0F0000 171 |
| 02000300E1 | M | 00ACE00E1 |
| 0000030153 | M | 0FFFF0153 |

**TLB Final Contents**

| Line: | Set #1 Valid | Tag | Data | Set #2 Valid | Tag | Data |
|---|---|---|---|---|---|---|
| 0 | 1 | 020003 | 00ACE0 | 1 | 000003 | 0FFF0 |
| 1 | 1 | 00003 | 0D0D00 | | | |
| 2 | | | | | | |
| 3 | | | | | | |

**Page Table Initial Contents**

| Virtual Page # | Data |
|---|---|
| 0000000 | 0F0000 |
| 0000001 | 030000 |
| 0000002 | 0B0000 |
| 0000003 | 0F2000 |
| ... | ... |
| 0000030 | 0FFFF0 |
| 0000031 | 0D0D00 |
| ... | ... |
| 0100000 | 0B2000 |
| 0100030 | 0D0000 |
| 0100000 | 0E0000 |
| 0100300 | 065000 |
| 0100310 | 060000 |
| 0200030 | 00ACE0 |