# CS 212: Midterm Exam Review Worksheet 1

For the exercises on this worksheet, assume we have a machine with:

* 32-bit virtual memory addresses
* 256 byte page size
* 32-bit page table entries
* TLB with 64 entries, none are pre-loadeed

**Question 1**: How many bits are in the offset and virtual page number portions of addresses on this machine?

**Question 2**: How many levels would be required in a multi-level page table for this machine?

**Question 3**: For the binary virtual address below, break it up into the sections that represent the offset, the page directory indexes, and the page table index.

11010001011101001011001011010010

**Question 4**: Assume that a process on this machine is currently using 8 pages, and below is the current virtual page to physical page frame mapping for the process:

0xf94a4c -> 0x12c83f
0xf94a4d -> 0xf72123
0xf94a4e -> 0x03a8fe
0xf94a4f -> 0x3cd654
0xf94a50 -> 0x4219be
0xf94a51 -> 0x9fc773
0xf94a52 -> 0x89a62a
0xf94a53 -> 0x327dd6

What is the physical address of the process’s virtual address 0xf94a509c?

**Question 5:** Let’s say a process accesses the following virtual addresses in this order, and the TLB has no entries loaded beforehand. For each access, state whether the access results in a TLB hit or a TLB miss.

0xf94a4c03

0xf94a4cff

0xf94a52a4

0xf94a5300

0xf94a52a5

**Question 6:** Which principle makes the TLB so effective, spacial locality or temporal locality?