Due at the beginning of recitation R20 on Friday November 16.

Consider a system with 32-bit virtual addresses, $2^{20}$ bytes of physical memory, and a single-level page table using a page size of $2^{14}$ bytes.

(A) Which virtual address bits are used to select the page table entry?

Bits used to select page table entry: $A[\_31:14]$

(B) How many entries does the page table have?

Number of page table entries: $2^{32}/2^{14} = 2^{18}$

(C) How many pages of physical memory are there?

Number of physical memory pages: $2^{20}/2^{14} = 2^6 = 64$

A portion of the contents of the page table is shown to the right; all numbers are in hexadecimal.

Assume a store (sw) instruction causes a write to virtual address 0x13210.

(D) What physical address is written to? Give a hex address, or answer “can’t tell” if you can’t determine the answer.

VPN = (0x13210 >> 14) = 0b100 = 4  
→ PPN = PageTable[VPN].PPN = 6 = 0b110

Physical address or “can’t tell”: 0x1B210

(E) What bits in the page map, if any, are changed by the execution of the store instruction?

PageTable[4].D goes from 0 to 1 to mark the page as dirty.