12.29. According to the Mutex lock ordering rule, because each thread here acquires its mutexes in order and release them in reverse order, the program is deadlock-free. It CANNOT deadlock.

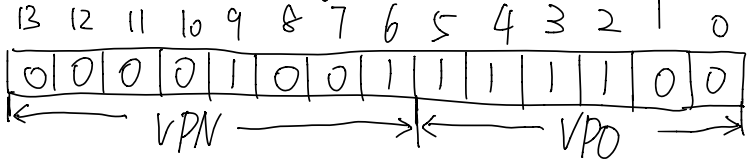
9.11 Virtual Address: 0X027C

12=8+4

$= 0b\ 0000\ 0010\ 0111\ 1100$

16x3 =48

A. Virtual Address Format

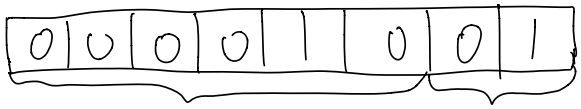


28

PPO = VPO = $0b\ 111100 = 4+8+16+32 = 60$

$= 0X3C$

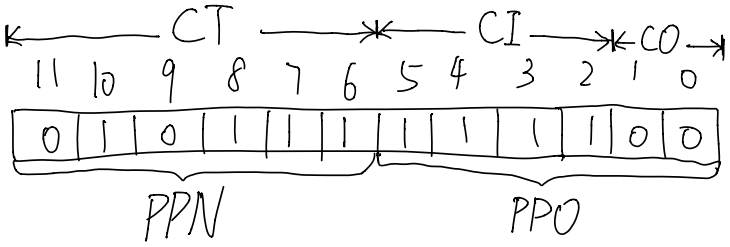
VPN



B. Address Translation

Parameter	Value	
VPN	$0b\ 0000\ 1001 = 0X09$	
TLB index	$0b\ 01 = 0X01$	
TLB tag	$0b\ 0000\ 10 = 0X02$	
TLB Hit?	NO	← because it's invalid
Page fault?	NO	
PPN	0X17	← read from Page Table

c. Physical address format



PPN = 0x17 = 16+7 = 0b010111 16

D. Physical memory reference 1+2+4+16 ⇒ 23

Parameter	Value
Byte offset	0b00 = 0x00
Cache index	0b1111 = 0x0F
cache tag	0b010111 = 0x17
cache hit	No
cache byte returned	NULL

9.15 After the memory is allocated, the last bit of the header will turn from 0 to 1.

Thus, header = size + 1.

Request	Block Size	Block header
malloc(3)	8	0X09
malloc(11)	16	0X11
malloc(20)	24	0X19
malloc(21)	24	0X19