Problem 1.

A. When the call to exit(0) is made, the process exits. When the process exits, all children threads are interrupted and torn down. The thread that would eventually print “Hello, world!\n” is still executing the call to Sleep(1) at the time that the other thread calls exit(0), so the process is destroyed before the call to printf is executed.

B. You can use 2 different Pthread functions: a. pthread_exit(): this function doesn’t tear down the entire process, and allows all the other threads to continue. b. Call pthread_join() on the other thread: this function will block until the other thread terminates. In this case, it’ll make this thread wait until the other thread returns (after printing “Hello, world!\n”).

Given a 32 bit virtual address space and a 24-bit physical address, determine the number of bits in the VPN, VPO, PPN, and PPO for the following page sizes P:

P	VPN bits	VPO bits	PPN bits	PPO bits
1 KB	22	10	14	10
2 KB	21	11	13	11
4 KB	20	12	12	12
8 KB	19	13	11	13

The number of VPO and PPO bits are the same, and is the log base 2 of the page size. VPN and PPN are the remaining bits from the virtual address size and the physical address size, respectively.

Thus: for 1 KB,

VPO = PPO = $\log_2 1024 = 10$

VPN = 32 - 10 = 22

PPN = 24 - 10 = 14

Problem 2.

a. VPO [5:0] → log2(page size) = log2(64) = 6 bits
   think of it as we can offset a number of bytes into the page
   VPN [13:6] → the rest of the bits, tells us how many pages we have (256)
   TLBI [7:6] → log2(number of sets) = log2(4) = 2 bits
   TLBT [13:8] → log2(number of possible tags) = log2(4*16) = 6 bits
b. PPO [5:0] → same as VPO
   PPN [11:6] → the rest of the bits
   CO [1:0] → 4-byte cache lines can be addressed by 2 bits
   CI [5:2] → log2(# of cache lines) = log2(16) = 4 bits
   CT [11:6] → log2(number of possible cache tags) = log2(4*16) = 6 bits

c. For the VA = 001101 10 010101 = 0xD95
   i. VPO = 010101 = 0x15
      VPN = 001101 10 = 0x36
      TLBI = 10 = 0x2
      TLBT = 001101 = 0x0D
   ii. PA = 101110 0101 01 = PPN + VPO = 0xB95
      PPO = 010101 = VPO = 0x15
      PPN = 0x2E = 101110 (from TLB)
      CO = 0x1 = 1
      CI = 0x5 = 101
      CT = 0x2E = 101110
   iv. 0x69 = 105 (in decimal)

Problem 3.

Step	Thread	Instr.	$\%rdx_1$	$\%rdx_2$	cnt
1	1	H_1	----------	----------	0
2	1	L_1	0	----------	0
3	2	H_2	----------	----------	0
4	2	L_2	----------	0	0
5	2	U_2	----------	1	0
6	2	S_2	----------	1	1
7	1	U_1	1	----------	1
8	1	S_1	1	----------	1
9	1	T_1	1	----------	1
10	1	T_2	----------	1	1

The value of cnt is 1. This is a different result compared to the sequential case!