**Question 1**

1. A, B
2. B
3. C
4. B
5. D
6. A,B,C
7. B,E
8. B
9. A,C,D
10. B
11. C
12. D
13. B

**Question 2** (some ambiguity, but these are my preferred)

1. Linker
2. Linker
3. Compiler
4. OS
5. OS, Hardware
6. Hardware
7. Loader
8. Hardware

**Question 3**

5, 2, 4

**Question 4**

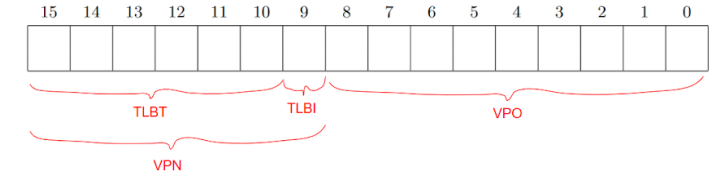
1. None
2. x=0.250000,s=1
   x=0.500000,s=2
   5,3
3. x, .data, global memory segment
   func, .text, text memory segment
   my_array ← ignore this as its ambiguous, since we did not take a pointer
   my_array[0], ---, stack
   pointer, .bss, global memory segment
   pointer[0], ---, heap

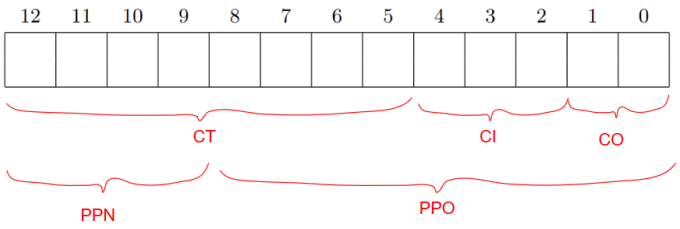
**Question 5**

1. Function call inlining
2. A -- because more dynamic function calls are eliminated

3. C -- better locality
4. Move store outside loop (accumulate in temporary), loop unrolling
5. 100
6. 100

**Question 6**




| Virtual Addr. | Physical Address | TLB Miss? | Page Fault? | Cache Miss? | Byte Read |
|---|---|---|---|---|---|
| 0x1DFD | 0x 3FD | Y | N | N | 0x C2 |
| 0x1DFE | 0x 3FE | N | | | 0x 11 |
| 0x1DFF | 0x 3FF | N | | | 0x 33 |
| 0x1E00 | 0x | Y | Y | | 0x |

**Question 7**

1. Printed:

Yek, Do, Se
Yek

2. Race:

No
No

3. Deadlock

No
Yes

4. Character

M - Zombie

## Question 8

1.

| | |
|---|---|
| %rsp - 0x00 | return address |
| %rsp - 0x08 | user[0].daily_notification_time[4] |
| %rsp - 0x10 | user[0].daily_notification_time[3] |
| %rsp - 0x18 | user[0].daily_notification_time[2] |
| %rsp - 0x20 | 0 x 00 00 00 00 00 00 00 09 |
| %rsp - 0x28 | user[0].daily_notification_time[0] |
| %rsp - 0x30 | user[0].dollars |
| %rsp - 0x38 | user[0].username, bytes 7-15 |
| %rsp - 0x40 | user[0].username, bytes 0-7 |
| %rsp - 0x48 | |
| %rsp - 0x50 | |

2. 10,-1,1000000
3. 10,5,0x0000000000400616