HW2 keys/tips

Q1

1a.

Write all instructions. Try to complete the code without looking at the slide first.

The total number of executed instructions is 802.

1b.

The total number of instructions executed is 427.

Once we have the address of A[i] in a register, we can use its address as base register to access A[i+1].

Q2

Tips: write a nested loop, calculate the address of T[i][j].

All multiplications can be done with shift operation. Pay attention to the shift amounts.

The key concept we expect students to learn is the storage of 2-D array in memory, i.e., how a 2-D array is mapped to a 1-D array.

Q3

The key concepts: representation of characters and numbers, and strings.

Write two loops.

The first loop finds out n, the number of decimal digits in the string. What is the character before NUL in str1 and str2?

The second loop adds pairs of digits. The index goes from n-1 to 0. Keep track of the carry.

Do not forget the NUL character that terminates the destination string.

Check your answers in RARS, with randomly generated numbers.

Things you can explore/play with: how strings are stored in memory, how each digit is stored in memory, and how we access each character in a string.

Q4

Here is an example. Once you figure out the machine code, check your answers in RARS.

Example:

```
Instruction:    addi   t0, t1, 3
Find out register numbers: addi x5,x6,3
It is an I-type instruction
Immediate: 000000000011
opcode:   0010011
rd:       00101
funct3:   000
rs1:      00110
rs2:      00011
funct7:   0000000
machine code in bits: 00000000001100110000010100 10011
machine code in hex: 00330293
```

A table like the following helps to place bits in the right location.

funct7	rs2	rs1	funct3	rd	opcode
0000000	00011	00110	000	00101	0010011

Q5

a.

sw x10,-16(x25)

b.

addi x14,x4,64

c.

and x23,x10,x5

d.

srai x30,x31,20

You can also check your answers in RARS.

Practice encoding/decoding with more instructions, e.g., your lab code.