CS204 - Computer Architecture

Graded Lab Assignment 1

Date: 16th February 2022, Deadline: 24th February, 2022 11.59PM.

Max. Marks: 50

General Guidelines:

- **Consider this deadline as a hard deadline. No request to change this deadline will be entertained.**
- **Zero marks will be awarded if found copied from others. We will use appropriate tools to check the copy cases.**
- **You need to upload a single zip file containing 4 files (one for each question, labeled rollno q1, rollno q2, rollno q3 and rollno q4). Name the zip file with your roll number.**
- **First 2 lines in the file should be - Your name, Roll no.**
- **Include comments (to the point and sufficient) in the code for improved readability and help in recalling during evaluations.**

Question 1: Procedure calls (**15 marks**)

Create a queue data structure at memory location 0x10001000 using 3 procedures:

Enqueue() (**4 marks for logic, 1 mark for output**),

Dequeue() (**4 marks for logic, 1 mark for output**),

Size() (**4 marks for logic, 1 mark for output**).

Suppose the sequence of operations given as a string: E 20 E 12 E 9 D D S E 23.....

E is enqueuing the number in the queue and D is removing a number from the queue.

The queue should be stored at memory location: **0x10001000.**

Whenever S is called in the sequence of operations the size of the queue should be computed and stored at **0x10005000** or at a register of your choice.

Question 2: Merging elements of two sorted arrays (**10 marks: 7 for logic and 3 for output**)

There are two sorted arrays stored at locations whose starting addresses are given in registers x11 and x12, i.e self initialized. Write a program in RISC-V that merges the elements of these two arrays in a sorted order and stores them at a new location whose starting address is 0x10001000. Here you can initialize the starting addresses and the sorted arrays yourselves during the compile time, i.e. changes can be made in the editor.

Question 3: Read the machine code of an instruction and save its opcode, rs1, rs2, rd or immediate field whatever is applicable in memory locations starting from 0x10001000

For example 0x005180b3 is machine code for add x1 x3 x5

Now your code must be able to understand which format this instruction belongs to i.e. R type. Then fetch rs1 i.e. 3, rs2 i.e. 5 , rd i.e. 5 and opcode for add instruction. Store these values (3,) in memory location starting from 0x10001000. Do it for following 5 instructions:

add, slti, lw,sw,beq.

Marks division: 3 marks per instruction. In each instruction, 1 mark per correct fetching storing the extracted value. [15 marks]

Question 4: Two strings are stored at location 0x10001000 and 0x10002000 respectively.

Write a function that compares these strings and places the total number of characters that are different at register x7.

String 1: 0x10001000: “heyhowareYou”

String 2: 0x10002000:”helloIareyou”

Output:x7: 4

Capital and small letters are not distinguished i.e. function is not case sensitive. You will be given 3 inputs in registers storing starting addresses of both string and size of strings. Both strings are of the same length.

Marks division: Storing string correctly at given addresses(2 marks)

Comparison logic: 7 marks

Storing correct output: 1 marks