CS230 DLDCA Quiz-2, Thu 12 Sep 2024, 11:40am-12:20pm, Max. Marks: 5

Name: Sample Answers_____ Roll number: _____ House: _____

General instructions

- Write only in the space provided. Answer briefly but crisply (not lengthily or loosely).
- You are allowed to refer to your own hand-written notes only.
- Write neatly and clearly. Up to **+2 HP** for neat handwriting, neat/crisp answers.
- Answers generally have to be (briefly) explained. State any necessary assumptions.

1. The following C structure has been defined in a header file.

```
struct s2 {
   int x; // size 32 bits
   char *y; // size 32 bits
};
```

Consider the following C-code:

```
int init(struct s2 M[]) {
   int i;
   struct  s2 *ptr;
   for(i = 0; i != 10; i++) {
      ptr = &M[i];
      ptr->x = 65539;
      ptr->y = malloc(i+3);
   } // End for()
   return 1;
} // End init()
```

Hint: 65539 = (2^16)+3

```
# Assembly code corresponding to above C code is below.

1    INIT:      addi  $sp, $sp, -8
2               sw    $ra, 0($sp)
3               sw    $a0, 4($sp)
4               add   $s0, $zero, $zero     # i in s0
5    FOR:       beq   $s0, 10, EXIT         # loop exit
6               sll   $t0, $s0, 3
7               add   $t0, $t0, $a0         # ptr in t0
8               li    $t1, 65539
9               sw    $t1, 0($t0)           # store ptr->x
10              addi  $a0, $s0, 3           # prepare argument
11              jal   MALLOC                # function call
12              sw    4($t0), $v0           # store ptr->y
13              addi  $s0, $s0, 1
14              j     FOR
15   EXIT:      ori   $v0, $zero, 1
16              lw    $ra, 0($sp)
17              addi  $sp, $sp, 8
18              jr    $ra
```

(a) Gives above is the outline of the assembly code for this function. The line numbers on the left side are for convenience, and are not part of the assembly code. Fill in the blanks to achieve the indicated functionality. **[2 marks]**

(b) The code is wrong in that it does not save all the required registers. What register(s) must it additionally save as *callee*? Why? **[0.5 marks]**

s0 is a callee saved register which is being modified by init() but not saved/restored

(c) What register(s) must it additionally save as *caller*? Why? **[0.5 marks]**

t0 is a caller saved register which init() is accessing after call to malloc, but value of t0 could be modified by malloc. So init() must save t0 as caller (and restore before using it in line 12).

(d) Suppose the value of PC of the function call instruction (line 11) is 0x08102000. What is the value of $ra when the body of malloc starts executing?

ra (return address) for malloc will be set to +4 = 0x08102004

(e) Identify any one pseudo-instruction in the already given code, and give the corresponding real MIPS instruction(s) for each. **[1 mark]**

Ans1: li in line 8, replace with
lui $t1, 1
ori $t1, $t1, 3 # can use addi instead
(can use $at instead of $t1, except the final destination)
OR
Ans2: beq in line 5, replace with
addi $at, $0, 10 # can use ori instead
beq $s0, $at, EXIT

2. **Optional, for House Points (up to 5HP):** For nearly 2.5 years during Covid, there were mask mandates around the world, including/especially in scientific institutions. The highest quality scientific evidence for such interventions is a *randomised controlled trial (RCT)*. A review of various RCTs on masks was published in Jan 2023, in the Cochrane library. It showed:

(a) that N95 masks as well as cloth masks offer about 80% reduced spread

(b) that N95 masks offer near 100% reduced spread, while cloth masks offer about 50%

(c) that N95 masks offer about 80% reduced spread, while cloth masks offer only about 20%

(d) that neither N95 masks nor cloth masks provide statistically significant reduction in spread

Your remarks on the above: Ans: (d). RCTs before as well as during Covid have always shown no statistically significant reduction in spread due to use of cloth or N95 masks. The world, especially scientists, fell into groupthink instead of critical thinking, and lost their marbles in vastly exaggerated threat. Groupthink is a well known psychological phenomenon. The objective of your education is to inculcate independent and critical thinking.