ICS Homework 1

Feb 16, 2023

1 HCL

Please write down the HCL expressions for the following signals.

Example: Show if the two input signals **a** and **b** are equal

```
bool eq = (a&&b) || (!a && !b);
```

1. The HCL expression for a signal **nand**, which is equal to **NAND** of inputs **a** and **b**, the truth table is given, and you should only use **NOT** (!) and **OR** (||) operators.

```
bool nand = !a || !b
```

NAND	0	1
0	1	1
1	1	0

2. The HCL expression for a three-way xor called **XOR3**. If and only if all the inputs are the same, output will be true. Each input and output is one-bit wise. The three input signals are **a**, **b** and **c**. Hint: You can use boolean expressions or case expressions.

```
bool XOR3 = [((!a&&!b&&!c) || (!a&&b&&c) !! (a&&!b&&c) ||(a&&b&&!c))
1: 1;];
```

2 Y86

```
0x000:                          | .pos 0
0x000:                          | init:
0x000: 30f40002000000000000     |   irmovq stack, %rsp
0x00a: ________[1]________      |   irmovq stack, %rbp
0x014: 801e00000000000000       | call main
0x01d: 00                       | halt
0x01e:                          | main:
0x01e: 30f70003000000000000     |   irmovq list, %rdi
0x028: 30f60300000000000000     |   _____[2]_____
0x032: 803c00000000000000       |   call calculate
0x03b: 90                       |   ret
0x03c:                          | calculate:
0x03c: 6300                     |   _____[3]_____
0x03e: 30f30800000000000000     |   irmovq $8, %rbx
0x048: 2072                     |   rrmovq %rdi, %rdx
0x04a: 706d00000000000000       |   jmp test
0x053:                          | loop:
0x053: 5012000000000000000      |   _____[4]_____
0x05d: 6010                     |   addq %rcx, %rax
0x05f: ________[5]________      |   andq %rsi, %rax
0x061: 6032                     |   addq %rbx, %rdx
0x063: 5022000000000000000      |   mrmovq (%rdx), %rdx
0x06d:                          | test:
0x06d: 6222                     |   andq %rdx, %rdx
0x06f: 745300000000000000       |   jne loop
                                |
0x200:                          |   ______[6]______
0x200:                          | stack:
                                |
0x300:                          | .pos 0x300
0x300:                          | .align 8
0x300:                          | list:
0x300: 0800000000000000         |   .quad 0x8
0x308: 2003000000000000         |   .quad ____[7]____
0x310: 0900000000000000         |   .quad 0x9
0x318: 0000000000000000         |   .quad 0x0
0x320: 0a00000000000000         |   .quad 0xa
0x328: 1003000000000000         |   .quad 0x310
```

1. Please fill in the blanks within above Y86 binary and assembly code.
2. Please calculate the value of **%rax** after the program **HALT**.