

ICS EXE 1

March 10, 2020

1 ICS (Organization)

You can use the self-checking tools in the same directory to check your answer. More detail can be found in README.

1.1 HCL Programming: MID3

The reference manual of the Hardware Control Language can be found at [here](#). Read the material and design an hardware module MID3, which output the middle number among the 3 inputs ($A \neq B \neq C$). Hint: you can use the help from MIN3 and MAX3, which has been introduced on the class.

1.2 HCL Programming: Adder

Figure 1 is a hardware module called HALF-ADDER, which can add two one-bit value A and B . S is the sum and C is the carry. Figure 2 is a hardware module named FULL-ADDER,

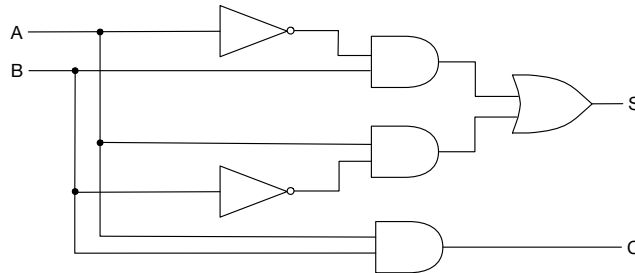


Figure 1: Half adder

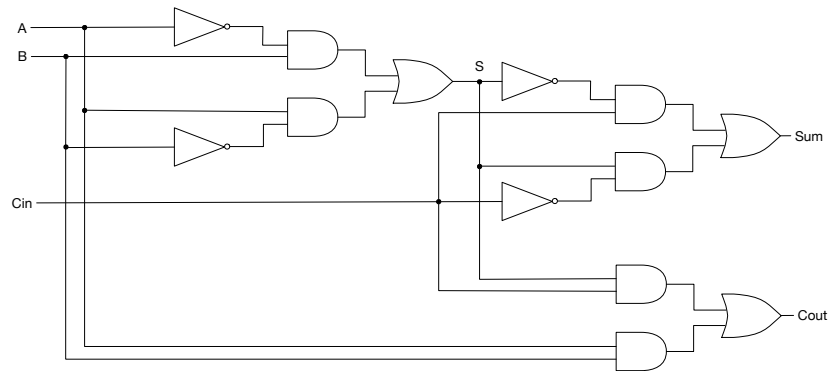


Figure 2: Full adder

You can write the HCL expression of C like this:

```
1 bool C = A && B;
```

1.2.1

Please write the HCL expression of S :

```
1 bool S =
```

1.2.2

Please write the HCL expression of Sum (You can use A , B , and S now):

```
1 bool Sum =
```

1.2.3

Please write the HCL expression of $Cout$ (You can use A , B , and S now):

```
1 bool Cout =
```

1.2.4

Now we have a 1-bit full adder as shown in figure 3. How to use this hardware module to construct a 4-bit full adder? Please draw it in figure 4.

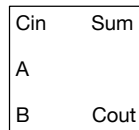


Figure 3: 1-bit full adder



Figure 4: 4-bit full adder

2 ICS (System Software)

2.1 File

List 5 commonly used Unix system calls for file I/O. What's the relationship between them and those functions in the c standard I/O library?

2.2 Virtual Memory

Morden computer's physical memory could reach 128GB or higher. Why do we still need virtual memory?

2.3 Process

2.3.1

What is the relationship between virtual memory and process?

2.3.2

What is the relationship between application and process?

2.4 User&Kernel Mode

2.4.1

What are the differences between user mode and kernel mode?

2.4.2

```
1  int array[10];  
2  void func1(void) {  
3      array[5000] = 40;  
4      return 0;  
5  }  
6  
7  void func2(void) {  
8      array[5] = 40;  
9      return 0;  
10 }
```

During the execution of the two functions given above, will the control flow changes from user mode to kernel mode?