EE599-002 Assignment 3: Hardly Software

Implementor's Notes

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ABSTRACT

This assignment is quite simple. A basic block to combinatorial circuit compiler was provided by Dr. Dietz. Yet, this conversion to combinatorial logic only used the fundamental gates (and, or, and xor); as we know from basic digital logic courses, NAND or NOR equivalents must be generated for proper implementation of the circuit. Our assignment was to change the needed components of `bb6.c` to implement strictly NAND or NOR logic; I chose to implement NAND.

1. GENERAL APPROACH

The approach was simple as long as pre-existing knowledge of NAND equivalence was present. First, a basic NAND gate function was implemented as the following code:

```
int gatenand(register int a, register int b)
{
   /* Simplifications */
   if (a == 0) return(1);
   if (b == 0) return(1);
   if (b == 1 && a == 1) return(0);

   return(mkgate(a, b, NAND));
}
```

Then, each gate function was stepped through and changed to their NAND equivalent circuits. These equivalences are as follows: In order to implement Figure 1, Not's return statements was changed to the following:

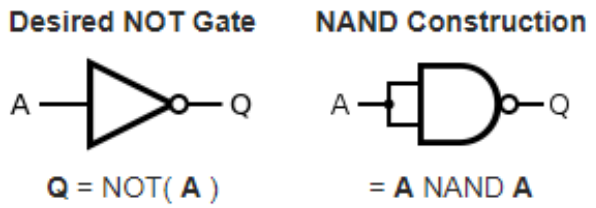

Figure 1: NOT to NAND

```
return(mkgate(a,a,NAND));
```

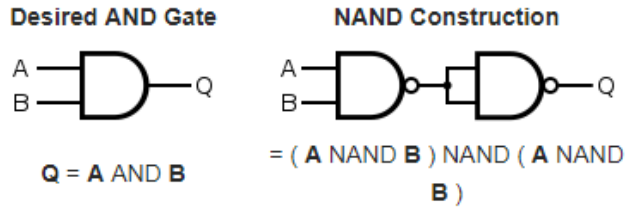

Figure 2: AND to NAND

In order to implement Figure 2, And's return statements was changed to the following:

```
return(gatenand(gatenand(a,b),gatenand(a,b)));
```

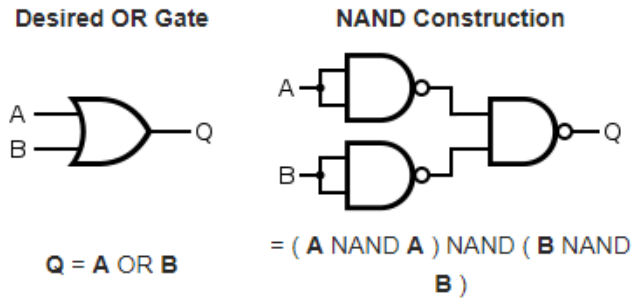

Figure 3: OR to NAND

In order to implement Figure 3, Or's return statements was changed to the following:

```
return(gatenand(gatenot(a),gatenot(b)));
```

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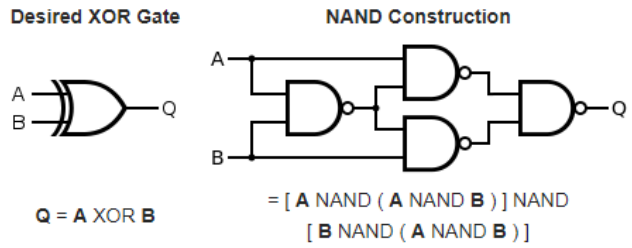

Figure 4: XOR to NAND

In order to implement Figure 4, Xor's return statements was changed to the following:

```
return(gatenand(gatenand(a,gatenand(a,b)),gatenand(gatenand(a,b),b)));
```

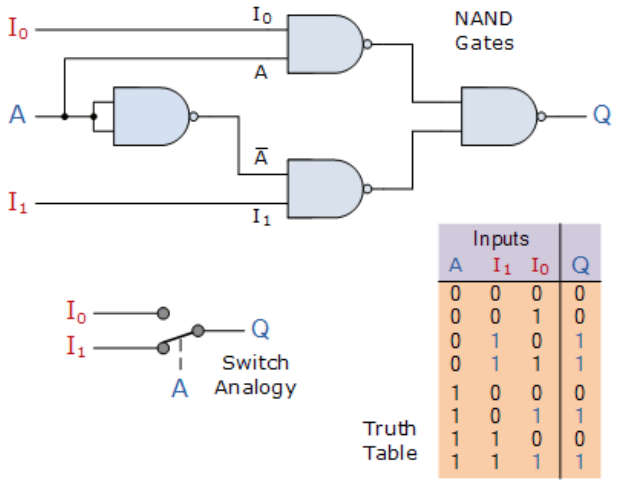

Figure 5: 2-1 MUX to NAND

In order to implement Figure 5, Mux's return statements was changed to the following:

```
return(gatenand(gatenand(t, i),gatenand(gatenot(i),
    e)));
```

2. TESTING

The testing scheme found in test.c is a the same testing file provided by Dr. Dietz for this assignment.

3. ISSUES

No issues came up during the implementation of this project. The only slight issue I had was the concern that arose from how easy the assignment was. I almost felt like I was missing a part of the assignment, but I read over the assignment brief multiple times and everything seemed in order.