T 1

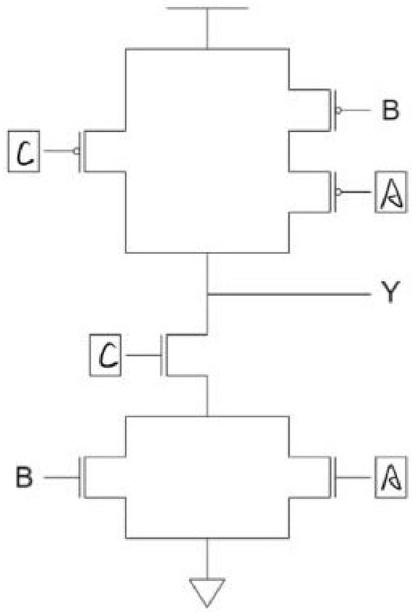

Figure 1: Circuit

Truth Table			
A	B	C	Y
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	0
1	1	0	1
1	1	1	0

T 2

Prove:

Simply prove taht NOT AND OR can be represented by NAND:

Not

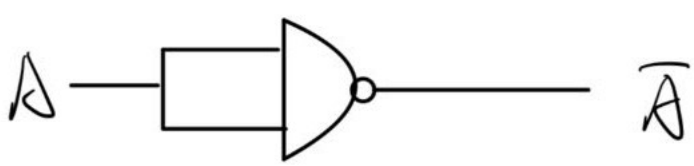

Figure 2: NOT

AND

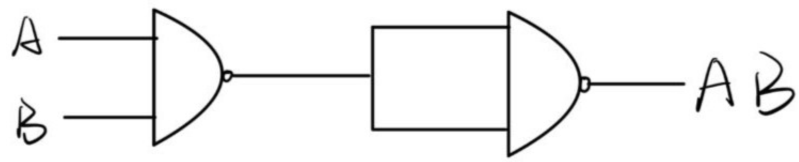

Figure 3: AND

OR

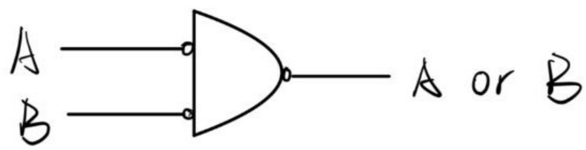

Figure 4: OR

In this way we have proved that NAND is logically complete.

T 3

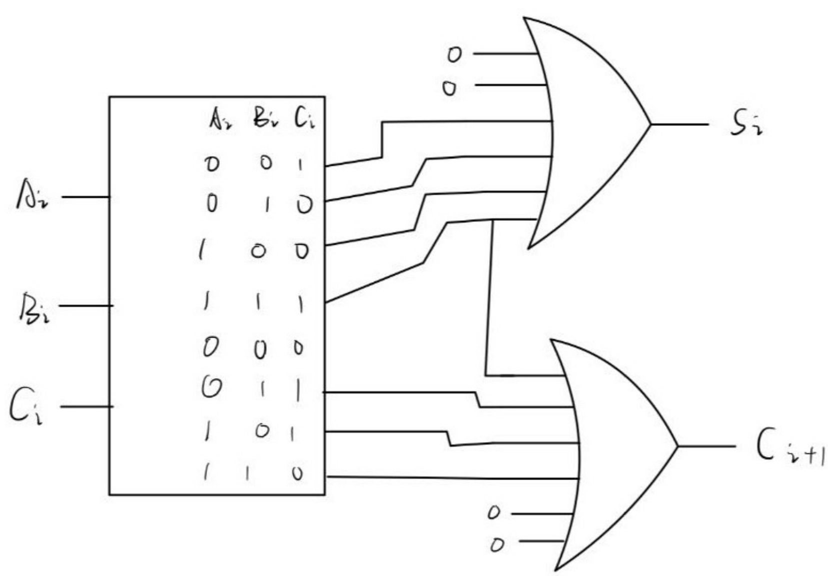

Figure 5: Full Adder

T 4

1. The maximum value of A[1:0] is 3(11).
2. The maximum value of B[1:0] is 3(11).
3. the maximum possible value of Y is 9(1001).
4. 4 bits.
5. As below

A[1]	A[0]	B[1]	B[0]	Y[3]	Y[2]	Y[1]	Y[0]
0	0	0	0	0	0	0	0
0	0	0	1	0	0	0	0
0	0	1	0	0	0	0	0
0	0	1	1	0	0	0	0
0	1	0	0	0	0	0	0
0	1	0	1	0	0	0	1
0	1	1	0	0	0	1	0
0	1	1	1	0	0	1	1
1	0	0	0	0	0	0	0
1	0	0	1	0	0	1	0
1	0	1	0	0	1	0	0
1	0	1	1	0	1	1	0
1	1	0	0	0	0	0	0
1	1	0	1	0	0	1	1
1	1	1	0	0	1	1	0
1	1	1	1	1	0	0	1

Table 1: Truth table

6. Implement the third bit of output, Y[2] from the truth table using only AND, OR, and NOT gates:

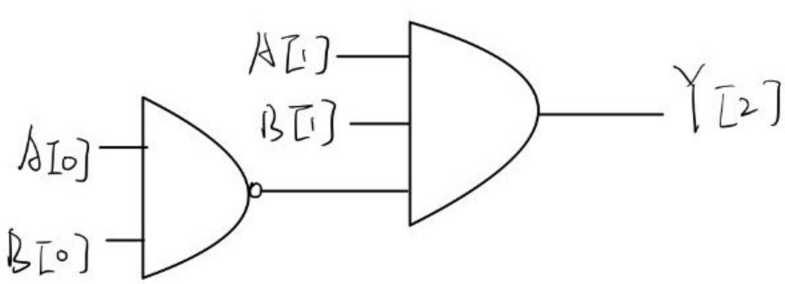

Figure 6: Y[2]

T 5

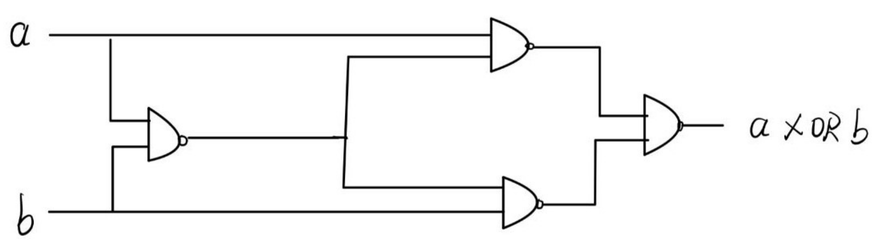

Figure 7: XOR

T 6

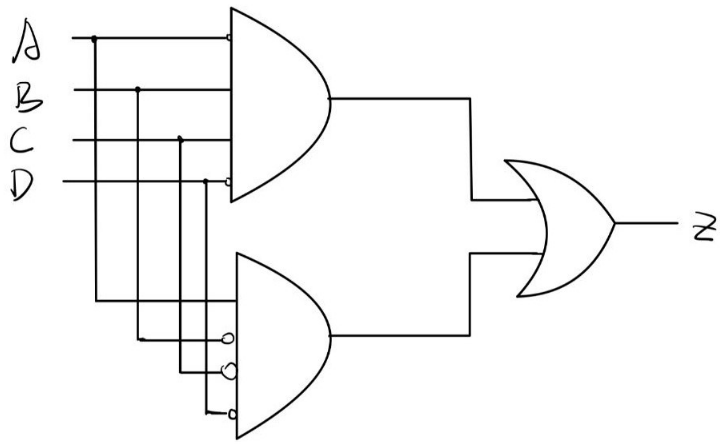

Figure 8: Logic circuit

A	B	C	D	Z
0	0	0	0	0
0	0	0	1	0
0	0	1	0	0
0	0	1	1	0
0	1	0	0	0
0	1	0	1	0
0	1	1	1	0
1	0	0	0	0
1	0	0	1	0
1	0	1	0	0
1	0	1	1	0

Table 2: Truth Table

T 7

1.

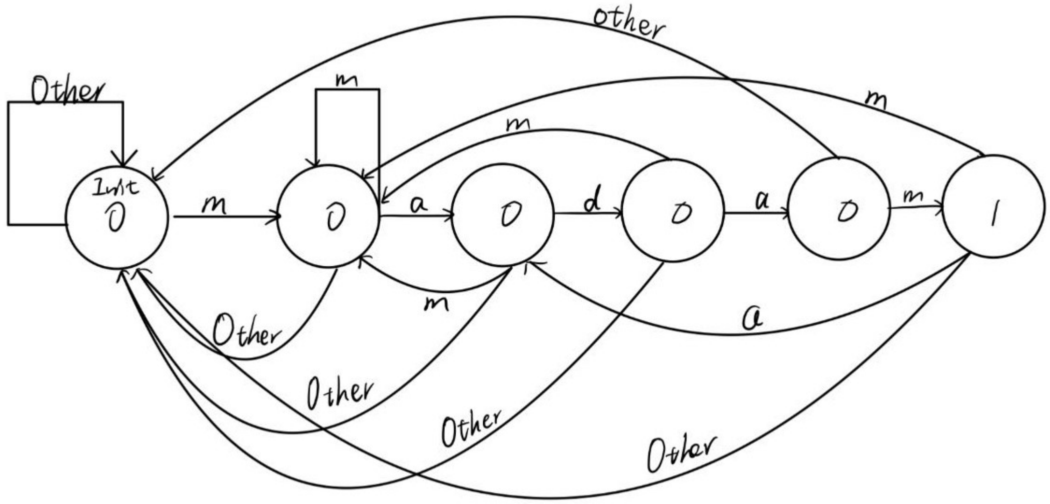

Figure 9: State diagram

2.

In this case, there are six unique states, so we would need a minimum of **six** latches to implement this FSM.

T 8

- The maximum address space of the memory is 2^a addresses.
- the memory has an address space of 2^a addresses, and each address can store B bits of data, so the total data capacity is $2^a \cdot b$ bits.

T 9

- $A[1:0] = 00$; $WE = 1$.
- Just need to add k Gated D-Latches to each line and connect them as shown in the diagram.
- We need 6 line to find $2^8 - 1$ address , so we need to add 4 lines.

T 10

1. **At least 82 bits**
   - **occupation ratio** : Every team needs 7 bits , cause 2^7 is the smallest numbers that bigger than 99.
   - **score** : Every team needs 2 bits.
   - **time remaining** : 8 bits , 2 fot the minutes and 6 for the seconds.
   - **skill charge ratio** : Every player needs 7 bits.
2. **Still 82**
3. **I'm sorry that I have no idea about this question.**