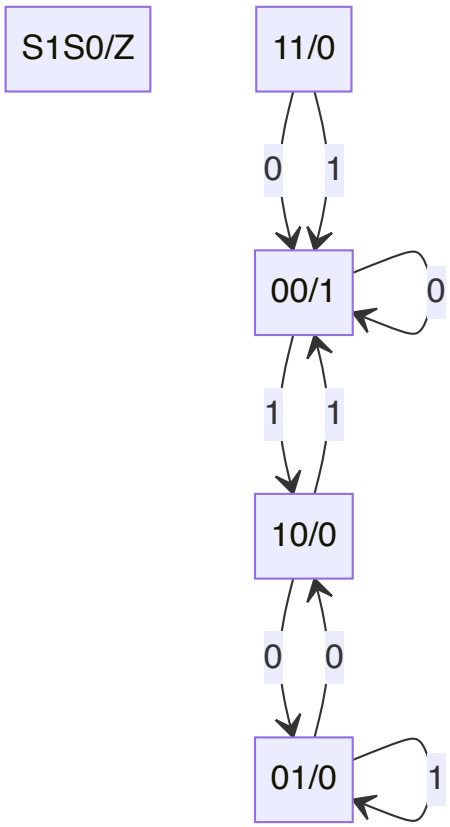
HW3

T1

(a).

S_0	S_1	X	Z	S_0'	S_1'
0	0	0	1	0	0
0	0	1	0	1	0
0	1	0	0	1	0
0	1	1	0	0	1
1	0	0	0	0	1
1	0	1	1	0	0
1	1	0	1	0	0
1	1	1	1	0	0

(b).



T2

Add the contents of register 2 to the contents of the register 1, and store them in the register 0;

If the result is equal or more than zero, he next instruction to execute will be the instruction at x3039.

T3

(a). Opcode.

(b). Operands

T4

Fetch (F) costs 100 cycles, and each of decode (D) the instruction, Fetch operand (FO), Execute (E) the instruction and Store the result (SR) costs only 1 cycle, so it will takes

$$100 + 1 + 1 + 1 + 1 = 104 \tag{1}$$

Cycles.

T5

The opcode will be 6bit, the SR will be 6bit and the DR will be 6bit because $2^6 = 64$,.

Thus, the immediate number will be:

$$32 - 6 - 6 - 6 = 14 \tag{2}$$

bit.

So, the range of the immediate number is

$$2^{13} \sim -2^{13} + 1 \tag{3}$$

T6

(a). The range of the immediate number will be increase. Because we need less bit giving to the registers, and thus we have 2 more bits give to the immediate number.

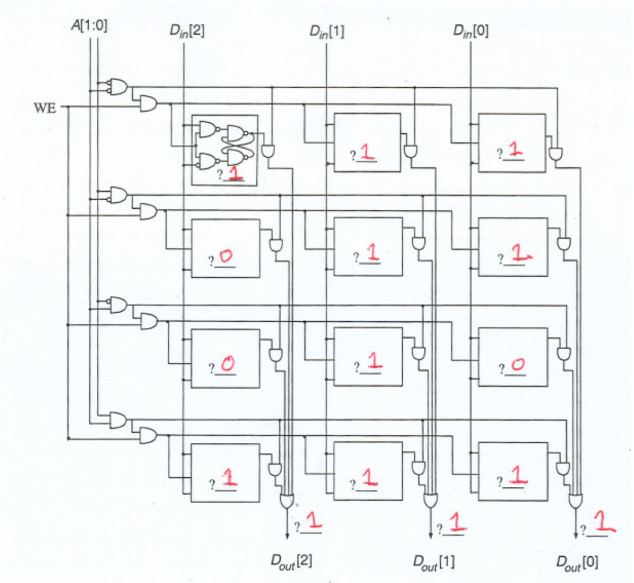
(b). We can get 1 more bit to the offset, thus we will improve our ability for addressing space.

(c). We can get 1 more bit to the offset, thus we can reach more address.

T7

	fetch instruction	decode	evaluate address	fetch data	excute
PC	ALL				JMP
IR	ALL				
MAR	ALL			ADD	
MDR	ALL				ADD

T8



T9

(a).

$$\begin{matrix} MAR : 001 \\ MDR : 00110000 \end{matrix} \tag{4}$$

(b).

$$MDR : 00010101 \tag{5}$$

T10

Memory Accesses

	R/W	MAR	MDR				
Access 1	W	x4000	1	1	1	1	0
Access 2	R	x4003	1	0	1	1	0
Access 3	W	x4001	1	0	1	1	0
Access 4	R	x4002	0	1	1	0	1
Access 5	W	x4003	0	1	1	0	1

Memory before Access 1

x4000	0	1	1	0	1
x4001	1	1	0	1	0
x4002	0	1	1	0	1
x4003	1	0	1	1	0
x4004	1	1	1	1	0

Memory after Access 3

x4000	1	1	1	1	0
x4001	1	0	1	1	0
x4002	0	1	1	0	1
x4003	1	0	1	1	0
x4004	1	1	1	1	0

Memory after Access 5

x4000	1	1	1	1	0
x4001	1	0	1	1	0
x4002	0	1	1	0	1
x4003	0	1	1	0	1
x4004	1	1	1	1	0

T11

(a). 8bit

(b). 7bit

(c). 3bit

T12

(a).

$$\frac{1}{2 \times 10^{-9}} = 5 \times 10^{8} \tag{6}$$

(b).

$$\frac{1}{8} \times 5 \times 10^{8} = 6.25 \times 10^{7} \tag{7}$$

T13

- Fetch: Get instruction from memory. Load address of next instruction in the Program Counter.
- Decode: Find out what the instruction does.
- Evaluate Address: Calculate address of the memory location that is needed to process the instruction.
- Fetch Operands: Get the source operands (either from memory or register file).
- Execute: Perform the execution of the instruction.
- Store Result: Store the result of the execution to the specified destination.