Introduction to Computing Systems
Homework 2

PB18111697 王章瀚

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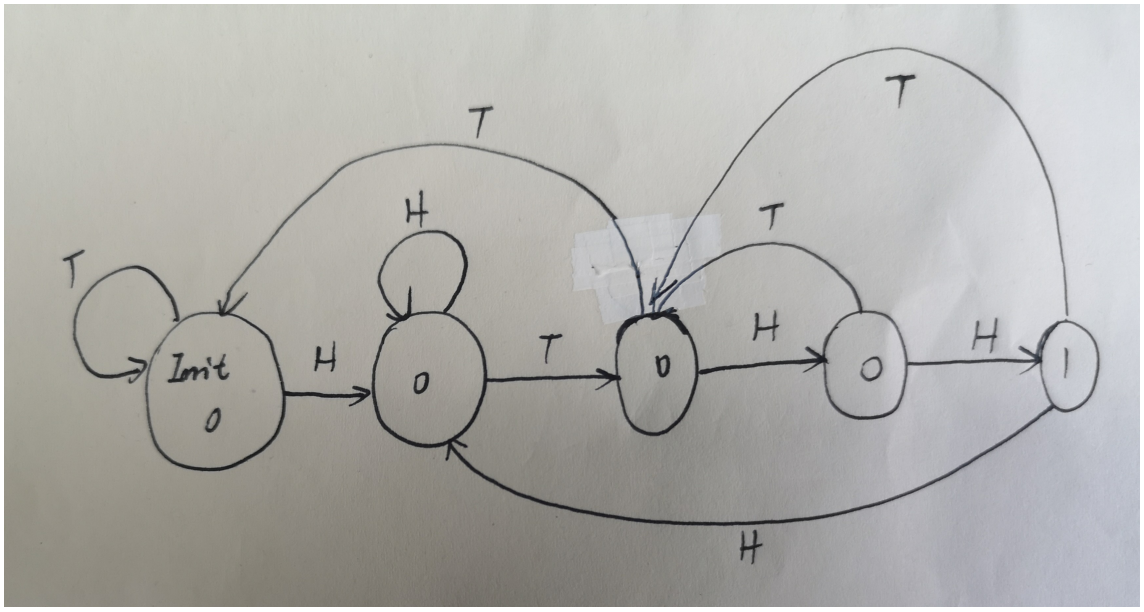
1

a



b

Since there are 5 states in all, 3 state variables(I mean a variables with 3 bits) will be needed.

2

The addressability is 16 byte and it has 2^7 memory locations, so the computer has $16byte \times 2^7 = 2048$ bytes of memory.

3

a

A[1:0]=105A[1:0] should be 01, WE = 1

b

It needs $\lceil log_2(800) \rceil = 10$ address lines.
And the addressability maintains.

c

$2^{10} - \lceil log_2(800) \rceil = \underline{224}$

4

a

The address space of this memory is $\underline{2 \text{ bits}}$, which is $2^2 = \underline{4}$ locations.

b

The addressability of this memory is $\underline{16 \text{ bits}}$.

c

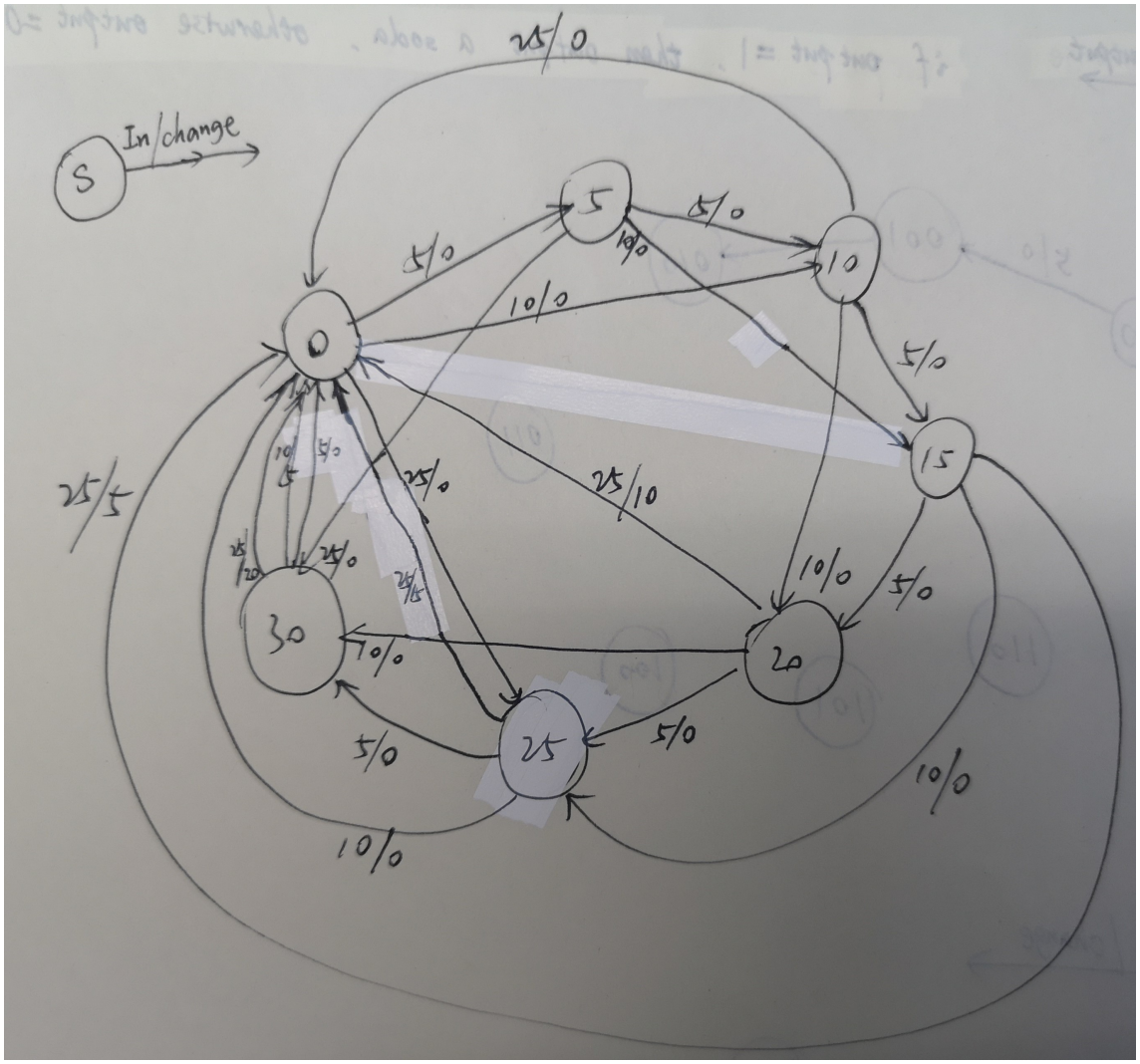
It's $4 \times 16 \; bits = \underline{8 \; bytes}$

d

WE	A[1:0]	Di[15:0]	D[15:0]	Read/Write
0	01	xFADE	x4567	Read
1	10	xDEAD	xDEAD	Write
0	00	xBEEF	x0123	Read
1	11	xFEED	xFEED	Write

5

And the states diagram is as below.



6

Using "-" to represent the state haven't been changed.

	PC	IR	MAR	MDR	R0	R1	R2
Fetch	x3004	x62BE	x3003	x62BE	x3000	x3000	x3002
Decode	-	-	-	-	-	-	-
Evaluate Address	-	-	-	-	-	-	-
Fetch Operands	-	-	x3000	x62BF	-	-	-
Execute	-	-	-	-	-	-	-
Store Result	-	-	-	-	-	x62BF	-

7

a

$\lceil log_2(1151) \rceil = \underline{11\ bits}$.

b

$\lceil log_2(40) \rceil = \underline{6\ bits}$.

c

$32 - 11 - 6 \times 3 = \underline{3\ bits}$.

8

```
0101 000 000 1 00000     ;AND R0, R0, #0
1001 010 001 111111      ;NOT R2, R1
0001 010 010 1 00001     ;ADD R2, R2, #1
0001 010 010 000 011     ;ADD R2, R2, R3
0000 101 000000001       ;BRnp
0001 000 000 1 00001     ;ADD R0, R0, #1
1111 0000 0010 0101      ;HALT
```

9

if R2 < R1, R4 = 0, otherwise, R4 = 1.