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Q1: Minimize:

The last digit of the student ID: 6

\Rightarrow Function: 1.4 $F = \sum m(2, 5, 13, 15) + \sum d(8, 9, 10, 11)$
We have the table follow Quine-McCluskey method:

✓ 2	0010	(2, 10) - 010	(8, 9, 10, 11) 10--x (don't care)
✓ 8	1000	✓ (8, 9) 100-	
✓ 5	0101	✓ (8, 10) 10-0	(9, 11, 13, 15) 1--1
✓ 9	1001	(5, 13) -101	
✓ 10	1010	✓ (9, 11) 10-1	
✓ 11	1011	✓ (9, 13) 1-01	
✓ 13	1101	✓ (10, 11) 101-	
✓ 15	1111	✓ (11, 15) 1-11	
		✓ (13, 15) 11-1	

We have PI chart: (We ignore the don't care value)

	2	5	13	15
(9, 11, 13, 15)			x	x
(2, 10)	x			
(5, 13)		x	x	

From the chart we have:

$$F(A, B, C, D) = 1--1 + -101 + -010$$

$$= AD + B\bar{C}D + \bar{B}C\bar{D}$$

Q2: The last digit : 6

$$\rightarrow A = q_2 q_1 q_0 = 010$$

$$B = q_2 q_1$$

$$\rightarrow A = 010$$

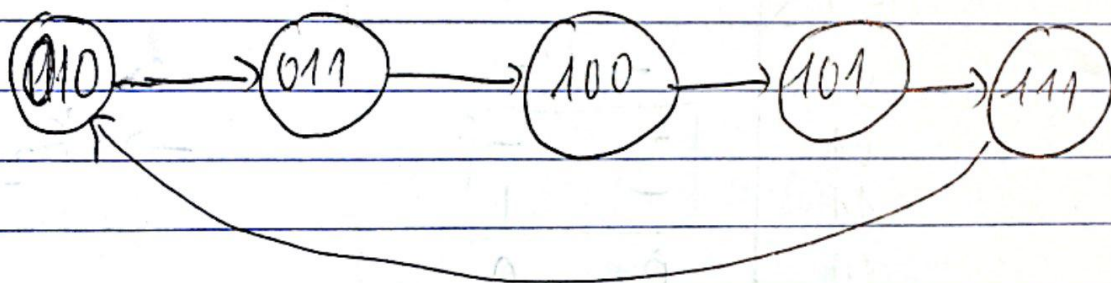
$$B = 011$$

$$C = 100$$

$$D = 101$$

$$E = 111$$

We redraw the state diagram:



The transition table:

PS	NS
$q_2 q_1 q_0$	$Q_2 Q_1 Q_0$
010	011
011	100
100	101
101	111
111	010

The excitation table using JK flip-flop:

PS	NS	$J_2 K_2$	$J_1 K_1$	$J_0 K_0$
$q_2 q_1 q_0$	$Q_2 Q_1 Q_0$			
010	011	0 -	- 0	1 -
011	100	1 -	- 1	- 1
100	101	- 0	0 -	1 -
101	111	- 0	1 -	- 0
111	010	- 1	- 0	- 1

We have Karnaugh table for :

J_2	$q_2 q_1$	q_0	
		0	1
	00	-	-
	01	0	1
	11	-	-
	10	-	-

$$\Rightarrow J_2 = q_0$$

K_2	$q_2 q_1$	q_0	
		0	1
	00	-	-
	01	-	-
	11	-	1
	10	0	0

$$\Rightarrow K_2 = q_1$$

J_1	$q_2 q_1$	q_0	
		0	1
	00	-	-
	01	-	-
	11	-	-
	10	0	1

$$\Rightarrow J_1 = q_0$$

K_1	$q_2 q_1$	q_0	
		0	1
	00	-	-
	01	0	1
	11	-	0
	10	-	-

$$\Rightarrow K_1 = \bar{q}_2 q_0$$

T_0

$d_2 q_1$ \ q_0	0	1
00	-	-
01	1	-
11	-	-
10	1	-

$\rightarrow T_0 = 1$

 K_0

$d_2 q_1$ \ q_0	0	1
00	-	-
01	-	1
11	-	1
10	-	0

$\rightarrow K_0 = q_1$

We use 3 JK FF to design logic diagram:

