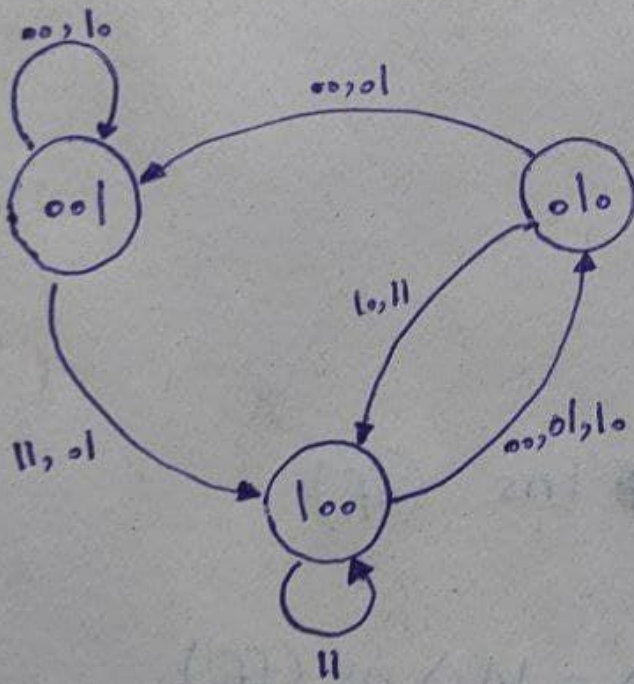
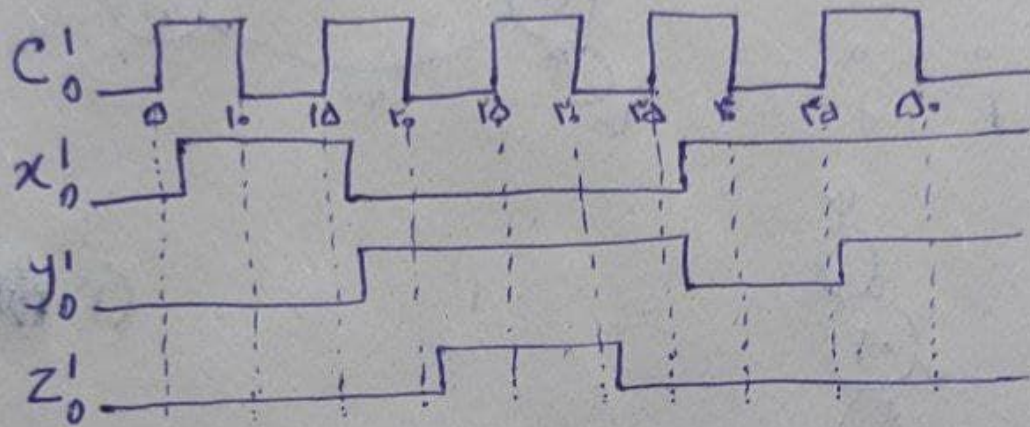
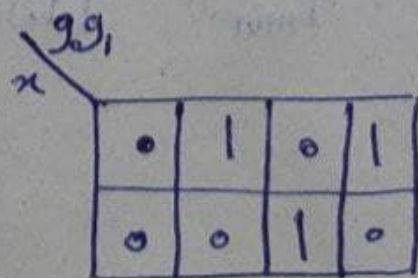
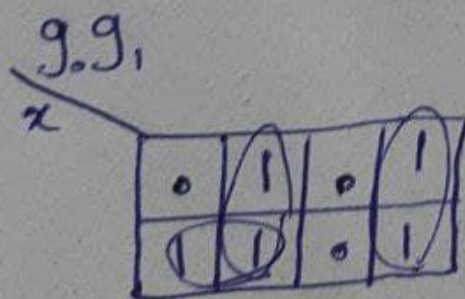


(الف) $D_{ff} : 1 + 1 + 1 = 3 \text{ ns} , T_{ff} = 1 + 1 + 1 = 3 \text{ ns}$

$\Rightarrow T_{min} = 3 \text{ ns} + 3 \text{ ns} = 6 \text{ ns} \Rightarrow f_{max} = 10 \text{ MHz}$

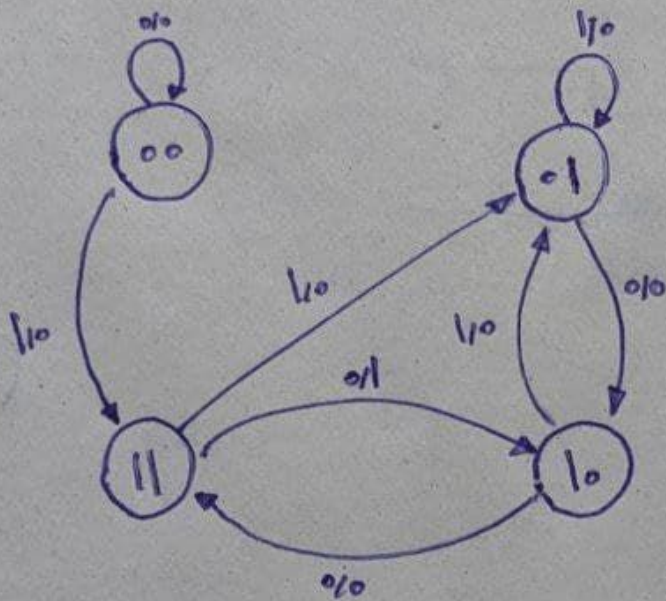
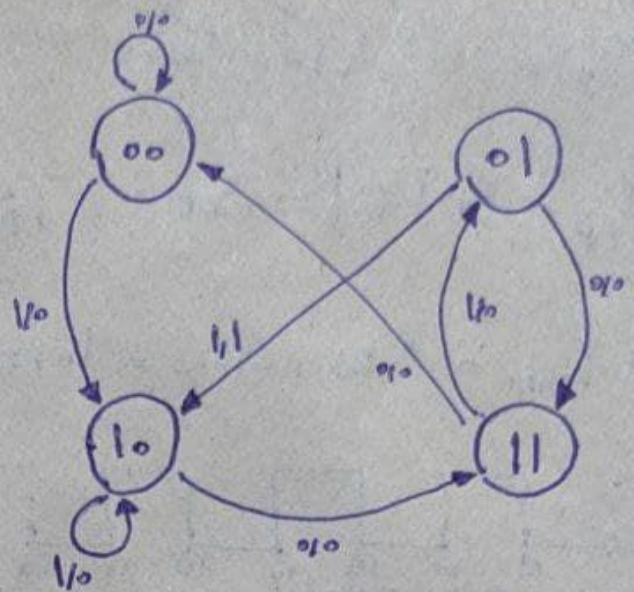


$Z(t) = x(t) g_2(t) g_1(t) \rightarrow$ مدار میلی



$g_0(t) \quad g_1(t) \quad x(t) \quad g_0(t+1) \quad g_1(t+1) \quad z(t)$

0	0	0	0	0	0
0	0	1	1	0	0
0	1	0	1	1	0
0	1	1	1	0	1
1	0	0	1	0	0
1	1	1	0	0	0
1	1	0	0	0	0
1	1	0	1	1	0



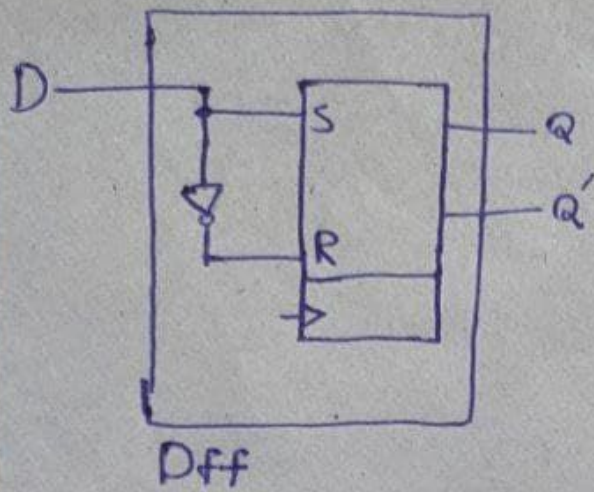
$$T_{min} = 0.1\Delta + 0.1\Delta + \underbrace{0.1\Delta}_{\text{setup}} = 1 \text{ ns} \quad (f_{fi})$$

(c)

$$T_{min} = \underbrace{0.1\Delta}_{\text{teq}} + \underbrace{0.1\Delta}_{\text{or}} + \underbrace{0.1\Delta}_{\text{and}} + \underbrace{0.1\Delta}_{\text{setup}} = 1.4\Delta \text{ ns} \quad (f_{fr})$$

$$\Rightarrow f_{max} = \frac{1}{T_{min}} = \frac{1}{1.4\Delta \text{ ns}} = 100 \text{ MHz}$$

(٦) الف



Setup time = $1\Delta + 1 = 2\Delta$ ns
propagation delay = 2Δ ns

(ستاپ) $T_{min} = 2$ ns

(وسط) $T_{min} = 1\Delta + 1\Delta + 1\Delta = 3\Delta$ ns

(ست راست) $T_{min} = 1\Delta + 1\Delta + 1\Delta = 3\Delta$ ns

$$f_{max} = \frac{1}{T_{min}} \approx 38461538,46$$