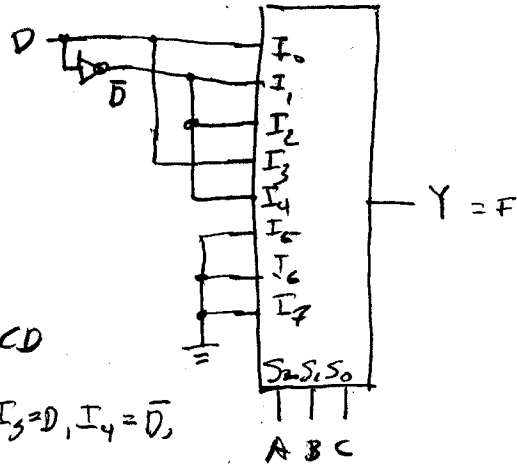
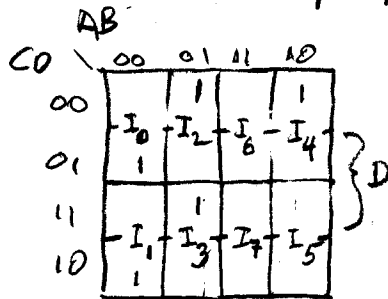


12.23 Implement $F = m_1 + m_2 + m_4 + m_7 + m_8$ with 8-input mux.

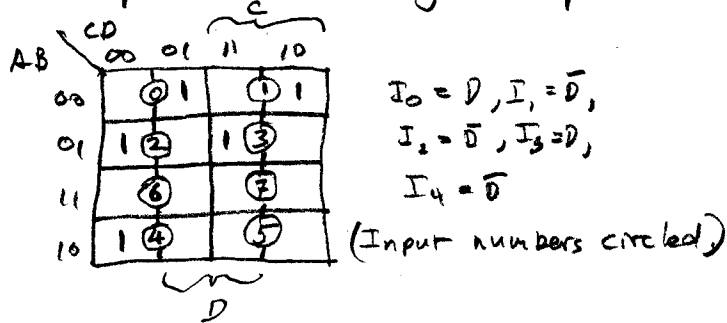
With a K. map approach (careful with input numbers):



For minterms, use binary number ABCD

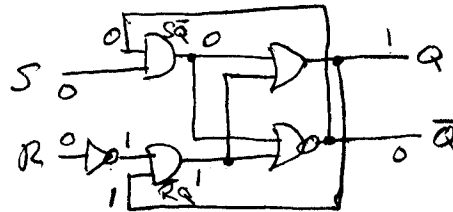
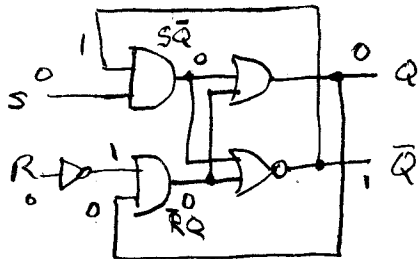
so $m_1 = \bar{A}\bar{B}C\bar{D}$. $I_0 = D$, $I_1 = \bar{D}$, $I_2 = \bar{D}$, $I_3 = D$, $I_4 = \bar{D}$,
rest are 0.

Perhaps the following K. map numbering is clearer:



12.27

With $R=S=0$ this circuit has two stable states (note Q and \bar{Q} outputs are truly complements):



(a) For the state above, w/ $S=0$,
IF $R \rightarrow 1$ $\bar{R}Q=0$ and
nothing changes.

(b) IF $R=0, S=1, S\bar{Q} \rightarrow 1, Q \rightarrow 1, \bar{Q} \rightarrow 0$,
 $\bar{R}Q \rightarrow 1, S\bar{Q} \rightarrow 0$
and we are in the
state $Q=1, \bar{Q}=0$.
[IF $S \rightarrow 0$, stays in
this state. (FF "set").]

(c) IF $R=1, S=1, S\bar{Q}=1 \rightarrow Q=1, \bar{Q}=0$
 $\bar{R}Q=0$ since $R=1$. But now $\bar{Q}=0$
so $S\bar{Q}=0$ and $Q \rightarrow 0, \bar{Q} \rightarrow 1$. Unstable.

(d) For the state above w/ $S=0$,
IF $R \rightarrow 1, \bar{R}Q=0, \bar{Q}=1, Q=0$,
and we are in the state $Q=0$.
IF R returns to 0, stays in this
state ($Q=0$).

(e) IF $R=0$ and $S \rightarrow 1$ nothing
changes since $S\bar{Q}$ still 0.

(f) IF $R=1, S=1, \bar{R}Q=0 \rightarrow \bar{Q}=1$
 $\bar{Q}=1 \Rightarrow S\bar{Q}=1 \Rightarrow Q=1, \bar{Q}=0$
 $\bar{Q}=0 \Rightarrow S\bar{Q}=0 \Rightarrow Q=0, \bar{Q}=1$
and the output is unstable.

Truth table:

Present State			Next State
R	S	Q	Q
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	unstable (oscillates) (strictly, the next state is 1)
1	1	1	unstable (") (" " " " " ")

Generally, if R & S are turned off simultaneously,
the output may continue to oscillate. An input on S or R
will restore the appropriate states. But this probably depends
on details of the gates used - best to avoid $R=S=1$.
The chipmunk "diglog" simulation shows oscillation in this
case (see plots).

Schematic

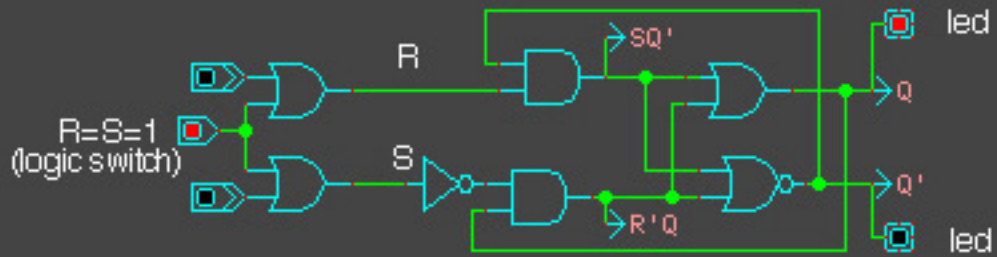


Fig. P12.27 Flip Flop

Frills Editing

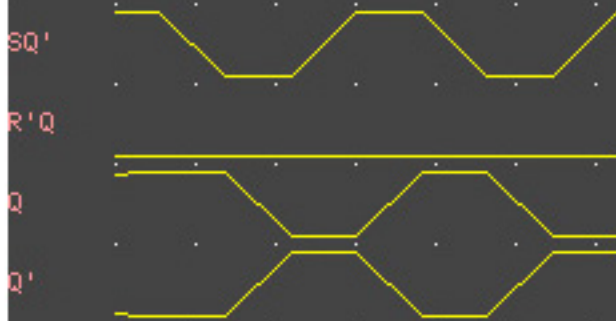
HELP

CAT



Cursor Misc

23:39 ROT



Timing Diagram (R=S=1)
note relaxation oscillations

QUIT

Configure

Trigger

Reset

OFF Value:

Time

Fast

Dump

PLOT

QUIT