ECE213: Digital Electronics

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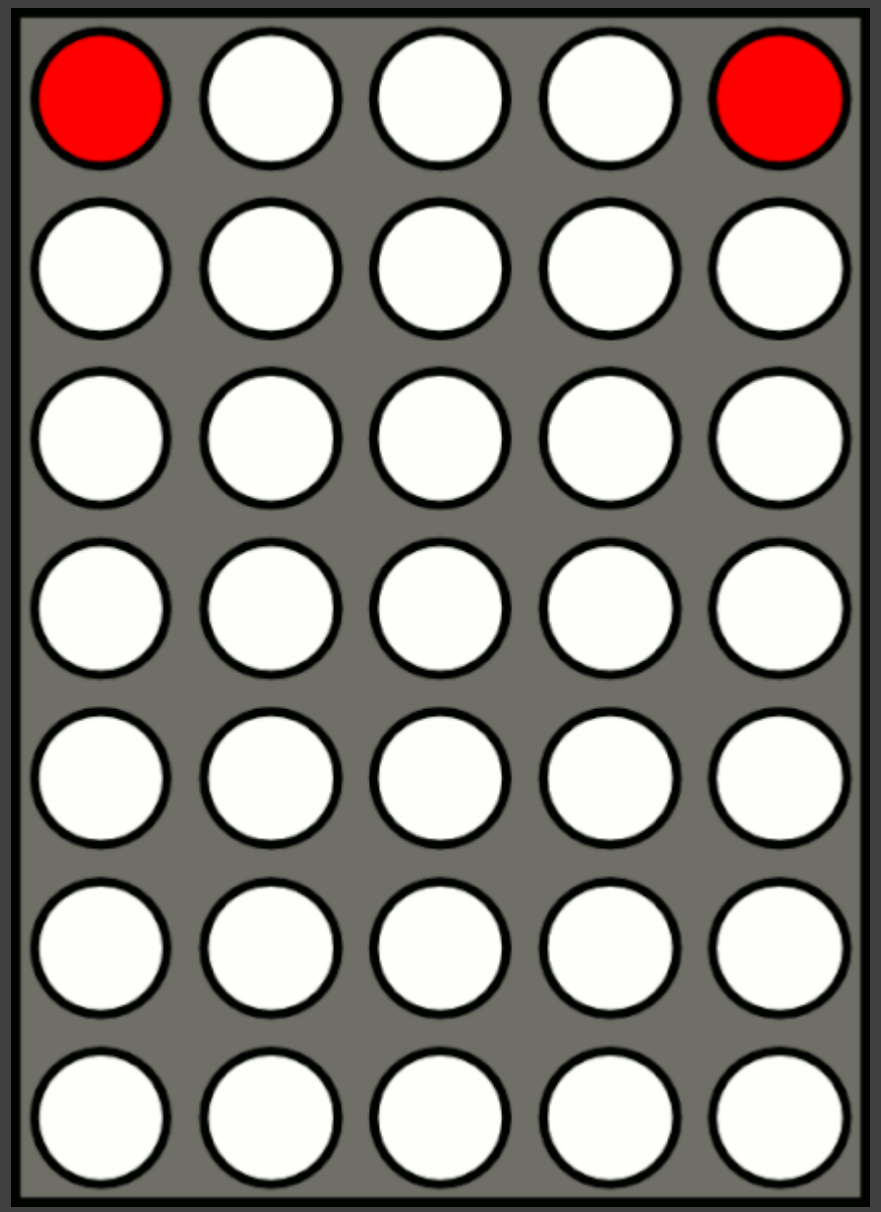
The Course Contents

Unit IV

Introduction to Sequential Logic Circuits : Basic sequential circuits: SR-latch, D-latch, D flipflop, JK flip- flop, T flip-flop, Conversion of basic flip-flops



Introduction to Sequential Logic Circuits

Flip Flop Conversions : JK, SR, D, T

To make your own flip flop.

FF X

A	S	Q	$\bar{Q}$	
0	0	0	1	Reset
0	1	1	0	Set
1	0	$\bar{Q}$	Q	Toggle
1	1	Q	$\bar{Q}$	No change

To convert

JK	to	SR
JK	to	D
JK	to	T
SR	to	JK
SR	to	D
SR	to	T
D	to	JK
D	to	SR
D	to	T
D	to	JK
T	to	SR
T	to	D

Introduction to Sequential Logic Circuits

Flip Flop Conversions

Steps to Convert the flip flop.

Step 1: Find/Identify the available and required flip flop.

Step 2: Make the Excitation tables of available flip flop

Step 3: Make the char. table of required flip flop.

Step 4: Map the excitation table over the char. table.

Step 5: Solve for the Boolean eq.

Step 6: Implement the required flip flop using eq.

Introduction to Sequential Logic Circuits

Flip Flop Conversions

Ex Convert the JK to D flip flop.

Step 1 av. JK req: D

Step 2 Excitation table of av. (JK)

Q_n	Q_{n+1}	J	K
0	0	0	X
0	1	1	X
1	0	X	1
1	1	X	0

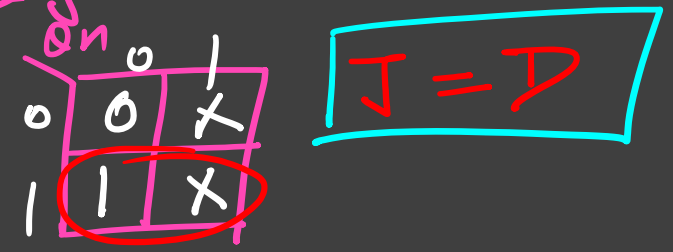
Step 3 Char. table of req (D)

D	Q_n	Q_{n+1}	J	K
0	0	0	0	X
0	1	0	X	1
1	0	1	1	X
1	1	1	X	0

Step 4 Mapping

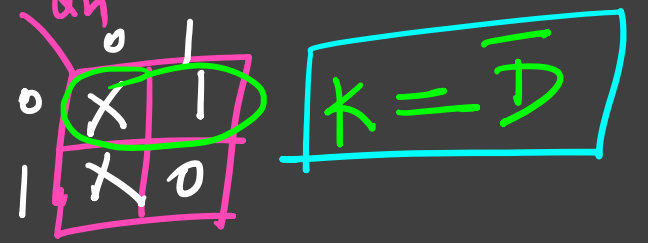
Step 5 Solve for Boolean eq.

For J

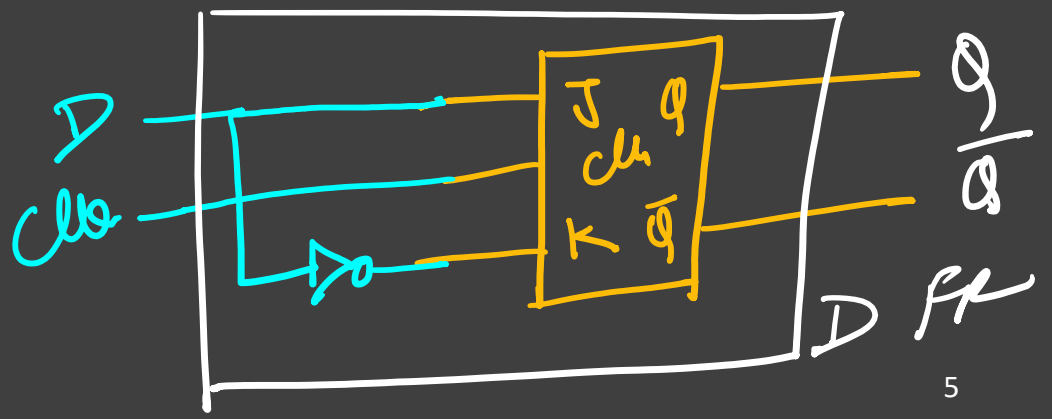


$J = D$

For K



$K = \bar{D}$



Introduction to Sequential Logic Circuits

Flip Flop Conversions

Ex: Convert SR to JK

Sol: Step 1: av: SR req: JK

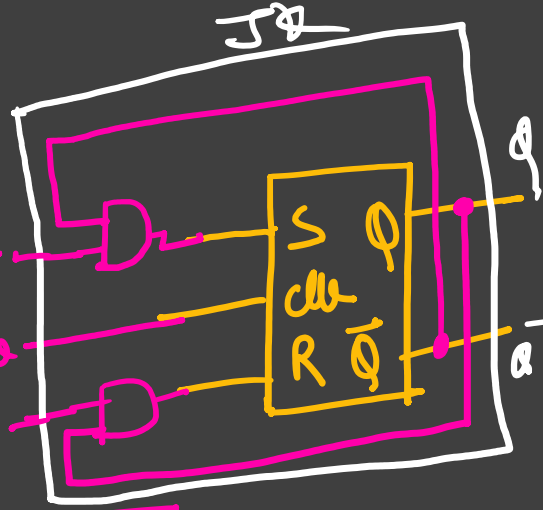
Step 2: Excitation table of av (SR)

Q_n	Q_{n+1}	S	R
0	0	0	X
0	1	1	0
1	0	0	1
1	1	X	0

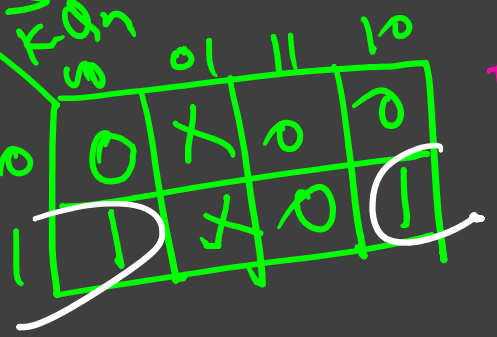
Step 3: Char. table of req

J	K	Q_n	Q_{n+1}	S	R
0	0	0	0	0	X
0	0	1	1	X	0
0	1	0	0	0	1
0	1	1	0	0	1
1	0	0	1	1	0
1	0	1	1	X	0
1	1	0	1	1	0
1	1	1	0	0	1

Step 4: Mapping

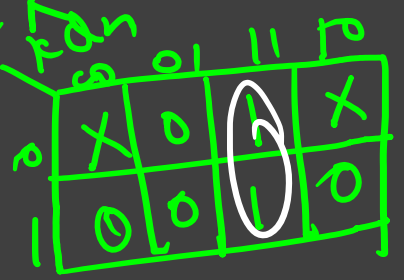


Step 5: for S



$S = J\overline{Q_n}$

for R



$R = KQ_n$

Introduction to Sequential Logic Circuits

Flip Flop Conversions

Ex Convert D to JK

Sol. Step 1 Given: D Req JK

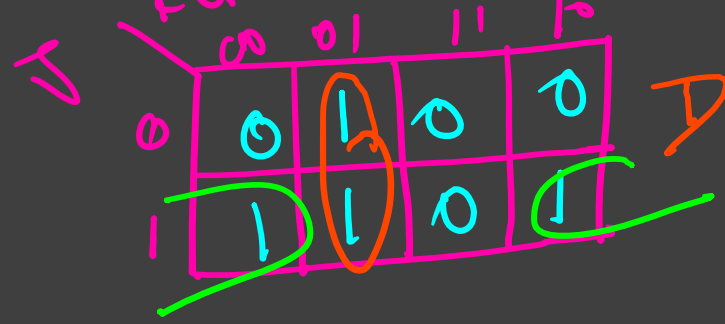
Step 2 Excitation table

Q_n	Q_{n+1}	D
0	0	0
0	1	1
1	0	0
1	1	1

Steps Char. table

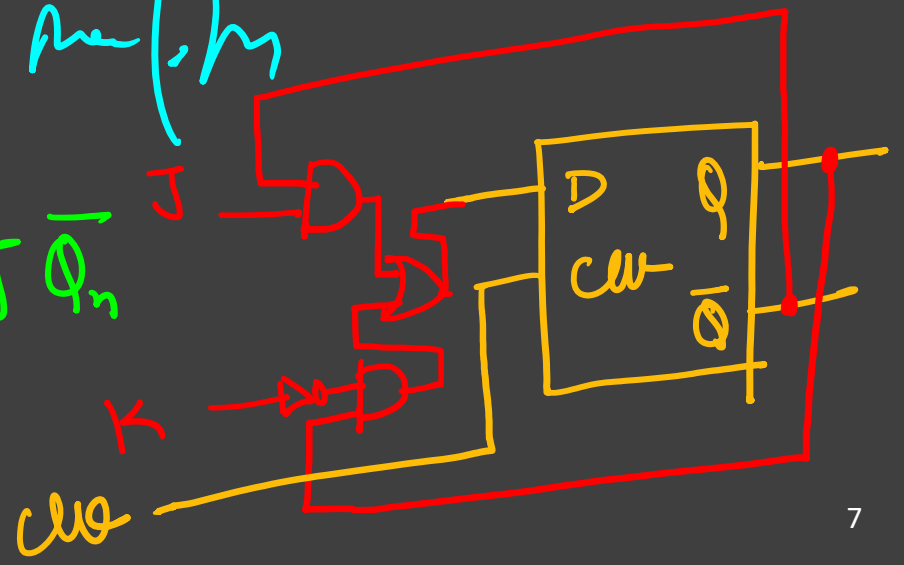
J	K	Q_n	Q_{n+1}	D
0	0	0	0	0
0	0	1	1	1
0	1	0	0	0
0	1	1	0	0
1	0	0	1	1
1	0	1	1	1
1	1	0	1	1
1	1	1	0	0

Step 3: Boolean eq.



$$D = \bar{K}Q_n + J\bar{Q}_n$$

Step 4: Analysis



Introduction to Sequential Logic Circuits

Flip Flop Conversions

Ex Convert T to FF X (The truth table is on slide no 3.)

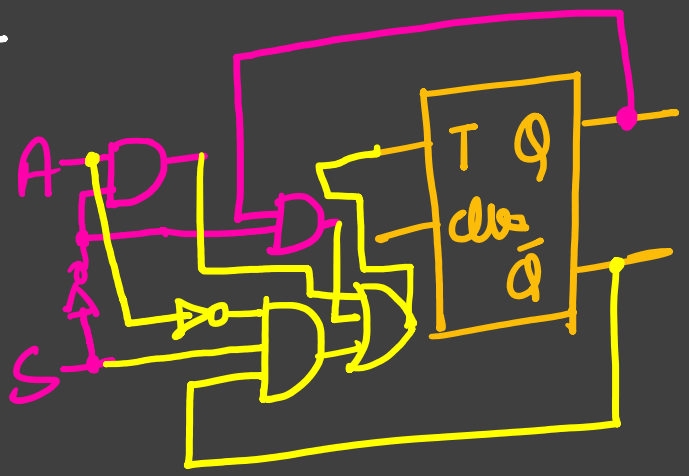
Sol 1) Gv: T Req: X

2)

Q_n	Q_{n+1}	T
0	0	0
0	1	1
1	0	1
1	1	0

3) Char table (4)

A	S	Q_n	Q_{n+1}	T
0	0	0	0	0
0	0	1	0	1
0	1	0	1	1
0	1	1	0	0
1	0	0	1	1
1	0	1	1	0
1	1	0	0	0
1	1	1	0	0



(5)

A \ SQn	00	01	11	10
0	0	1	0	1
1	1	1	0	0

$T = A\bar{S} + \bar{S}Q_n + \bar{A}SQ_n$

Introduction to Sequential Logic Circuits

~~Flip Flop Conversions~~

Next CA

Syllabus – Unit 3 & Unit 4

Type – MCQ

No. of Qns – 30

Time – 1 hr

Date : ~~10 April 2021~~ 9 April 2021 (On field, in Makeup class) (On tutorial)

(0.25) Note: -ve Marks of $\frac{1}{4}^{th}$ for every wrong question

⇒ Platform : OAS / Google form.