Computer Architecture

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From Flip-Flop to Flip-Flop

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- To "change a flip flop to the other flip flop" means to convert one type of flip flop (like an SR flip flop) into a different type of flip flop (like a JK flip flop) by modifying its input logic, essentially creating a new circuit with the desired functionality using additional logic gates to achieve the desired behavior of the new flip flop type; this often involves creating a conversion table and using logic simplification techniques like K-maps to determine the required input connections for the new flip flop based on the original flip flop's output and state.

From FF to FF (continued)

- **Conversion tables:**
- To convert between flip flop types, you need to create a conversion table that maps the input combinations of the original flip flop to the required input combinations of the new flip flop, considering the current state of the flip flop
- **Logic gates:**
- By adding or modifying the connections of logic gates within the circuit, you can achieve the desired input behavior for the new flip flop type.

Steps To Convert from One Flip Flop to Other

- **Steps To Convert from One Flip Flop to Other**

- Draw the truth table of the required flip-flop.

- Write the corresponding outputs of sub-flip-flop to be used from the excitation table.

- Draw K-Maps using required flip flop inputs and obtain excitation functions for sub-flip-flop inputs.

Conversion of J-K Flip-Flop into D Flip-Flop

- Step-1: We construct the characteristic table of D flip-flop and excitation table of JK flip-flop.

- Step-2: Using the K-map we find the boolean expression of J and K in terms of D.

- Step-3: We construct the circuit diagram of the conversion of JK flip-flop into D flip-flop.

Excitation Table of different Flip-Flops

- SR:

Q	Q+	S	R
0	0	0	X
0	1	1	0
1	0	0	1
1	1	X	0

JK:

Q	Q+	J	K
0	0	0	X
0	1	1	X
1	0	X	1
1	1	X	0

- D:

Q	Q+	D
0	0	0
0	1	1
1	0	0
1	1	1

T:

Q	Q+	T
0	0	0
0	1	1
1	0	1
1	1	0

D Flip-Flop from JK Flip-Flop

- How can we define J and K:

D	Q	Q+	J	K
0	0	0	0	x
0	1	0	x	1
1	0	1	1	x
1	1	1	x	0

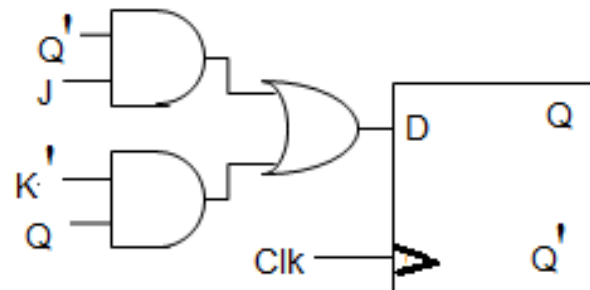- J: D   K: D'

Converting a D Flip-Flop to JK Flip-Flop

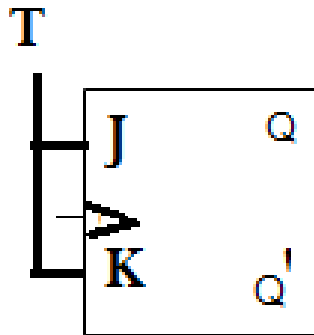- The corresponding table as well as the k-map and the related schema follows:

J	K	Q	Q+	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

Q \ JK	00	01	11	10
0	0	0	1	1
1	1	0	0	1

Converting a JK Flip-Flop to T Flip-Flop

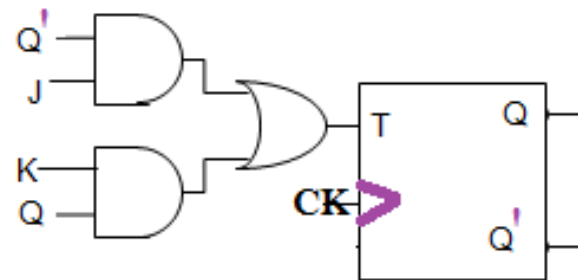- In order to convert JK FF to T FF it is enough to connect J and K:

- Solve it to confirm that it is correct.
- Use the general algorithm of conversion.

Converting a T Flip-Flop to JK Flip-Flop

- The corresponding table as well as the k-map and the related schema follows:

J	K	Q	Q+	T
0	0	0	0	0
0	0	1	1	0
0	1	0	0	0
0	1	1	0	1
1	0	0	1	1
1	0	1	1	0
1	1	0	1	1
1	1	1	0	1

JK Q	00	01	11	10
0	0	0	1	1
1	0	1	1	0

Converting D Flip-Flop to T Flip-Flop
Converting T Flip-Flop to D Flip-Flop

- T= D XOR Q
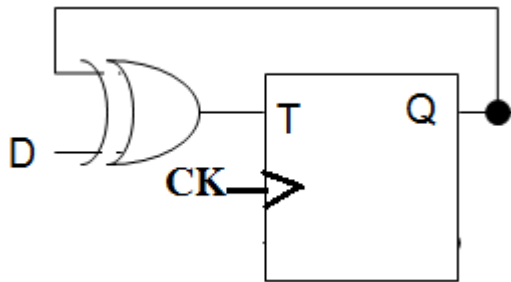
D	Q	Q+	T
0	0	0	0
0	1	0	1
1	0	1	1
1	1	1	0

- D= T XOR Q

T	Q	Q+	D
0	0	0	0
0	1	1	1
1	0	1	1
1	1	0	0