Excitation tables: D flip-flop

Characteristic tables define the behavior of flip-flops:

D flip-flop

D	Q	Q^+	Operation
0	0	0	reset
0	1	0	reset
1	0	1	set
1	1	1	set

T flip-flop

T	Q	Q^+	Operation
0	0	0	hold
0	1	1	hold
1	0	1	toggle
1	1	0	toggle

Excitation table: Shows what input is necessary to generate a given output

Different view of flip-flop operation

Inputs: Q, Q^+

Output: control (D or T)

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

How do we get a new state of 0 with a D flip-flop?

Input 0

How do we get a new state of 1 with a D flip-flop?

Input 1

Notice that column D is a copy of column Q^+,

because the new state is the same as the control input D

Excitation tables: T flip-flop

Characteristic table:

T flip-flop

T	Q	Q^+	Operation
0	0	0	hold
0	1	1	hold
1	0	1	toggle
1	1	0	toggle

Excitation table:

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

How do we keep the current value?

Hold: T = 0

How do we change the current value?

Toggle: T = 1

Why do we use excitation tables?

To implement finite state machines