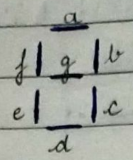
05.03.2019

BCD to seven segment code

* 

eg: CALCULATOR

- Glowing of LEDs results in displaying numbers
- 0-9 numeric values can be shown.

decimal values	INPUTS A	B	C	D	OUTPUTS a	b	c	d	e	f	g
0 =	0	0	0	0 →	1	1	1	1	1	1	0
1 =	0	0	0	1 →	0	1	1	0	0	0	0
2 =	0	0	1	0 →	1	1	0	1	1	0	1
3 =	0	0	1	1 →	1	1	1	1	0	0	1
4 =	0	1	0	0 →	0	1	1	0	0	1	1
5 =	0	1	0	1 →	1	0	1	1	0	1	1
6 =	0	1	1	0 →	1	0	1	1	1	1	1
7 =	0	1	1	1 →	1	1	1	0	0	0	0
8 =	1	0	0	0 →	1	1	1	1	1	1	1
9 =	1	0	0	1 →	1	1	1	1	0	1	1

- 1 represents that LED is ON.
- 0 represents that LED is OFF.

* K-Map for a :

ab \ cd	00	01	11	10
00	1	0	1	1
01	0	1	1	1
11	*	*	*	*
10	1	1	*	*

- $x \Rightarrow \bar{b}\bar{d} + bd + a + c$

$\Rightarrow a + c + b \odot d$

* K-Map for b :

ab \ cd	00	01	11	10
00	1	1	1	1
10	1	0	1	0
11	*	*	*	*
10	1	1	*	*

- $x \Rightarrow \bar{b} + \bar{c}\bar{d} + cd$

$\Rightarrow \bar{b} + c \odot d$

* **K-Map for c :**

ab \ cd	00	01	11	10
00	1	1	1	0
01	1	1	1	1
11	*	*	*	*
10	1	1	*	*

• $x \Rightarrow b + \bar{c} + cd$

* **K-Map for d :**

ab \ cd	00	01	11	10
00	1	0	1	1
01	0	1	0	1
11	*	*	*	*
10	1	1	*	*

• $x \Rightarrow \bar{b}\bar{d} + a + b\bar{c}d + c\bar{d} + \bar{a}\bar{b}c$

* **K-Map for e :**

ab \ cd	00	01	11	10
00	1	0	0	1
01	0	0	0	1
11	*	*	*	*
10	1	0	*	*

• $x \Rightarrow \bar{b}\bar{d} + c\bar{d}$

* **K-Map for f :**

ab \ cd	00	01	11	10
00	1	0	0	0
01	1	1	0	1
11	*	*	*	*
10	1	1	*	*

• $x \Rightarrow \bar{c}\bar{d} + \bar{a}\bar{c} + \bar{a}\bar{d} + a$

* **K-Map for g :**

ab \ cd	00	01	11	10
00	0	0	1	1
01	1	1	0	1
11	*	*	*	*
10	1	1	*	*

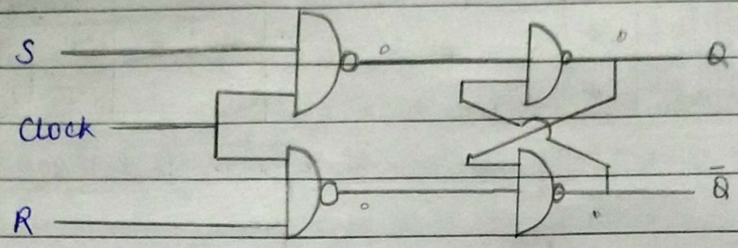
• $x \Rightarrow b\bar{c} + a + c\bar{d} + \bar{b}c$

12·03
2019

PAGE :
DATE : / /

FLIP - FLOPS

** SR Flip - Flop :



Clock	S	R	Q	$\bar{Q}$
1	0	0	Q	$\bar{Q}$
1	0	1	0	1
1	1	0	1	0
1	1	1	Forbidden Condition	

* CHARACTERISTIC TABLE :

	Q (Previous state)	S	R	Q_n (next state) Output
n_0	0	0	0	0
n_1	1	0	0	1
n_2	0	0	1	0
n_3	1	0	1	0
n_4	0	1	0	1
n_5	1	1	0	1
n_6	0	1	1	X
n_7	1	1	1	X

(FORBIDDEN CASE)

* EXCITATION TABLE :

Q (Previous state)	Q_n (next state)	S	R
inputs		outputs	
0	0	0	*
0	1	1	0
1	0	0	1
1	1	*	0

Value of SR in Ch. Table.

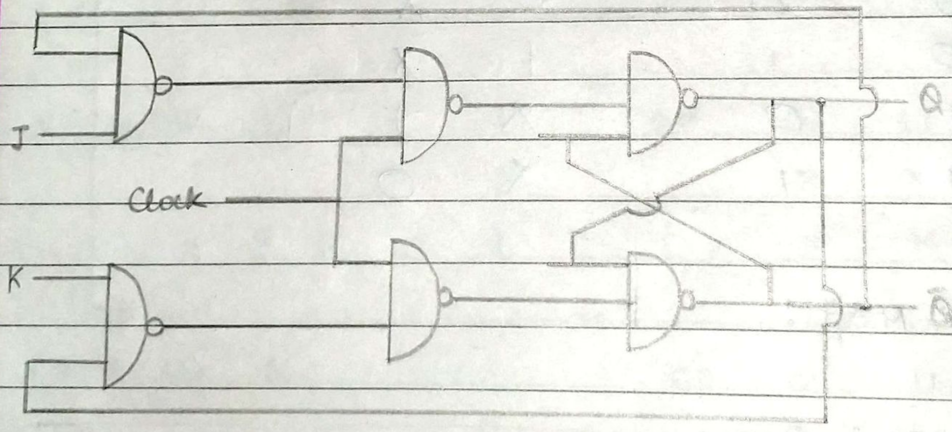
* K-Map :

① for Q_n :

q \ sr	00	01	11	10
0		1		
1	1	1	*	*

$x = q + \bar{s}r$

** JK Flip-Flop :



Clock	J	K	Q	$\bar{Q}$
1	0	0	Q	$\bar{Q}$
1	0	1	0	1
1	1	0	1	0
1	1	1	$\bar{Q}$	Q

(Race Round Condition)

PAGE :
DATE : / /

* CHARACTERISTIC TABLE :

Q	J	K	$\overline{Q}_n$
0	0	0	0
1	0	0	1
0	0	1	0
1	0	1	0
0	1	0	1
1	1	0	1
0	1	1	1
1	1	1	0

* Excitation Table

Input		Output	
Q	Q_n	J	K
0	0	0	X
0	1	1	X
1	0	X	1
1	1	X	0

* K-Map :

① For Q_n :

PAGE:
DATE: / /

15.03.2019

* CONVERSION of flipflops :

- JK flipflop to SR flipflops :
  ↓ Excitation Table. ↓ Characteristic Table

Characteristic Table:

S	R	Q	Q_n
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	x
1	1	1	x

Excitation Table

J	K
0	x
x	0
0	x
x	1
1	x
x	0
x	x
x	x

KMAP for J:

S \ RQ	00	01	11	10
0		x	x	
1	1	x	x	x

J = S

KMAP for K:

S \ RQ	00	01	11	10
0				
1				

- SR flipflop to JK Flip flop :
  ↓ ↓

PAGE :
DATE : / /

Characteristic Table

J	K	Q	Q_n
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

Excitation Table

S	R
0	*
*	0
0	*
0	1
1	0
*	0
1	0
0	1

- KMAP for R :

J \ KQ	00	01	11	10
0	*		1	*
1			1	

$\Rightarrow KQ$

- KMAP for S :

J \ KQ	00	01	11	10
0		*		
1	1	*		1

$\Rightarrow J + \bar{Q}$

* according to Q Q_n we can get S R .

18.03
2019

DATE: / /

* COMPUTER PERFORMANCE *

* Execution time : formula for performance.

$\frac{1}{\text{Execution time}}$

Computer x : 10 s
Computer y : 15 s

* Relative performance : $\frac{\text{Performance of } x}{\text{Performance of } y} = \frac{\frac{1}{\text{Execution }(x)}}{\frac{1}{\text{Execution }(y)}}$

$= \frac{\text{execution time }(y)}{\text{execution time }(x)}$

$= \frac{15}{10} = 1.5$ times faster than y.

* CPU time :
no. of instructions to be executed × clock cycle × no. of seconds.

• clock cycle also known as clock period / clock rate.

ex: ① instructions = 10
clock cycles = 2 (per instruction)
seconds (time) = 30 ns.

$= 10 \times 2 \times 30 = \underline{600 \text{ ns}}$ = CPU time.

ex: ② instructions = 1000, 10 ns.

↓

50% = 3 clock cycles = (500 × 3 × 10)
20% = 2 clock cycles = (200 × 2 × 10)
30% = 5 clock cycles. = (300 × 5 × 10)

$= (500 \times 3 \times 10) + (200 \times 2 \times 10) + (300 \times 5 \times 10)$

$= 15000 + 4000 + 15000 = 34000$

$GHz \Rightarrow 30$
$Hz \Rightarrow 20$

PAGE :
DATE : / /

- clock rate = $\frac{1}{\text{clock period}}$

ns converted to second

$\Rightarrow$ 10 ns $\Rightarrow 10 \times 10^{-9}$

$\Rightarrow \frac{1}{10 \times 10^{-9}} \Rightarrow \frac{10^9}{10} \Rightarrow 10^8$ Hz

ex. Clock period from clock rate:
rate $\Rightarrow$ 2 GHz $\Rightarrow 10^{30}$

$\Rightarrow \frac{1}{2 \times 10^{30}} \Rightarrow \frac{1}{2} \times 10^{-30} \Rightarrow .5 \times 10^{-30}$ seconds.

- **AMDHAL'S LAW:**

Q: suppose that a task makes extensive use of floating point operations with 40% of the time consumed by floating point operation with a new hardware design. If the floating point module is speed up by factor 4 then what is the overall speedup.

$$\Rightarrow \frac{1}{(1-P) + \frac{P}{n}}$$

P → Parallel fraction
n → factor
(1-P) → sequential factor fraction

(FORMULA for AMDHAL'S LAW)

P $\Rightarrow$ how much improved

PAGE :
DATE : / /

$\Rightarrow$ (P) $\Rightarrow$ 40% $\Rightarrow$ 0.4 $\left(\frac{40}{100}\right)$

$\Rightarrow$ $n = 4$

$$\Rightarrow \frac{1}{(1-0.4) + \frac{0.4}{4}} \Rightarrow \frac{1}{0.6 + 0.1} \Rightarrow \frac{1}{0.7}$$ total speedup.

Q:

a) $$\frac{1}{(1-P) + \frac{P}{N}} \Rightarrow \frac{1}{(1-0.3) + \frac{0.3}{20}} \Rightarrow \frac{1}{0.7 + \frac{0.3}{20}}$$

$$\Rightarrow \frac{1}{\frac{17}{20}} \Rightarrow \frac{20}{17} \Rightarrow \underline{\underline{1.17}}$$

b) $$\frac{1}{(1-P) + \frac{P}{n}} \Rightarrow \frac{1}{(1-0.25) + \frac{0.25}{300}} \Rightarrow \frac{1}{0.75 + \frac{25}{300}}$$