10-04-2022

Chapter 6:

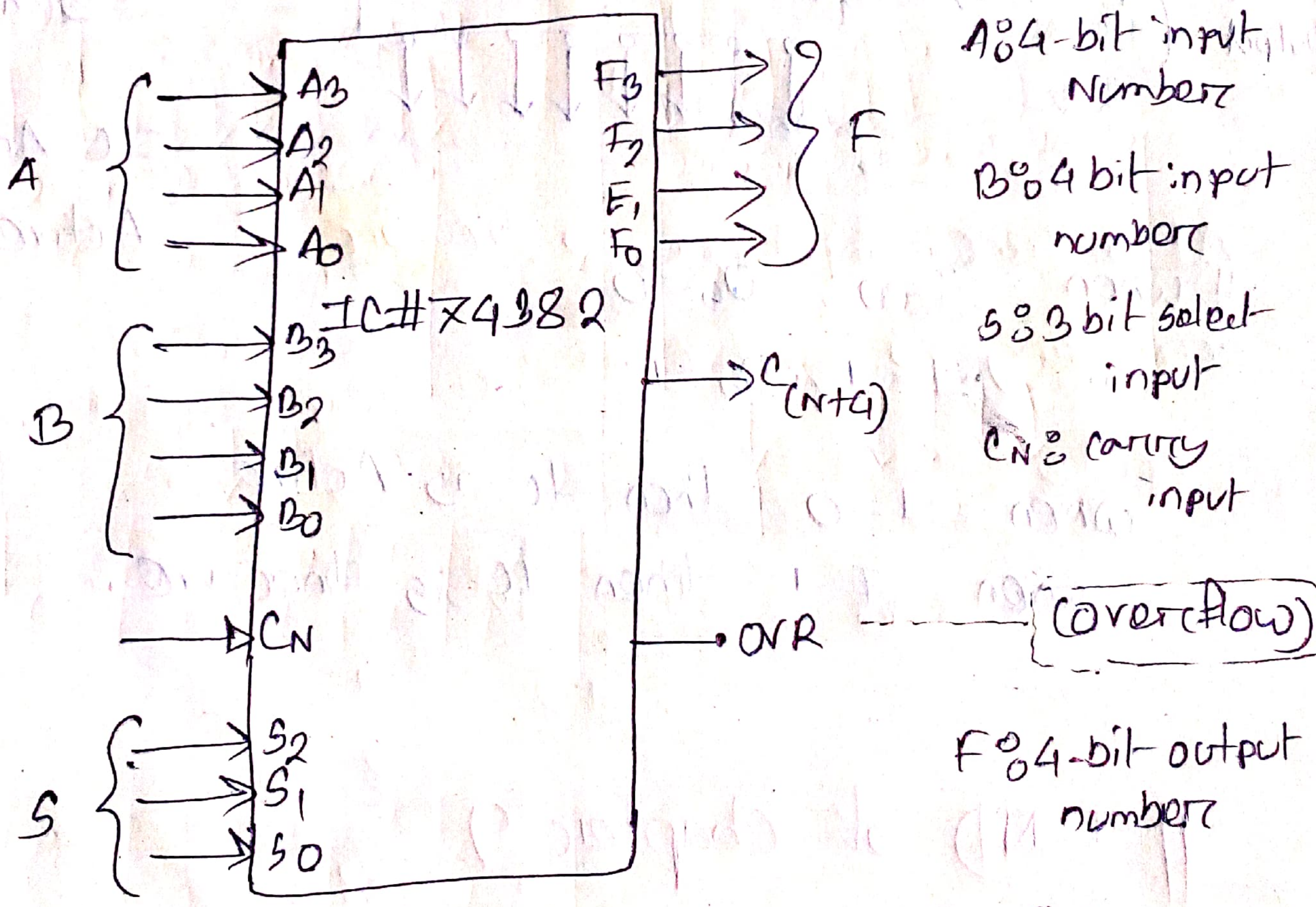
IC#1
N=0

IC#2
N=4
C4 = Carry In
C8 = Carry Out

ALU: (Arithmetic Logic Unit)

IC# 74382: (4 bit ALU)

Block Diagram:



A: 4-bit input Number

B: 4 bit input number

S: 3 bit select input

CN: carry input

F: 4-bit output number

C(N+4): Carry output

OVR: overflow

Function Table:

	S_2 S_1 S_0	operation	comments
	✓ 0 0 0	CLEAR	$F_3F_2F_1F_0 = [0000]$
Arithmetic op	0 0 1	B minus A	C_N has to be 1 (কেনাহুন subtraction co Addition ।সাবেক লাগে(য))
	0 1 0	A minus B	C_N has to be 1; $C_N = 1$
	0 1 1	A plus B	$C_N = 0$
Logical op	1 0 0	A XOR B ($A \oplus B$)	Ex-OR operation
	1 0 1	A OR B ($A+B$)	OR operation
	1 1 0	AB (A and B)	AND operation
	✓ 1 1 1	PRESET	$F_3F_2F_1F_0 = [1111]$

$$\boxed{\begin{array}{l} A_3A_2A_1A_0 = [1\ 0\ 1\ 1] \\ B_3B_2B_1B_0 = [1\ 1\ 0\ 1] \end{array}} \longrightarrow S_2S_1S_0 = [1\ 0\ 0]$$

$F_3F_2F_1F_0$

$= [\ 0\ 1\ 1\ 0$

$S_3S_2S_1 = [0\ 1\ 1]$ $\qquad C_N = 0$

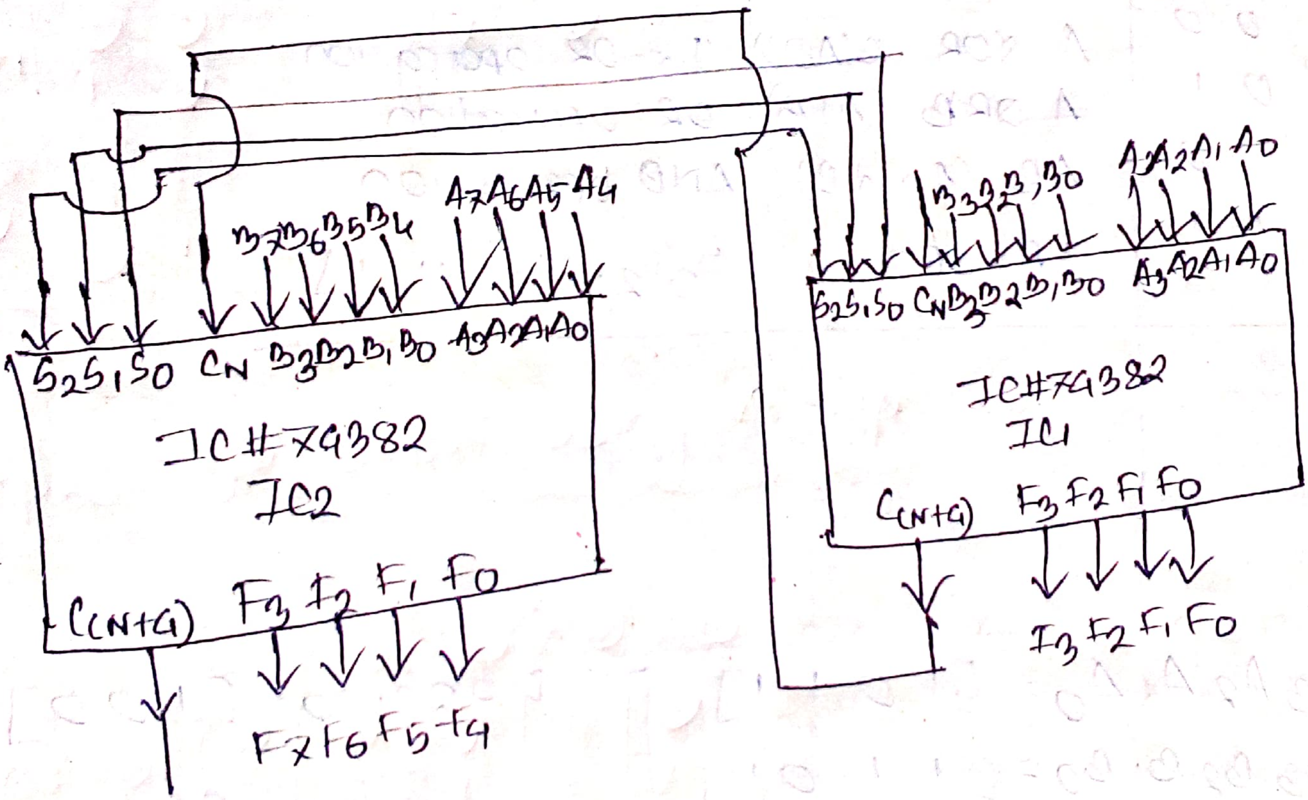
$F_3F_2F_1F_0 = [\ 1000\ ]$

$C_{(N+4)} = 1$

~~$C(N+4)$~~

Design 8 bit ALU using IC# 74382:

$$\begin{array}{cccccccc} A_7 & A_6 & A_5 & A_4 & A_3 & A_2 & A_1 & A_0 \\ B_7 & B_6 & B_5 & B_4 & B_3 & B_2 & B_1 & B_0 \\ \hline [F_7 & F_6 & F_5 & F_4 & F_3 & F_2 & F_1 & F_0] \end{array}$$



13-04-22

Synchronous counter design for any random sequence [Final এ অবশ্যই আসবে] VVI

Ex: $\boxed{0, 1, 3, 5, 7}$, 0 ...

Before Pulse			After Pulse		
C	B	A	C	B	A
0	0	0	0	0	1
0	0	1	0	1	1
0	1	0	1	0	1
0	1	1	1	0	1
1	0	0			
1	0	1			
1	1	0			
1	1	1			

(*) Undesired states

If undesire state comes then it starts from 000.

circuit excitation table

Step-8

J	K	clk	
0	0	↓	No change
0	1	↓	0
1	0	↓	1
1	1	↓	Toggle

Before Pulse			After Pulse								
C	B	A	C	B	A	J_C	K_C	J_B	K_B	J_A	K_A
0	0	0	0	0	0	0	x	0	x	1	x
0	0	1	0	0	1	0	x	1	x	x	0
(*) 0	1	0	0	0	0	0	x	x	1	0	x
0	1	1	1	0	1	1	x	x	1	x	0
(*) 1	0	0	0	0	0	x	1	0	x	0	x
1	0	1	1	1	1	x	0	1	x	x	0
(*) 1	1	0	0	0	0	x	1	x	1	0	x
1	1	1	0	0	0	x	1	x	1	x	1

Truth Table of JK:

	J	K	CLK	J	K
0→0	0	0		0	x
	0	1			
0→1	1	0		1	x
	1	1			
1→1	0	0		x	0
	1	0			
1→0	1	1		x	1
	0	1			

Step 2: Simplification using K-Map

$J_C = AB$;

	$\bar A \bar B$	$\bar A B$	AB	$A \bar B$
$\bar C$	0	0	1	0
C	x	x	x	x

$K_C = \bar A + B$;

	x	x	x	x
	1	0	1	1

$J_B = A$;

	0	1	x	x
	0	1	x	x

$K_B = 1$;

	$\bar{A}\bar{B}$	$A\bar{B}$	AB	$\bar{A}B$
$\bar{C}$	x	x	1	1
C	x	x	1	1

$J_A = \bar{B}\bar{C}$;

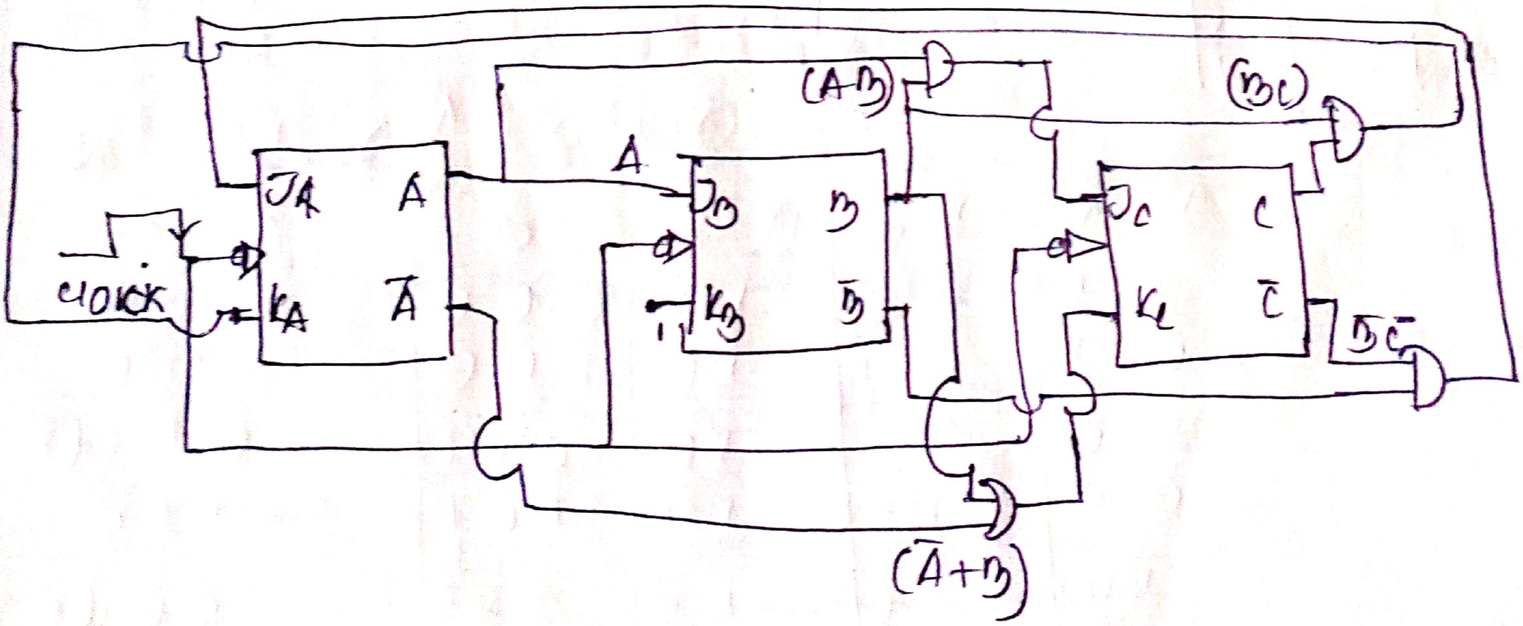
	$\bar{A}\bar{B}$	$A\bar{B}$	AB	$\bar{A}B$
$\bar{C}$	1	x	x	0
C	0	x	x	0

$K_A = BC$;

	$\bar{A}\bar{B}$	$A\bar{B}$	AB	$\bar{A}B$
$\bar{C}$	x	0	0	x
C	x	0	1	x

Step 3: circuit Diagram

$\boxed{MOD8 - J_A = K_A = 1; J_B = K_B = A; J_C = K_C = AB}$ Instead of → $\boxed{J_A = \bar{B}\bar{C}, K_A = BC \quad J_B = A, K_B = 1 \quad J_C = AB, K_C = \bar{A}+B}$



17-04-2022

$F(A,B,C) = \Sigma$

Sequence: $\boxed{0, 1, 4, 6, 7,}$ 0, 1 ---

Step-1: Circuit excitation table

Before pulse	After pulse	J_C	K_C	J_B	K_B	J_A	K_A
000	001	0	x	0	x	1	x
001	~~00~~ 100	1	x	0	x	x	1
* 010	000	0	x	x	1	0	x
* 011	000	0	x	x	1	x	1
100	110	x	0	1	x	0	x
* 101	000	x	1	0	x	x	1
110	111	x	0	x	0	1	x
* 111	000	x	1	x	1	x	1

Step 2: Simplification Using K-Map

$J_C = A\bar{B}$;

	$\bar{A}\bar{B}$	$A\bar{B}$	AB	$\bar{A}B$
$\bar{C}$	0	1	0	0
C	x	x	x	x

$K_C = A$;

	$\bar{A}\bar{B}$	$A\bar{B}$	AB	$\bar{A}B$
$\bar{C}$	x	x	x	x
C	0	1	1	0

$J_B = \bar{A}\ C$;

0	0	x	x
1	0	x	x

$K_B = \bar{C} + A$;

x	x	1	1
x	x	1	0

$J_A = \bar{B}\bar{C} + BC$

$= \overline{B \oplus C}$;

1	x	x	0
0	x	x	1

$K_A = 1$;

x	1	1	x
x	1	1	x

sequence : 0, 1, 3, 5, ~~8~~ 7, 9, 10, 13, 14, 15, 0,

Step 1 : Circuit excitation table

DCBA Before pulse	DCBA After pulse	J_D K_D	J_C K_C	J_B K_B	J_A K_A
0000	0001	0 x	0 x	0 x	1 x
0001	0011	0 x	0 x	1 x	x 0
* 0010	0000	0 x	0 x	x 1	0 x
0011	0101	0 x	1 y	x 1	x 0
* 0100	0000	0 y	x 1	0 y	0 x
0101	0111	0 y	x 0	1 x	x 0
* 0110	0000	0 x	x 1	x 1	0 x
0111	1001	1 x	x 1	x 1	x 0
* 1000	0000	x 1	0 x	0 x	0 x
1001	1010	x 0	0 x	1 x	x 1
1010	1101	x 0	~~1 y~~ 0 x	x 1	1 x
* 1011	0000	x 1	x 1	x 1	x 1
* 1100	0000	x 1	x 0	0 x	0 x
1101	1110	x 0	x 0	1 x	x 1
1110	1111	x 0	x 1	x 0	1 x
* 1111	0000	x 1		x 1	x 1

Step 2: Simplification using K-Map

$J_D = ABC$;

	$\bar{A}\bar{B}$	$\overline{AB}$	AB	$\bar{A}B$
$\bar{C}\bar{D}$	0	0	0	0
$C\bar{D}$	0	0	1	0
CD	x	x	x	x
$\bar{C}D$	x	x	x	x

$K_D = \bar{A}\bar{B} + AB$;

$= \overline{A \oplus B}$

x	x	x	x
x	x	x	x
1	0	1	0
1	0	1	0

$J_C =$ [illegible] ;

$AB\bar{D} + \bar{A}BD$

0	0	1	0
x	x	x	x
x [illegible]	x [illegible]	x	x [illegible]
[illegible]	[illegible]	x [illegible]	[illegible] 1

$K_C = \bar{A}\bar{B} + AB + \bar{A}B$

$= \overline{A \oplus B} + \bar{A}B$

x	x	x	x
1	0	1	1
1 x	0 x	1 x	x 0
x	x [illegible]	x	x [illegible]

$J_B = A$;

0	1	x	x
0	1	x	x
0	1	x	x
0	1	x	x

$K_B = \cancel{A}$;

$\overline{D} + A + \overline{C}$

x	x	1	1
x	x	1	1
x	x	1	0
x	x	1	1

$J_A = BD + \overline{B}\,\overline{C}\,\overline{D}$;

1 $\cancel{x}$	x	x	0
0	x	x	0
0	x	x	1
0	x	x	1

$K_A = D$;

x	0	0	x
x	0	0	x
x	1	1	x
x	1	1	x