Binary adders and subtractors

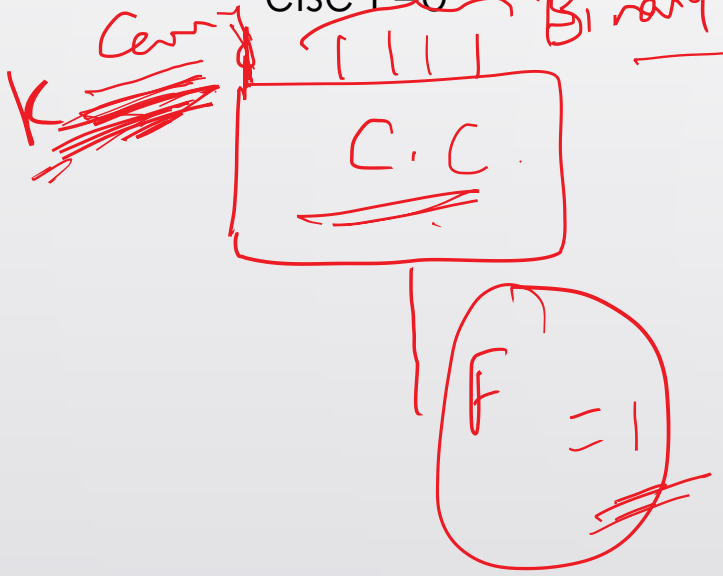
- Half adder, full adder, parallel adder
- Half subtractor , full subtractor, parallel subtractor
- Subtraction using complements, parallel adder/subtractor
- Carry Look ahead adder, Decimal adder

BCD ADDER: TRUTH TABLE

Binary Sum					BCD Sum					Decimal
K	Z_8	Z_4	Z_2	Z_1	C	S_8	S_4	S_2	S_1	
0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	1	0	0	0	0	1	1
0	0	0	1	0	0	0	0	1	0	2
0	0	0	1	1	0	0	0	1	1	3
0	0	1	0	0	0	0	1	0	0	4
0	0	1	0	1	0	0	1	0	1	5
0	0	1	1	0	0	0	1	1	0	6
0	0	1	1	1	0	0	1	1	1	7
0	1	0	0	0	0	1	0	0	0	8
0	1	0	0	1	0	1	0	0	1	9
0	1	0	1	0	1	0	0	0	0	10
0	1	0	1	1	1	0	0	0	1	11
0	1	1	0	0	1	0	0	1	0	12
0	1	1	0	1	1	0	0	1	1	13
0	1	1	1	0	1	0	1	0	0	14
0	1	1	1	1	1	0	1	0	1	15
1	0	0	0	0	1	0	1	1	0	16
1	0	0	0	1	1	0	1	1	1	17
1	0	0	1	0	1	1	0	0	0	18
1	0	0	1	1	1	1	0	0	1	19

BCD ADDER

- Binary sum can be converted to BCD by adding 6 to binary sum.
- 6 needs to be added only when binary sum is > 9 or $(1001)_2$
- Referring the truth table, write the expression for F such that, F=1 if binary sum is > 9 else F=0



Binary Sum $Z_8 Z_4 Z_2 Z_1$

Z_8Z_4 \ Z_2Z_1	00	01	11	10
00	0	0	0	0
01	0	0	0	0
11	1	1	1	1
10	0	0	1	1

$F = 1 \Rightarrow$ Add 6

$F = 0 \Rightarrow$ Add 0

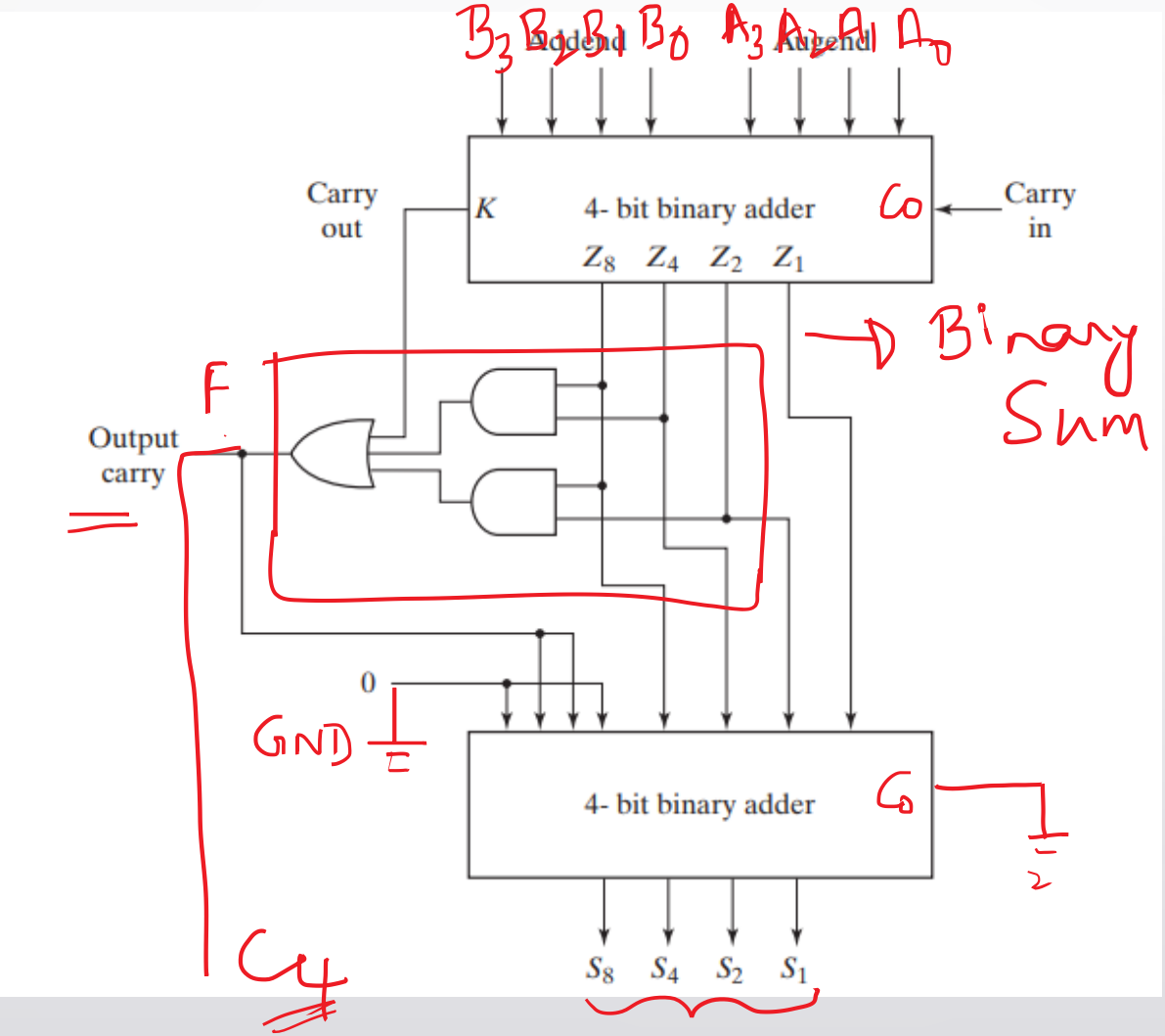
Sum > 9

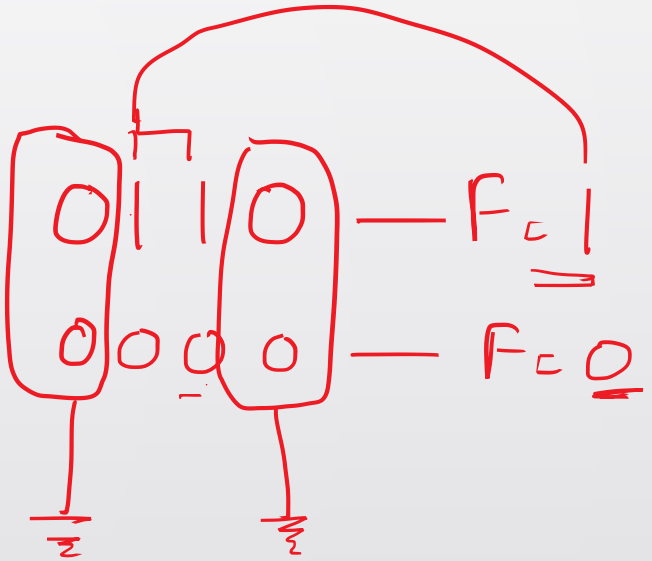
$F_1 = Z_8Z_4 + Z_8Z_2$

$F = K + F_1$

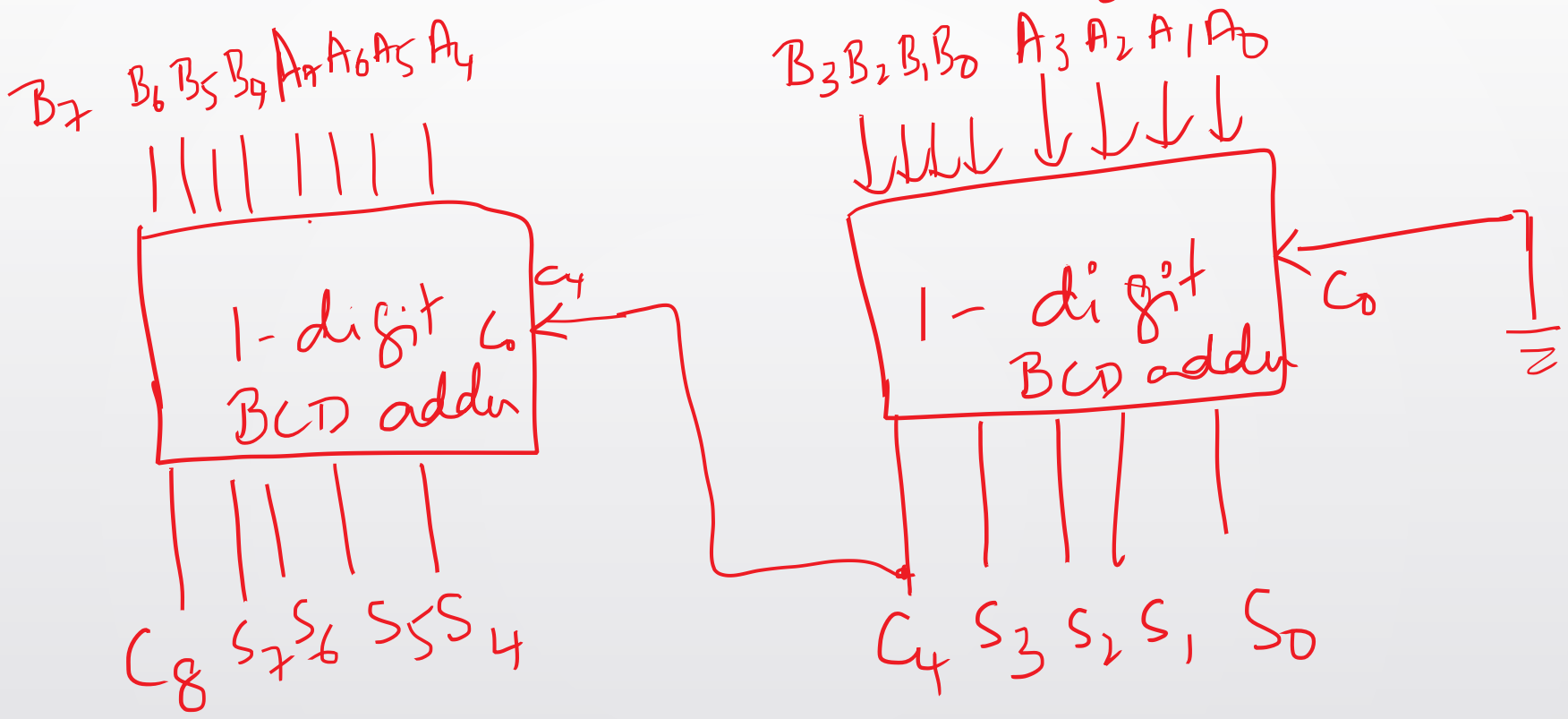
$F = K + Z_8Z_4 + Z_8Z_2$

Block diagram of BCD adder





2-digit BCD adder using 1-digit BCD adder



Reference:

- Digital design , third edition by morris mano, chapter 4

. Slides are used only as a supporting material to teach the subject.

. Students should write down the notes and read the text book.

Questions?