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BCD Adder

4-5 Decimal adder

BCD adder can't exceed 9 on each input digit. K is the carry.

Table 4-5
Derivation of BCD Adder

K	Binary Sum				C	BCD Sum				Decimal
	Z ₈	Z ₄	Z ₂	Z ₁		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	0	1	2
0	0	0	1	1	0	0	0	0	1	3
0	0	1	0	0	0	0	0	1	0	4
0	0	1	0	1	0	0	0	1	0	5
0	0	1	1	0	0	0	0	1	1	6
0	0	1	1	1	0	0	0	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

Rules of BCD adder

- When the binary sum is **greater than 1001**, we obtain a **non-valid BCD** representation.
- The **addition of binary 6(0110)** to the binary sum **converts it to the correct BCD** representation and also produces an output carry as required.
- To distinguish them from binary 1000 and 1001, which also have a 1 in position Z₈, we specify further that either Z₄ or Z₂ must have a 1.

$$C = K + Z_8Z_4 + Z_8Z_2$$

Implementation of BCD adder

- A decimal parallel adder that adds n decimal digits needs n BCD adder stages.
- The output carry from one stage must be connected to the input carry of the next higher-order stage.

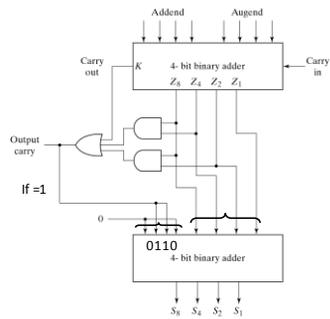


Fig. 4-14 Block Diagram of a BCD Adder