

Decimal Arithmetic Operation

Decimal Arithmetic Operation

- Decimal numbers in BCD are stored in computer registers in group of 4 bits.
- Each 4 bit group must be taken as a unit when performing decimal microoperation
- The following are the decimal arithmetic microoperation symbols:

Decimal Arithmetic Operation

TABLE 10-5 Decimal Arithmetic Microoperation Symbols

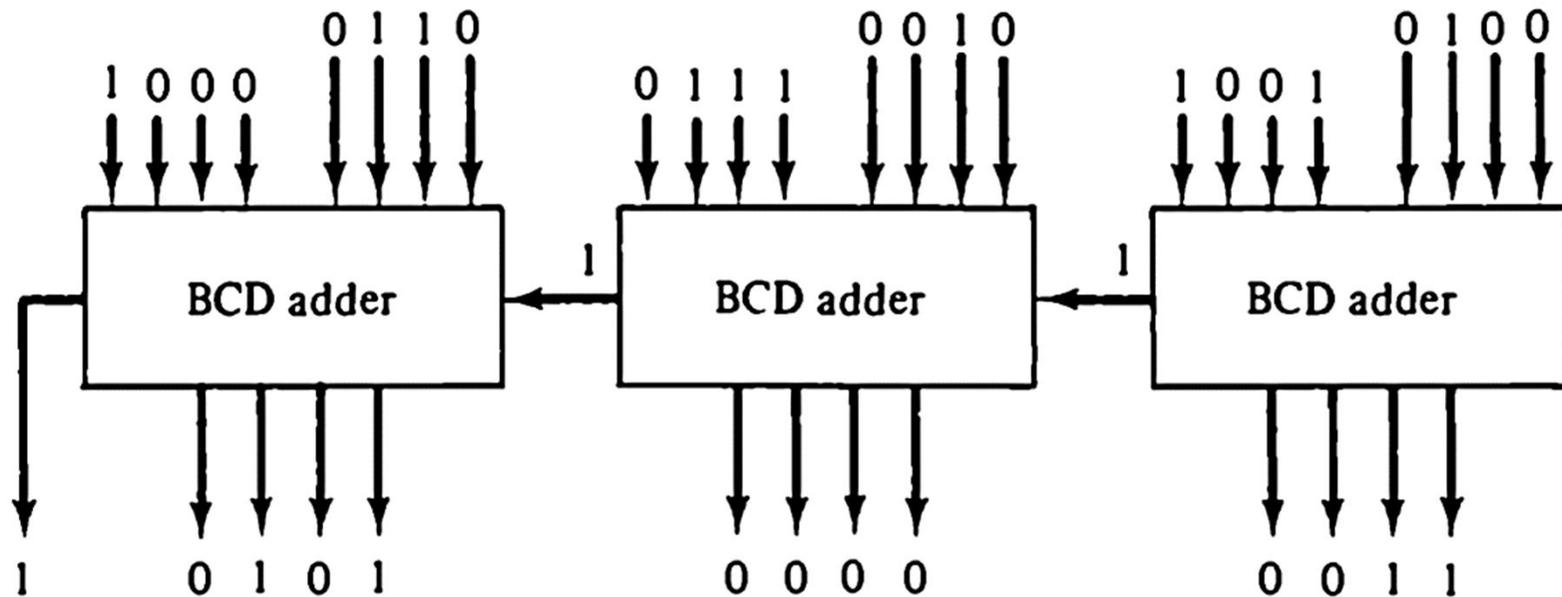
Symbolic Designation	Description
$A \leftarrow A + B$	Add decimal numbers and transfer sum into A
\bar{B}	9's complement of B
$A \leftarrow A + \bar{B} + 1$	Content of A plus 10's complement of B into A
$Q_L \leftarrow Q_L + 1$	Increment BCD number in Q_L
dshr A	Decimal shift-right register A
dshl A	Decimal shift-left register A

Decimal Arithmetic Operation

- Incrementing/Decrementing a register is same for binary and BCD that binary counter goes through 16 states from 0000 to 1111.
- The BCD counter goes through 10 states from 0000 to 1001 and back to 0000.
- A decimal shift right or left is proceeded by d to indicate a shift over four bits that hold the decimal digit.

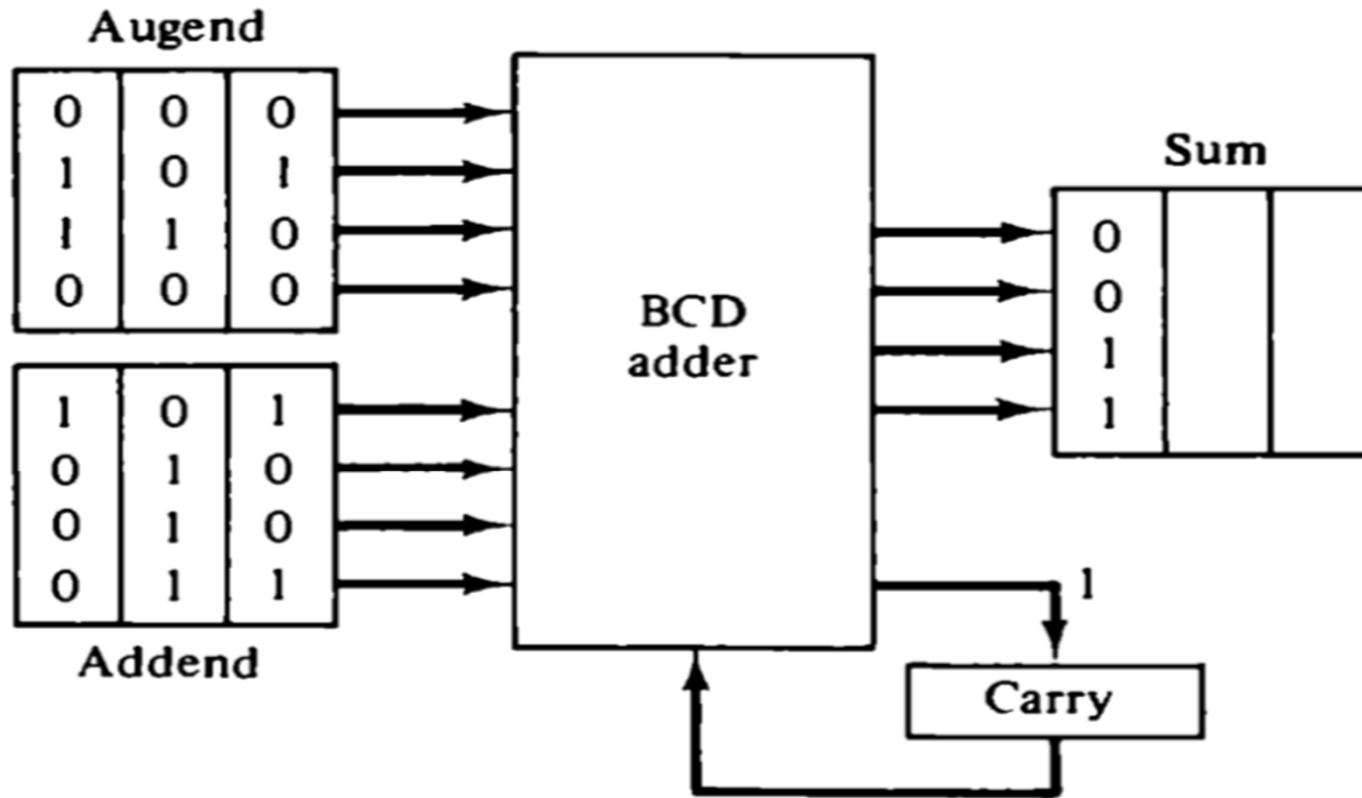
Addition and Subtraction

- A decimal data can be added in 3 different ways



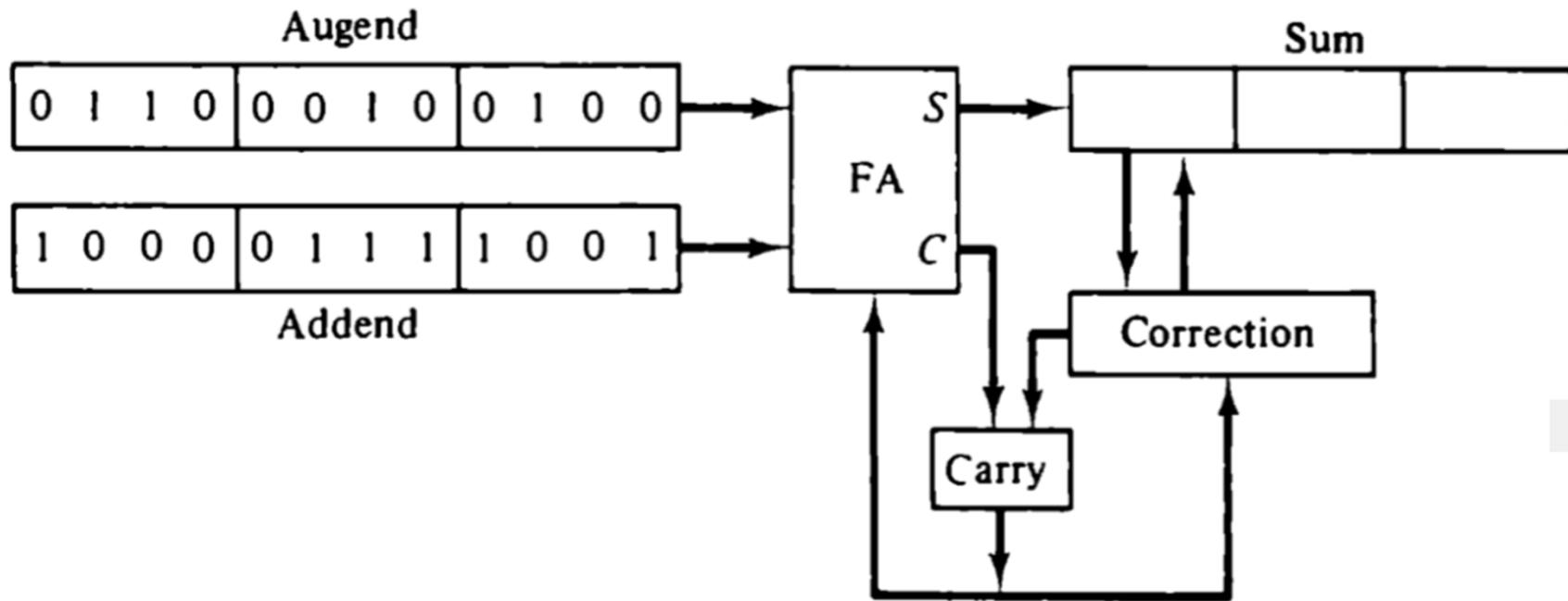
(a) Parallel decimal addition: $624 + 879 = 1503$

Addition and Subtraction



(b) Digit-serial, bit-parallel decimal addition

Addition and Subtraction



(c) All serial decimal addition

Figure 10-20 Three ways of adding decimal numbers.

Addition and Subtraction

- The parallel method uses a decimal arithmetic unit composed of as many BCD adder as there are digits in the number.
- In digit serial bit parallel method, the digits are applied to a single BCD adder serially, while the bits of each coded digit are transferred in parallel.
- In serial adder the bits are shifted one at a time through full adder. The binary sum formed after four shifts must be corrected into valid BCD digit.
- If it is ≥ 1010 , the binary sum is corrected by adding 0110 and generates a carry for next pair of digit.

Addition and Subtraction

- The parallel method is fast but requires a large number of BCD adders.
- The digit serial bit parallel method requires only one BCD adder which is shared by all the digits, so it is slower than parallel method.
- The serial method requires a minimum amount of equipment that is only one full adder, but is very slow.