| Decimal | Binary | Octal | Hexadecimal | ASCII |
|---|---|---|---|---|
| 0 | 00000000 | 0 | 0 | Null |
| 1 | 00000001 | 1 | 1 | SOH |
| 2 | 00000010 | 2 | 2 | STX |
| 3 | 00000011 | 3 | 3 | ETX |
| 4 | 00000100 | 4 | 4 | EOT |
| 5 | 00000001 | 5 | 5 | ENQ |
| 6 | 00000110 | 6 | 6 | ACK |
| 7 | 00000111 | 7 | 7 | BEL |
| 8 | 00001000 | 10 | 8 | BS |
| 9 | 00001001 | 11 | 9 | HT |
| 10 | 00001010 | 12 | A | LF |
| 11 | 00001011 | 13 | B | VT |
| 12 | 00001100 | 14 | C | FF |
| 13 | 00001101 | 15 | D | CR |
| 14 | 00001110 | 16 | E | SO |
| 15 | 00001111 | 17 | F | SI |
| 16 | 00010000 | 20 | 10 | DLE |
| 17 | 00010001 | 21 | 11 | DC1 |
| 18 | 00010010 | 22 | 12 | DDC2 |
| 19 | 00010011 | 23 | 13 | DC3 |
| 20 | 00010100 | 24 | 14 | DC4 |
| 21 | 00010101 | 25 | 15 | NAK |
| 22 | 00010110 | 26 | 16 | SYN |
| 23 | 00010111 | 27 | 17 | ETB |
| 24 | 00011000 | 30 | 18 | CAN |
| 25 | 00011001 | 31 | 19 | EM |
| 26 | 00011010 | 32 | 1A | SUB |
| 27 | 00011011 | 33 | 1B | ESC |
| 28 | 00011100 | 34 | 1C | FS |
| 29 | 00011101 | 35 | 1D | GS |
| 30 | 00011110 | 36 | 1E | RS |
| 31 | 00011111 | 37 | 1F | US |
| 32 | 00100000 | 40 | 20 | |
| 64 | 01000000 | 100 | 40 | |
| 128 | 10000000 | 200 | 80 | |
| 255 | 11111111 | 377 | FF | |

ASCII Character Codes

| ASCII | | ASCII | | ASCII | |
|---|---|---|---|---|---|
| 32 | space | 64 | @ | 96 | ` |
| 33 | ! | 65 | A | 97 | a |
| 34 | " | 66 | B | 98 | b |
| 35 | # | 67 | C | 99 | c |
| 36 | $ | 68 | D | 100 | d |
| 37 | % | 69 | E | 101 | e |
| 38 | & | 70 | F | 102 | f |
| 39 | ' | 71 | G | 103 | g |
| 40 | ( | 72 | H | 104 | h |
| 41 | ) | 73 | I | 105 | i |
| 42 | * | 74 | J | 106 | j |
| 43 | + | 75 | K | 107 | k |
| 44 | , | 76 | L | 108 | l |
| 45 | - | 77 | M | 109 | m |
| 46 | . | 78 | N | 110 | n |
| 47 | / | 79 | O | 111 | o |
| 48 | 0 | 80 | P | 112 | p |
| 49 | 1 | 81 | Q | 113 | q |
| 50 | 2 | 82 | R | 114 | r |
| 51 | 3 | 83 | S | 115 | s |
| 52 | 4 | 84 | T | 116 | t |
| 53 | 5 | 85 | U | 117 | u |
| 54 | 6 | 86 | V | 118 | v |
| 55 | 7 | 87 | W | 119 | w |
| 56 | 8 | 88 | X | 120 | x |
| 57 | 9 | 89 | Y | 121 | y |
| 58 | : | 90 | Z | 122 | z |
| 59 | ; | 91 | [ | 123 | { |
| 60 | < | 92 | \ | 124 | \| |
| 61 | = | 93 | ] | 125 | } |
| 62 | > | 94 | ^ | 126 | ~ |
| 63 | ? | 95 | _ | 127 | |

## Boolean Algebra & Digital Logic Gates

## Boolean Algebra

| | | |
|---|---|---|
| A AND B | A * B |  |
| A OR B | A + B |  |
| NOT A | $\overline{A}$ |  |

1's and 0's  True and False  Hi and Lo

## Boolean Algebra

| A | B | A AND B |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |

| A | B | A NAND B |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

## Boolean Algebra

| A | B | A OR B |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 1 |

| A | B | A NOR B |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 0 |

| A | B | A XOR B |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

## DeMorgan's Theorem

$$\overline{A \text{ AND } B} = \overline{A} \text{ OR } \overline{B}$$

$$\overline{A \text{ OR } B} = \overline{A} \text{ AND } \overline{B}$$

**Properties of a Boolean Algebra**

1. Operations are *commutative*.
   $A \bullet B = B \bullet A$
   $A + B = B + A$

2. Operations are *associative*.
   $(A \bullet B) \bullet C = A \bullet (B \bullet C)$
   $(A + B) + C = A + (B + C)$

3. Each operation is *distributive* over the other.
   $A \bullet (B + C) = (A \bullet B) + (A \bullet C)$
   $A + (B \bullet C) = (A + B) \bullet (A + C)$

4. There exists an *identity* element for each operation.
   + Identity $= 0$ $\quad A + 0 = A$
   $\bullet$ Identity $= 1$ $\quad A \bullet 1 = A$

5. There exists a *complement* for each element.
   Complement of $A = \overline{A}$
   Complement of $1 = 0$
   Complement of $0 = 1$

6. There exists an *inverse* for each operation.
   $A \bullet \overline{A} = 0$
   $A + \overline{A} = 1$

7. Each element is *idempotent*.
   $A \bullet A = A$
   $A + A = A$

8. The *absorption* property holds for each element.
   $A \bullet (A + B) = A$
   $A + (A \bullet B) = A$