NUMBER SYTEMS

1. Binary System = 0 and 1 Base -> 2

#(1011)2 = 23.1 + 22.0 + 21.1 + 20.1 = (11)10

1. Decimal System = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 Base ->10

#(348)10

1. Hexadecimal System = 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A*(10)*, B*(11)*, C*(12)*, D*(13)*, E*(14),* F*(15)* Base ->16

#(133A)16

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| Binary | Decimal | Hexadecimal |
| 0000 | 0 | 0 |
| 0001 | 1 | 1 |
| 0010 | 2 | 2 |
| 0011 | 3 | 3 |
| 0100 | 4 | 4 |
| 0101 | 5 | 5 |
| 0110 | 6 | 6 |
| 0111 | 7 | 7 |
| 1000 | 8 | 8 |
| 1001 | 9 | 9 |
| 1010 | 10 | A |
| 1011 | 11 | B |
| 1100 | 12 | C |
| 1101 | 13 | D |
| 1110 | 14 | E |
| 1111 | 15 | F |

1. Binary to Decimal
   1. (101011)2=(?)10

->20.1 + 21.1 + 22.0 + 23.1 + 24.0 + 25.1 = (43)10

* 1. (10110001)2=(?)10

-> 20.1 + 21.0 + 22.0 + 23.0 + 24.1 + 25.1 + 26.0 + 27.1 = *1 + 16 + 32 + 128* = (177)10

* 1. (100100)2=(?)10

->20.0 + 21.0 + 22.1 + 23.0 + 24.0 + 25.1 = (36)10

* 1. (1011100)2=(?)10

->20.0 + 21.0 + 22.1 + 23.1 + 24.1 + 25.0 + 26.1 = (92)10

1. Decimal to Binary
   1. (47)10=(?)2

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| |  |  |  | | --- | --- | --- | | Bölünen | Bölüm | Kalan | | 47 | 23 | 1 | | 23 | 11 | 1 | | 11 | 5 | 1 | | 5 | 2 | 1 | | 2 | 1 | 0 | | 1 | 0 | 1 | | 4710 = (101111)2 |

* 1. (128)10=(?)2

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| |  |  |  | | --- | --- | --- | | Bölünen | Bölüm | Kalan | | 128 | 64 | 0 | | 64 | 32 | 0 | | 32 | 16 | 0 | | 16 | 8 | 0 | | 8 | 4 | 0 | | 4 | 2 | 0 | | 2 | 1 | 0 | | 1 | 0 | 1 | | 12810 = (1000000)2 |

* 1. (117)10 = (?)2

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| |  |  |  | | --- | --- | --- | | Bölünen | Bölüm | Kalan | | 117 | 58 | 1 | | 58 | 29 | 0 | | 29 | 14 | 1 | | 14 | 7 | 0 | | 7 | 3 | 1 | | 3 | 1 | 1 | | 1 | 0 | 1 | | 11710 = (1110101)2 |

* 1. (33)10 = (?)2

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| |  |  |  | | --- | --- | --- | | Bölünen | Bölüm | Kalan | | 33 | 16 | 1 | | 16 | 8 | 0 | | 8 | 4 | 0 | | 4 | 2 | 0 | | 2 | 1 | 0 | | 1 | 0 | 1 | | 3310 = (100001)2 |

* 1. (431)10 = (?)2

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| |  |  |  | | --- | --- | --- | | Bölünen | Bölüm | Kalan | | 431 | 215 | 1 | | 215 | 107 | 1 | | 107 | 53 | 0 | | 53 | 26 | 1 | | 26 | 13 | 0 | | 13 | 6 | 1 | | 6 | 3 | 0 | | 3 | 1 | 1 | | 1 | 0 | 1 | | 43110 = (11101011)2 |

1. Decimal to Hexadecimal
   1. (232)10 = (?)16

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| |  |  |  | | --- | --- | --- | | Bölünen | Bölüm | Kalan | | 232 | 14 | 8 | | 14 | 0 | 14 | | 23210 = (E8)16  E->14 |

* 1. (987)10 = (?)16

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| |  |  |  | | --- | --- | --- | | Bölünen | Bölüm | Kalan | | 987 | 61 | 11 | | 61 | 3 | 13 | | 3 | 0 | 3 | | 98710 = (3D8)16  B-> 11, D->13 |

* 1. (356)10 = (?)16

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| |  |  |  | | --- | --- | --- | | Bölünen | Bölüm | Kalan | | 356 | 22 | 4 | | 22 | 1 | 6 | | 1 | 0 | 1 | | 35610 = (164)16 |

* 1. (785)10 = (?)16

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| |  |  |  | | --- | --- | --- | | Bölünen | Bölüm | Kalan | | 785 | 49 | 1 | | 49 | 3 | 1 | | 3 | 0 | 33 | | 78510 = (311)16 |

* 1. (4156)10 = (?)16

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| |  |  |  | | --- | --- | --- | | Bölünen | Bölüm | Kalan | | 4156 | 259 | 12 | | 259 | 16 | 3 | | 16 | 1 | 0 | | 1 | 0 | 1 | | 78510 = (103C)16  C-> 12 |

1. Hexadecimal to Decimal
   1. (FF)16 = (?)10

=160.15 + 161.15 = 16 + 240 = (255)10

* 1. (F4C)10 = (?)10

=160.12 + 161.4 + 162.15

=12 + 64 + 3840 = 3916

* 1. (EA)16 = (?)10

=160.10 + 161.14

=10 + 224 = (234)10

* 1. (3FA7)16 = (?)10

=160.7 + 161.10 + 162.15 + 163.3

=7 + 160 + 3840 + 12288 = (16295)10

* 1. (B86)16 = (?)10

=160.6 + 161.8 + 162.11

= 6 + 128 + 2816 = (2950)10

1. Binary to Hexadecimal
   1. (11111011101110010)2 = (?)16 => (1F772)16

2

7

7

F

1

* 1. (11101100101001)2 = (?)16 => (3B29)16

3

B

2

9

* 1. (101100110101)2 = (?)16 => (B35)16

B

3

5

* 1. (1110101010110010)2 = (?)16 => (EAB2)16

2

E

A

B

* 1. (1110100011010110)2 = (?)16 => (E8D6)16

6

E

8

D

BOOLEAN ALGEBRA

Boolean algebra is used to analyze and simplicity the digital(logic) circuits. I uses only the binary numbers i. e. 0 and 1. It is also called as Binary Algebra or Logical Algebra.

Rule in Boolean Algebra

* Variable used can have only two values 0 and 1
* Complement of a variable is represented by an overbar (-). Thus, complement of variable B is represented as
  + - B: 0 -> : 1
    - B: 1 -> : 0
* ORing of the variables is represented by a plus (+) sign between them. For example ORing of A, B, C is represented as A + B + C.
* Logical ANDing of the two or more variable is represented by writing a dot between them such as A.B.C. Sometime the dot may be omitted like A.B.C

Boolean Laws

There are six types of Boolean Laws

1. Commutative Law: Any binary operation which satisfies the following expression is referred to as commutative operation.

A.B = B.A

A+B = B+A

1. Associative Law: This law states that the order in which the logic operations are performed is irrelevant as their effect is the same.

(A.B).C = A.(B.C)

(A+B)+C= A+(B+C)

1. Distributive Law: Distributive law states the following condition.

A(B+C) = A.B + A.C

1. AND Law: These laws use the AND operation. Therefore they are called as AND laws.

* A.0 = 0
* A.1 = A
* A.A = A
* A. = 0

1. OR Law: These laws use the OR operation. Therefore they are called as OR laws.

* A+0 = A
* A+1 = 1
* A+A = A
* A+ = 1

|  |  |  |
| --- | --- | --- |
| A | B | A+B |
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 1 |

1. INVERSION Law: This law uses the NOT operation. The inversion law states that double inversion of a variable results in the original variable itself.

= A *(Tersinin tersi kendisine eşittir / double inversion of* ***A*** *equals the original variable itself)*

BOOLEAN THEOREMS

1. Boolean Functions/Expressions

F(A, B, C, D) = A + + ADC

*Boolean Expression*

*Boolean Function*

Y= A + + ADC

1. Truth Table Formation

A truth table represents a table having all combinations of inputs and their corresponding result.

F(A, B, C) = A + B.C

The number of rows in the truth table is 2n where n is 3

n=3 -> 2n = 23 = 8

|  |  |  |  |
| --- | --- | --- | --- |
| **A** | **B** | **C** | **F** |
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 1 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 |

DE MORGAN’S THEOREMS

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| Theorem 1  = +   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | A | B |  |  |  | + | | 0 | 0 | 1 | 1 | 1 | 1 | | 0 | 1 | 1 | 1 | 0 | 1 | | 1 | 0 | 1 | 0 | 1 | 1 | | 1 | 1 | 0 | 0 | 0 | 0 | | Theorem 1  = .   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | A | B |  |  |  | . | | 0 | 0 | 1 | 1 | 1 | 1 | | 0 | 1 | 0 | 1 | 0 | 0 | | 1 | 0 | 0 | 0 | 1 | 0 | | 1 | 1 | 0 | 0 | 0 | 0 | |

Boolean Expression Sİmplication

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