# Introduktion til Programmering og Problemløsning (PoP)

## Binære tal

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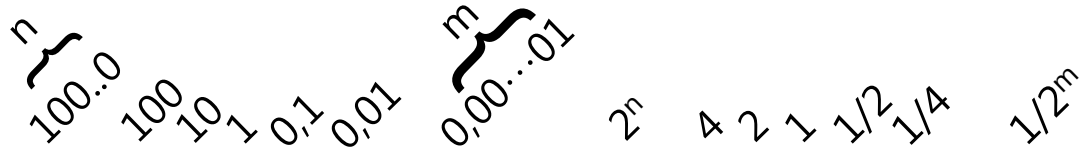
# Alt på computeren er relateret til binære tal

Decimal:
- Base – 10
- Alphabet – {0,1,..,9}

Binær:
- Base – 2
- Alphabet – {0,1}




$$v = \sum_{i=-m}^{n} d_i 10^i.$$

$$v = \sum_{i=-m}^{n} b_i 2^i,$$

| Dec | Bin |
|---|---|
| 0 | 0 |
| 1 | 1 |
| 2 | 10 |
| 3 | 11 |
| 4 | 100 |
| 5 | 101 |
| 6 | 110 |
| 7 | 111 |
| 8 | 1000 |
| 9 | 1001 |
| 10 | 1010 |
| 11 | 1011 |
| 12 | 1100 |
| 13 | 1101 |
| 14 | 1110 |
| 15 | 1111 |
| 16 | 10000 |
| 17 | 10001 |
| 18 | 10010 |
| 19 | 10011 |
| 20 | 10100 |
| 21 | 10101 |
| 22 | 10110 |
| 23 | 10111 |
| 24 | 11000 |
| 25 | 11001 |
| 26 | 11010 |
| 27 | 11011 |
| 28 | 11100 |
| 29 | 11101 |
| 30 | 11110 |
| 31 | 11111 |

| Dec | Bin |
|---|---|
| 32 | 100000 |
| 33 | 100001 |
| 34 | 100010 |
| 35 | 100011 |
| 36 | 100100 |
| 37 | 100101 |
| 38 | 100110 |
| 39 | 100111 |
| 40 | 101000 |
| 41 | 101001 |
| 42 | 101010 |
| 43 | 101011 |
| 44 | 101100 |
| 45 | 101101 |
| 46 | 101110 |
| 47 | 101111 |
| 48 | 110000 |
| 49 | 110001 |
| 50 | 110010 |
| 51 | 110011 |
| 52 | 110100 |
| 53 | 110101 |
| 54 | 110110 |
| 55 | 110111 |
| 56 | 111000 |
| 57 | 111001 |
| 58 | 111010 |
| 59 | 111011 |
| 60 | 111100 |
| 61 | 111101 |
| 62 | 111110 |
| 63 | 111111 |

# Dividér med 2 algoritmen

## Fra binær til decimal

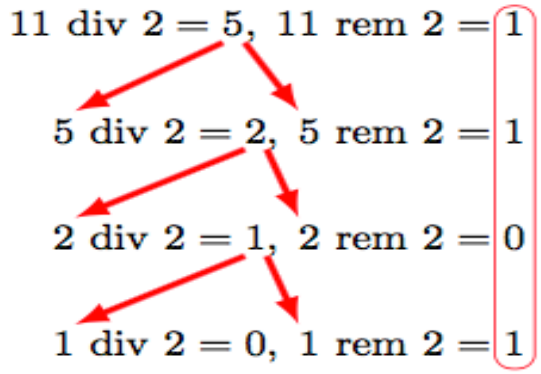
$1010_2 = ?$

$$v = \sum_{i=-m}^{n} b_i 2^i,$$

$1010_2 = 1 \cdot 2^3 + 0 \cdot 2^2 + 1 \cdot 2^1 + 0 \cdot 2^0$
$= 8 + 0 + 2 + 0$
$= 10$

## Fra decimal til binær

$11 = ?_2$



# Oktale og Heksadecimale tal

Oktale tal:

- Base – 8
- Alphabet – {0,1,2,3,4,5,6,7}

$8^n$ 64 8 1 1/8 1/64 $1/8^m$

$o_n \cdots o_2 o_1 o_0, o_{-1} o_{-2} \cdots o_{-m}$

$27,3_8$

Oktalciffer svarer til 3 bit:

$10111_2$ -> 010 $111_2$ -> $27_8$

Heksadecimale tal:

- Base – 16
- Alphabet: {0,1,2,3,4,5,6,7,8,9,a,b,c,d,e,f}

$16^n$ 256 16 1 1/16 1/256 $1/16^m$

$h_n \cdots h_2 h_1 h_0, h_{-1} h_{-2} \cdots h_{-m}$

$a3,9_{16}$

Heksalciffer svarer til 4 bit:

$10111_2$ -> 0001 $0111_2$ -> $17_{16}$

Et heksalciffer

Et oktalciffer

| Dec | Bin | Oct | Hex | Dec | Bin | Oct | Hex |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 32 | 100000 | 40 | 20 |
| 1 | 1 | 1 | 1 | 33 | 100001 | 41 | 21 |
| 2 | 10 | 2 | 2 | 34 | 100010 | 42 | 22 |
| 3 | 11 | 3 | 3 | 35 | 100011 | 43 | 23 |
| 4 | 100 | 4 | 4 | 36 | 100100 | 44 | 24 |
| 5 | 101 | 5 | 5 | 37 | 100101 | 45 | 25 |
| 6 | 110 | 6 | 6 | 38 | 100110 | 46 | 26 |
| 7 | 111 | 7 | 7 | 39 | 100111 | 47 | 27 |
| 8 | 1000 | 10 | 8 | 40 | 101000 | 50 | 28 |
| 9 | 1001 | 11 | 9 | 41 | 101001 | 51 | 29 |
| 10 | 1010 | 12 | a | 42 | 101010 | 52 | 2a |
| 11 | 1011 | 13 | b | 43 | 101011 | 53 | 2b |
| 12 | 1100 | 14 | c | 44 | 101100 | 54 | 2c |
| 13 | 1101 | 15 | d | 45 | 101101 | 55 | 2d |
| 14 | 1110 | 16 | e | 46 | 101110 | 56 | 2e |
| 15 | 1111 | 17 | f | 47 | 101111 | 57 | 2f |
| 16 | 10000 | 20 | 10 | 48 | 110000 | 60 | 30 |
| 17 | 10001 | 21 | 11 | 49 | 110001 | 61 | 31 |
| 18 | 10010 | 22 | 12 | 50 | 110010 | 62 | 32 |
| 19 | 10011 | 23 | 13 | 51 | 110011 | 63 | 33 |
| 20 | 10100 | 24 | 14 | 52 | 110100 | 64 | 34 |
| 21 | 10101 | 25 | 15 | 53 | 110101 | 65 | 35 |
| 22 | 10110 | 26 | 16 | 54 | 110110 | 66 | 36 |
| 23 | 10111 | 27 | 17 | 55 | 110111 | 67 | 37 |
| 24 | 11000 | 30 | 18 | 56 | 111000 | 70 | 38 |
| 25 | 11001 | 31 | 19 | 57 | 111001 | 71 | 39 |
| 26 | 11010 | 32 | 1a | 58 | 111010 | 72 | 3a |
| 27 | 11011 | 33 | 1b | 59 | 111011 | 73 | 3b |
| 28 | 11100 | 34 | 1c | 60 | 111100 | 74 | 3c |
| 29 | 11101 | 35 | 1d | 61 | 111101 | 75 | 3d |
| 30 | 11110 | 36 | 1e | 62 | 111110 | 76 | 3e |
| 31 | 11111 | 37 | 1f | 63 | 111111 | 77 | 3f |

# Resumé

I denne video har du hørt om:

- Talsystem (decimale, binære, oktale, hexadecimale)
- Dividér med 2 algoritmen