* Standard Forms
  + LIteral – variable either primed or unprimed
* Sum of Products (SOP)
  + F1 = x + yz + x'y'z'
  + 3 products of 1,2,3 literals which are OR'ed together
* Product of Sums (POS)
  + F2 = y(x'+z)(x+y+z)
  + 3 sum terms of 1, 2, 3 literals which are ADD'ed together
* Other Logic operations
  + Exclusive Or -> XOR

|  |  |  |
| --- | --- | --- |
| X y | Or | Xor |
| 00 | 0 | 0 |
| 01 | 1 | 1 |
| 10 | 1 | 1 |
| 11 | 1 | 0 |

* + NOR or not or (or a symbol arrow pointing down)

|  |  |  |
| --- | --- | --- |
| X y | Or | nor |
| 00 | 0 | 1 |
| 01 | 1 | 0 |
| 10 | 1 | 0 |
| 11 | 1 | 0 |
|  |  |  |

* + NAND -> not and (arrow up symbol)

|  |  |  |
| --- | --- | --- |
| X y | And | nand |
| 00 | 0 | 1 |
| 01 | 0 | 1 |
| 10 | 0 | 1 |
| 11 | 1 | 0 |

* Digital logic Gates
  + And (minimum 2 inputs and symbol is a big D)
  + Or (minimum 2 inputs and symbol is a concaved D)
  + Inverter -> not. (Flips an input to its opposite) (triangle with a circle on the point)
  + Buffer -> does not change the input signal (triangle)
  + Nand -> Not and -> (big D with a circle on it)
  + Nor -> Not or -> (concaved D with a circle on it )
  + Xor -> Exclusive or -> (Concaved D with a curve in front ) (circle with a + in it)
  + XNOR -> exclusive not or -> (same symbol as XOR but with a circle on it) (circle with dot)
* EX: F = [ (ABC)' (DE)' ]' (she designed the diagram on the board during class)
  + = ((ABC)')' + ((DE)')'
  + ABC + DE
* Integrated Circuits (IC)
  + Is a silicon semiconductor crystal -> Chip
  + Contains electronic components for constructing digital gates
* Levels of Integration
  + SSI (Small scale integration) -> # gates < 10
  + MSI (medium scale integration) -> 10 -> 1000 gates
  + LSI (Large scale integrations) -> 1000s of gates
  + VLSI (Very large scale integration) -> 100s of 1000s of gates
* Pr (3) : F = (AB + A'B') (CD' + C'D) (She drew the diagram on the board)

|  |  |
| --- | --- |
| X y z | F |
| 000 | 0 |
| 001 | 0 |
| 010 | 1 |
| 011 | 1 |
| 100 | 00 |
| 101 | 0 |
| 110 | 1 |
| 111 | 1   |  |  | | --- | --- | |  |  | |

|  |  |
| --- | --- |
| Min terms | Designation |
| X'y'z' | m0 |
| X'y'z | m1 |
| X'yz' | m2 |
| X'yz | m3 |
| Xy'z' | m4 |
| Xy'z | m5 |
| Xyz' | m6 |
| xyz | m7 |
|  |  |

A) List F as (sigma) of minterms

F(x1y1z) = (sigma) ( 2, 3, 6, 7)

B) List F' as (sigma) of minterms

F'(x1y1z) = (sigma) ( 0, 1, 4, 5)

C) Express F in sum of minterms in algebraic form

F = X'yz' + x'yz + xyz' + xyz

D) Simplify the function to an expression with a minimum number of literals

F = X'yz' + x'yz + xyz' + xyz

X'y(z' + z) + xy(z'+z)

X'y + xy

Y(x' + x)

Y

* Pr: Convert into SOP and POS
  + F = (AB + C) (B + C'D'\_
    - ABB + ABC'D' + BC + CC'D'
    - AB + ABC'D' + BC
    - AB( 1 + C'D') + BC
    - AB(1) + BC
    - AB + BC (SOP ANSWER)
    - B(A + C) (POS ANSWER)
* Chapter 3 Gate Level Minimization
* Simplification of Boolean Functions
  + 1) Algebraically
  + Karnaugh maps (K Map)
    - K map is diagram made up of squares, with each square representing one minterm of the function that is to be minimized
    - Two Variable K map (F(x,y)

|  |  |
| --- | --- |
| 00 (m0) | 01 (m1) |
| 10 (m2) | 11 (m3) |
|  |  |

|  |  |
| --- | --- |
| X'y' | X'y |
| Xy' | xy |
|  |  |

* + Problem (Below is given table)

|  |  |  |
| --- | --- | --- |
| X y | f |  |
| 00 | 1 |  |
| 01 | 1 |  |
| 10 | 0 |  |
| 11 | 0 |  |

* + - Kmap

|  |  |
| --- | --- |
| 1 | 1 |
| 0 | 0 |

* + Group of square => 1, 2, 4, …. 8, 16
  + F = x'
  + Function for the problem algebraically = F = x'y' + x'y
  + X'(y'+y)
  + X'
* EX : F = xy + xy – Simplify using k-maps

|  |  |  |
| --- | --- | --- |
| x\y | 0 | 1 |
| 0 | 0 | 0 |
| 1 | 1 | 1 |

* + F = x (using kmap)
  + F = xy + xy'
    - X(y + y')
    - X
* EX :
  + Kmap

|  |  |  |
| --- | --- | --- |
| x\y | 0 | 1 |
| 0 | 1 | 1 |
| 1 | 1 |  |

* + F = x' + y' (using k map)
  + Algebraically
    - F = (sigma) (0,1,2)
      * X'y' + x'y + xy'
      * X'(y' + y) + xy'
      * X' + xy'
      * (x' + x) (x' + y')
      * X' + y'
* 3 variable K map (F (x,y,z)
  + Kmap

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| x\yz | 00 | 01 | 11 | 10 |
| 0 | (m0) | (m1) | (m3) | (m2) |
| 1 | (m4) | (m5) | (m7) | (m6) |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| x\yz | 00 | 01 | 11 | 10 |
| 0 | X'y'z' | X'yz' | X'yz | X'yz' |
| 1 | Xy'z' | Xy'z | xyz | Xyz' |

|  |  |
| --- | --- |
| xyz | F |
| 000 | 0 |
| 001 | 0 |
| 010 | 1 |
| 011 | 1 |
| 100 | 1 |
| 101 | 0 |
| 110 | 1 |
| 111 | 0 |

Kmap for given table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| x\yz | 00 | 01 | 11 | 10 |
| 0 |  |  | 1 | 1 |
| 1 | 1 |  |  | 1 |

Groups of 1,2,4,8

F = x'y + xz'

Simplify algebraically

F = x'yz' + x'yz + xy'z' + xyz'

X'y(z' + z) + xz'(y'+y)

X'y+xz'