JYOTHISHMATHI INSTITUTE OF TECHNOLOGY & SCINCE

PPT ON COMBINATIONAL CIRCUIT FOR CODE CONVERTERS

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Functional Blocks

- Fundamental circuits that are the base building blocks of most larger digital circuits
- They are reusable and are common to many systems.
- Examples of functional logic circuits
 - Decoders
 - Encoders
 - Code converters
 - Multiplexers



Where they are used

- Multiplexers
 - Selectors for routing data to the processor, memory, I/O
 - Multiplexers route the data to the correct bus or port.
- Decoders
 - are used for selecting things like a bank of memory and then the address within the bank. This is also the function needed to 'decode' the instruction to determine the operation to perform.

Encoders

• are used in various components such as keyboards.



Formulation step

- Convert the specifications into a variety forms for optimal implementation.
 - Possible forms
 - Truth Tables
 - Expressions
 - K-maps
 - Binary Decision Diagrams



Last 3 steps

- Best illustrated by example
 - A BCD to Excess-3 code converter

BCD-to-Excess-3 Code converter

- BCD is a code for the decimal digits 0-9
- Excess-3 is also a code for the decimal digits

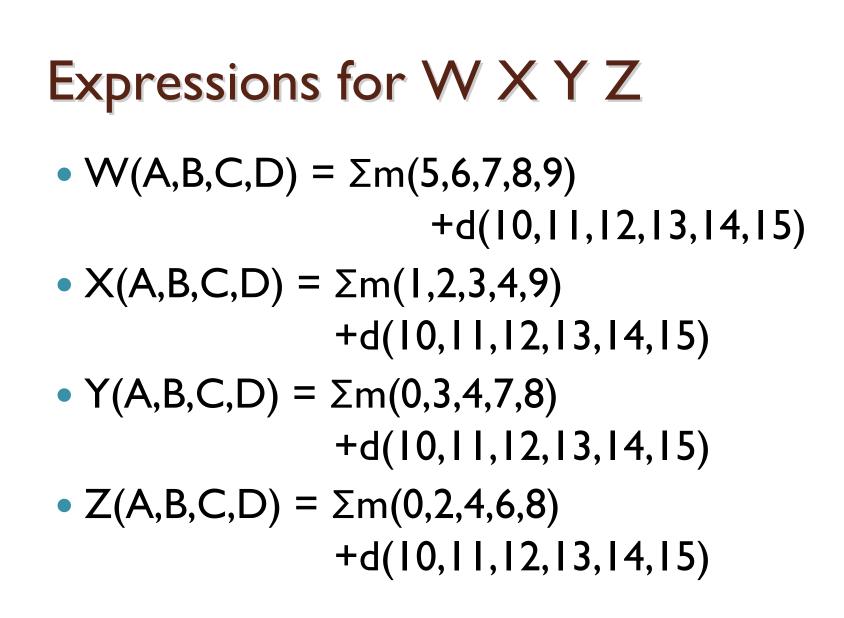
Decimal Digit	Input BCD	Output Excess-3
0	0 0 0 0	0011
1	0001	0100
2	0010	0101
3	0011	0 1 1 0
4	0100	0 1 1 1
5	0101	1000
6	0110	1001
7	0111	1010
8	1000	1011
9	1001	1100

Specification of BCD-to-Excess3

- Inputs: a BCD input, A,B,C,D with A as the most significant bit and D as the least significant bit.
- Outputs: an Excess-3 output W,X,Y,Z that corresponds to the BCD input.
- Internal operation circuit to do the conversion in combinational logic.

Formulation of BCD-to-Excess-3

- Excess-3 code is easily formed by adding a binary 3 to the binary or BCD for the digit.
- There are 16 possible inputs for both BCD and Excess-3.
- It can be assumed that only valid BCD inputs will appear so the six combinations not used can be treated as don't cares.



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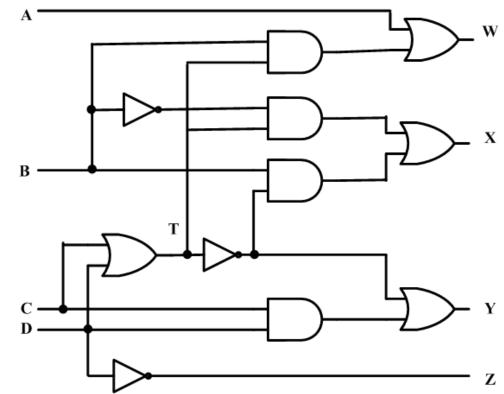
Two level circuit implementation

- Have equations
 - W = A + BC + BD = A + B(C+D)
 - X = B'C + B'D + BC'D' = B'(C+D) + BC'D'
 - Y = CD + C'D'
 - Z = D'
- Factoring out (C+D) and call it T
- Then T' = (C+D)' = C'D'
 - W = A + BT
 - $\circ X = B'T + BT'$
 - Y = CD + T'
 - Z = D'

Create the digital circuit

Implementing the second set of equations where T=C+D results in a lower gate count.

 This gate has a fanout of 3



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