SWE223: Digital Electronics Fall 2015

Lecture 3 Part 2
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11/10/2015

Textbooks

- Digital Logic And Computer Design by M. Morris Mano

Number system extended
&
Venn Diagram

Binary Coded Decimal (BCD)

- Used to represent the decimal digits 0 - 9.
- 4 bits are used.
- Each bit position has a weight associated with it (***weighted code***).
- Weights are: 8, 4, 2, and 1 from MSB to LSB (called 8-4-2-1 code).
- BCD Codes:

0: 0000	4: 0100	8: 1000
1: 0001	5: 0101	9: 1001
2: 0010	6: 0110	
3: 0011	7: 0111	

- Used to encode numbers for output to numerical displays
- Used in processors that perform decimal arithmetic.
- ***Example***: $(9750)_{10} = (1001\ 0111\ \ 0101\ \ 0000)_{BCD}$

9 7 5 0

Excess 3

- A BCD Code formed by adding 3 (0011) to its true four bit binary value.
- Excess 3 is a self complementing code. If the bits of the Excess-3 digit are inverted, they yield the 9's complement of the decimal equivalent.
- Excess-3 code is useful for performing decimal arithmetic digitally.

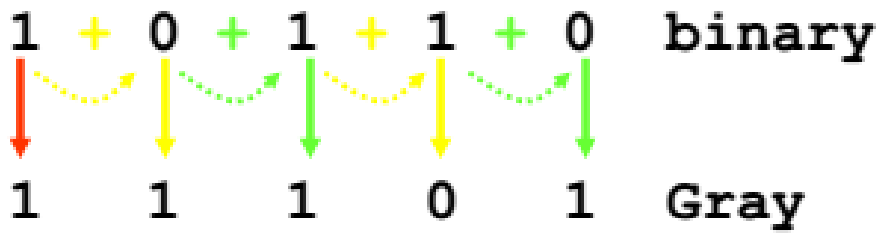
Examples

- 3 = 0011 + 0011 = 0110
- 1 = 0001 + 0011 = 0100

Gray code

- Binary-to-Gray code conversion
  - The MSB in the Gray code is the same as corresponding MSB in the binary number.
  - Going from left to right, add each adjacent pair of binary code bits to get the next Gray code bit. Discard carries.

ex: convert 10110_2 to Gray code



Combinational Logic Venn Diagram

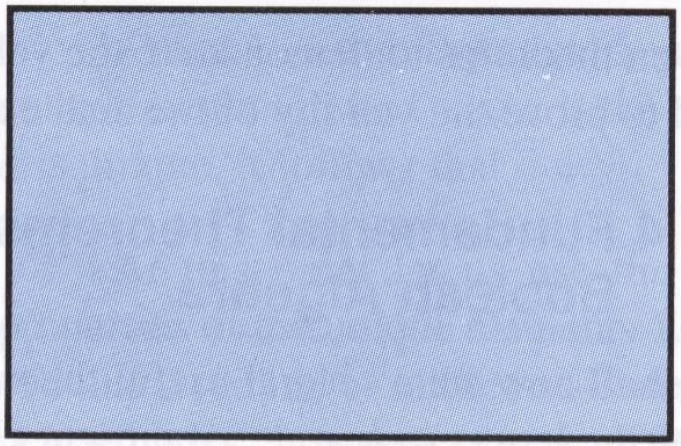
Operations on sets

Sets ≡ closed regions

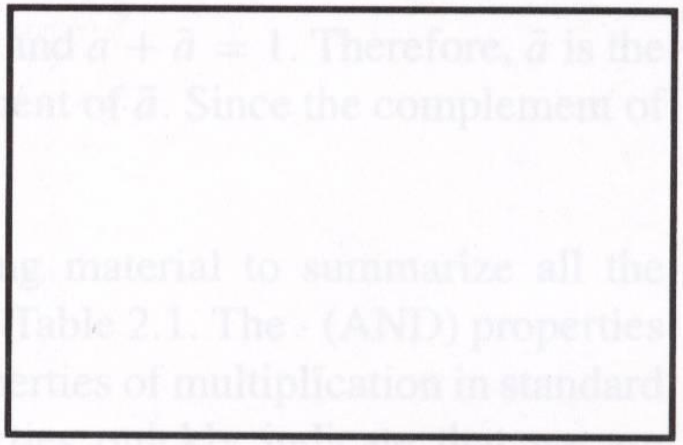
Sets correspond to elements

Intersection ∩ corresponds to •

Union ∪ corresponds to +

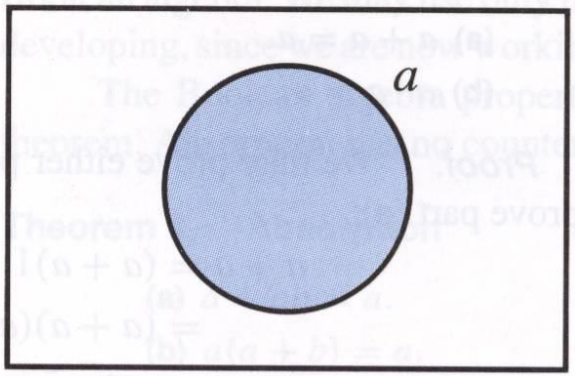


Universal set 1

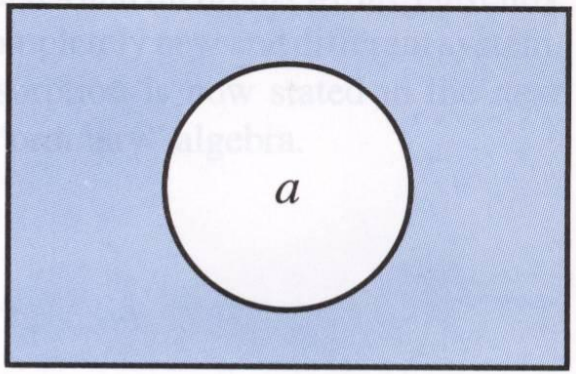


Null set 0

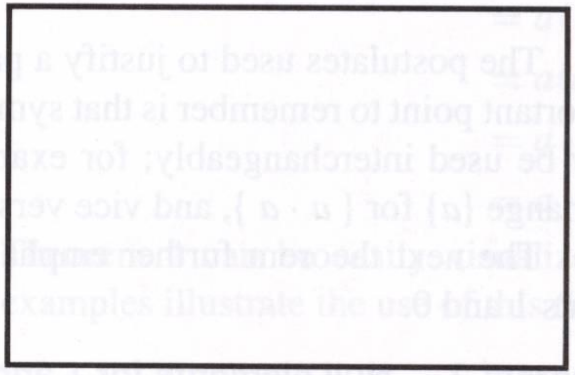
Combinational Logic Venn Diagram



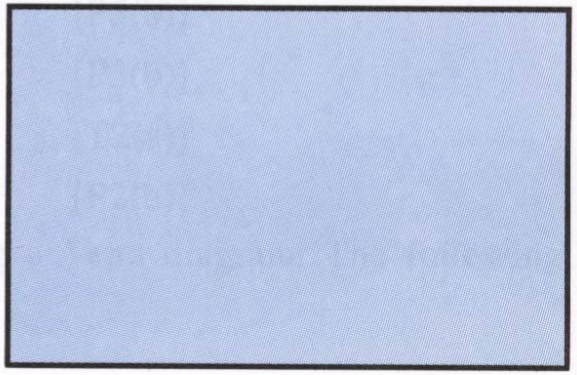
Set a



Set $\bar{a}$

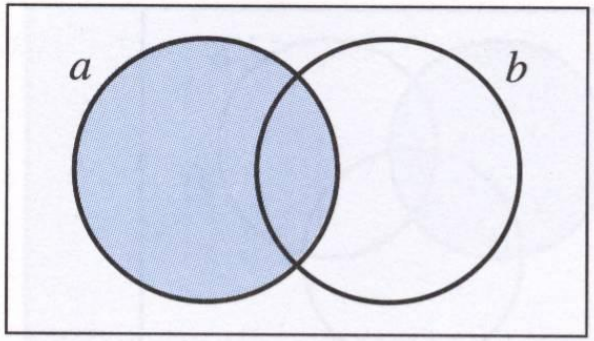


Set $a \cdot \bar{a}$

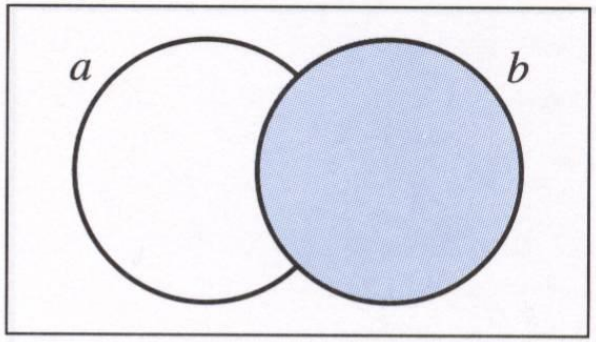


Set $a + \bar{a}$

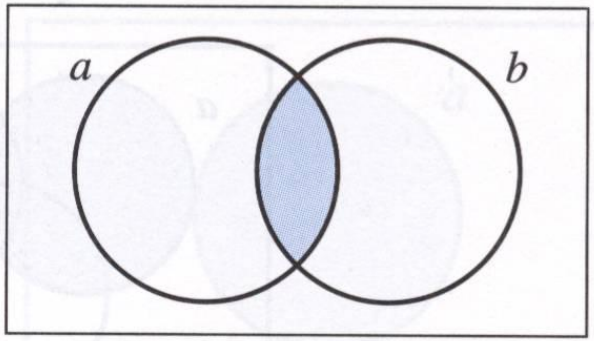
Combinational Logic Venn Diagram



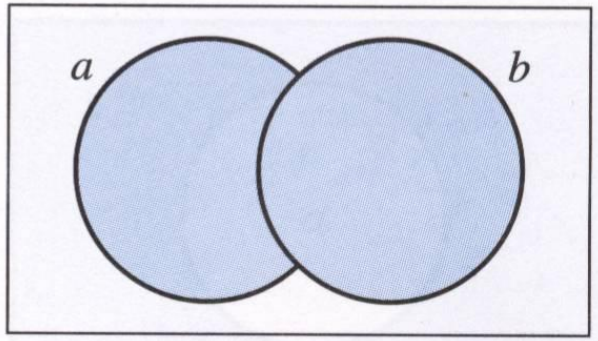
Set a is shaded.



Set b is shaded.



Set $a \cdot b$ is shaded.



Set $a + b$ is shaded.