Digital Circuits

ECS 371

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Lecture 4-5

Office Hours:
BKD 3601-7
Monday 1:30-3:30
Tuesday 10:30-11:30

ECS371.PRAPUN.COM

Problem Set 1

- The questions are assigned from the following textbook:
- Thomas L. Floyd, *Digital Fundamentals*, 10th Edition, Pearson Education International (2009).
- Only TWO of the problems will be graded. Of course, you do not know which problems will be selected; so you should work on all of them.
- Late submission will not be accepted.
- ***Write down all the steps*** that you have done to obtain your answers. You may not get full credit even when your answer is correct without showing how you get your answer.

Problem Set 1

- Chapter 2

  6, 9, 13, 19, 20, 22, 25, 28

- Chapter 3

  6, 8, 16, 20, 23

- Due date: June 24, 2009 (Thursday)
- Please submit your HW to the instructor 3 minutes BEFORE your class starts.
- Earlier submission is possible. There are two HW boxes in the EC department (6th floor) for ECS 371. (One for CS. Another one for IT.)

Review

- Convert the following decimal numbers to binary:

  (a) +29 (b) +85

- Express the following decimal numbers in binary as an 8-bit sign-magnitude number:

  (a) +29 (b) -85

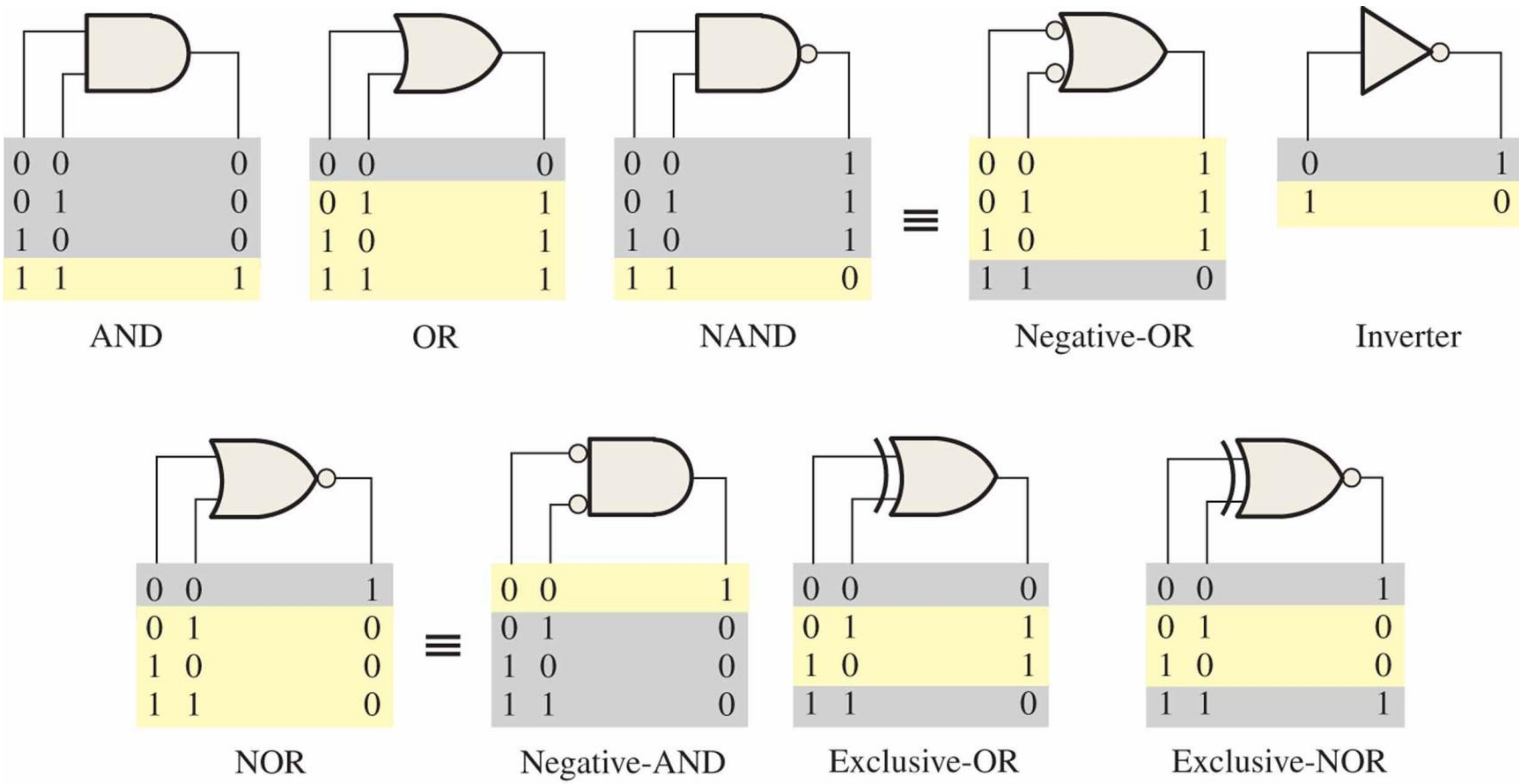
- Express the following decimal numbers as an 8-bit number in the 1's complement form:

  (a) +29 (b) -85

- Express the following decimal numbers as an 8-bit number in the 2's complement form:

  (a) +29 (b) -85

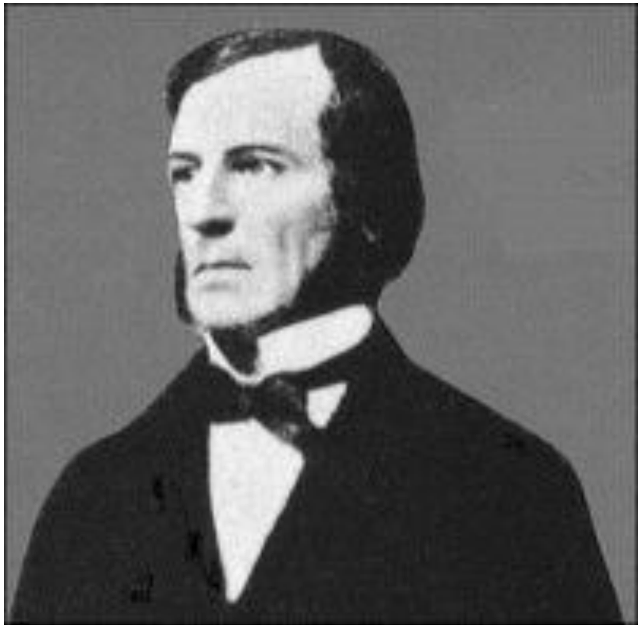
Logic Gates



Note: Active states are shown in yellow.

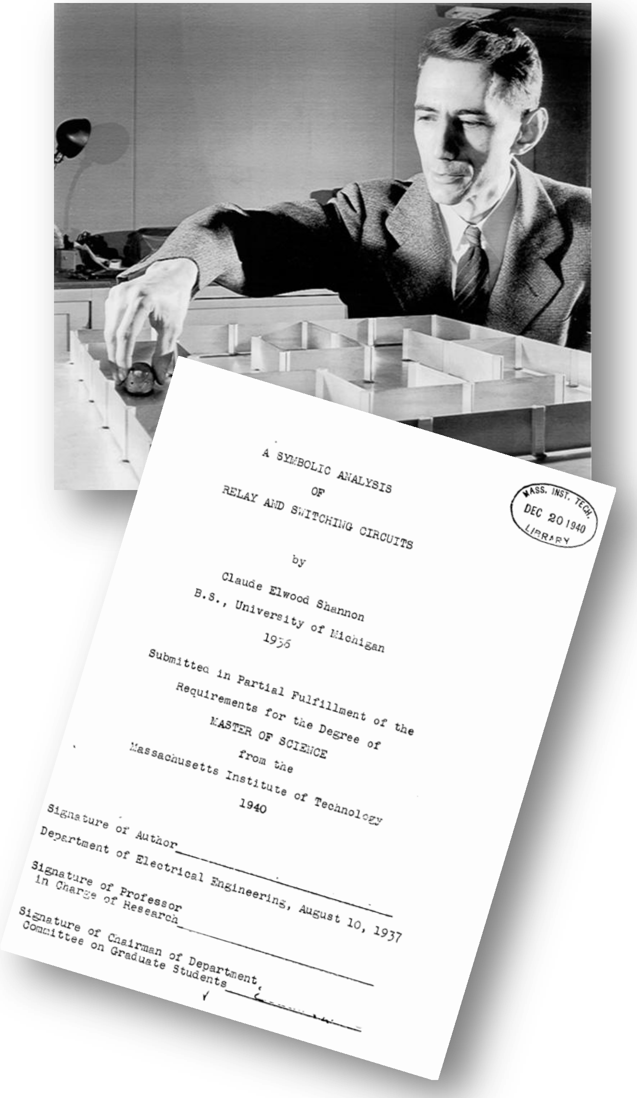
Boolean Algebra

- The mathematics of logic circuits.
- The algebra of two values.
- Usually taken to be 0 and 1.
- Developed in 1854 by George Boole in his book *An Investigation of the Laws of Thought*.
- Provide a concise way to express the operation of a logic circuit formed by a combination of logic gates.



C. E. Shannon (1916-2001)

- 1938 MIT master's thesis: A Symbolic Analysis of Relay and Switching Circuits
- Insight: The binary nature of Boolean logic was analogous to the ones and zeros used by digital circuits.
- The thesis became the foundation of practical digital circuit design.
- The first known use of the term bit to refer to a "binary digit."
- Possibly the most important, and also the most famous, master's thesis of the century.
- It was simple, elegant, and important.


A SYMBOLIC ANALYSIS
OF
RELAY AND SWITCHING CIRCUITS
by
Claude Elwood Shannon
B.S., University of Michigan
1936
Submitted in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
from the
Massachusetts Institute of Technology
1940
Signature of Author
Department of Electrical Engineering, August 10, 1937
Signature of Professor
in Charge of Research
Signature of Chairman of Department
Committee on Graduate Students

C. E. Shannon (con't)

- 1948: A Mathematical Theory of Communication
- Create the architecture and concepts governing digital communication.
- Invent Information Theory: Simultaneously founded the subject, introduced all of the major concepts, and stated and proved all the fundamental theorems.

The science of information theory tackles the following questions [Berger]

1. What is information, i.e., how do we measure it quantitatively?
2. What factors limit the reliability with which information generated at one point can be reproduced at another, and what are the resulting limits?
3. How should communication systems be designed in order to achieve or at least to approach these limits?