CALIFORNIA STATE UNIVERSITY
FULLERTON™

EGCP 180: DIGITAL LOGIC AND COMPUTER STRUCTURES

LECTURE 1 - SYLLABUS REVIEW

JAYA DOFE

Instructor Information

- Dr. Jaya Dofe
- Email: jdofe@fullerton.edu
- Canvas Course Page:
  - https://csufullerton.instructure.com/courses/3356887
- Class hours: MWe – 12:00 PM – 1:50 PM
- Classroom – CS301
- Office: E-402A
- Office Telephone: 657-278-5923
- Office Hours:
  - TBD (In-Person and via Zoom)
  - Link will be posted on course page
  - If you can't make it, email me and I will try to arrange suitable time

Learning Goals

- Explain the elements of digital system abstractions such as digital representations of information, digital logic, Boolean algebra.
- Apply Boolean algebra and DeMorgan's theorems to simplify basic mathematical expressions.
- Construct a Karnaugh Map. Relate K-Maps to truth tables.
- Understand how logic circuits are analyzed, designed, verified, and tested.
- Understand the basic organization of computer including its architecture, memory, Arithmetic Logic Unit, and control unit.
- Design and simulate digital circuits.

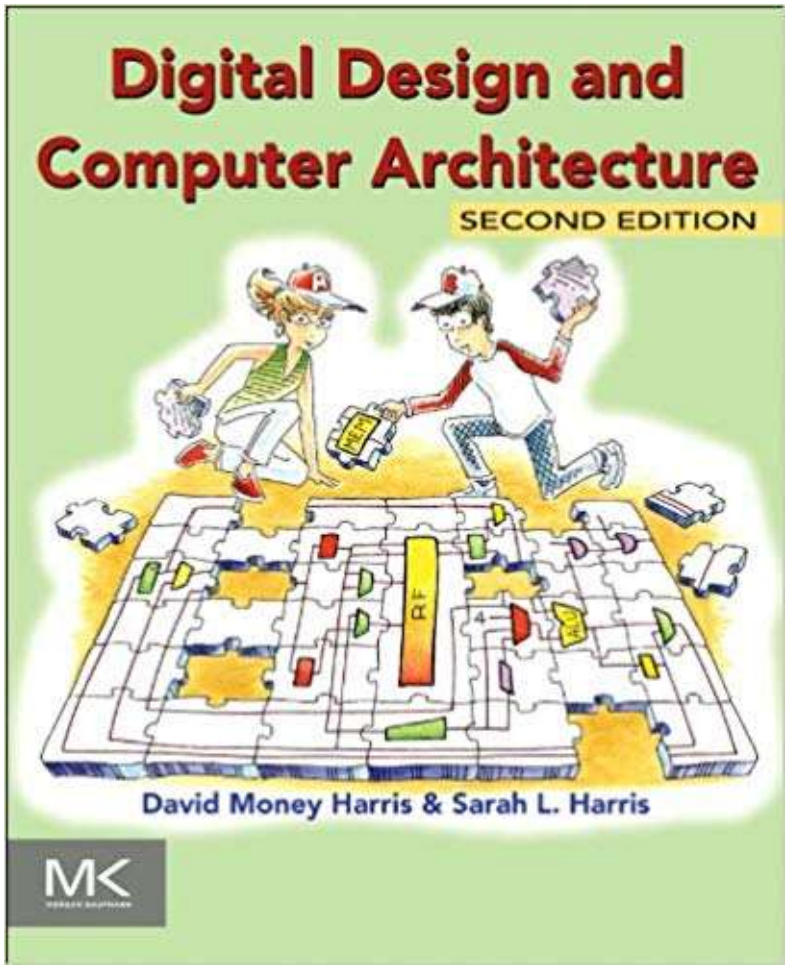
Course Textbook

Digital Design and Computer Architecture, 2nd Edition.

Authors: David Harris and Sarah Harris Jr;

Publisher:

Morgan Kaufmann, 2012



Attendance

- You are expected to attend every lecture and lab and responsible for the material covered in these
- If you do miss a lecture/lab, it is your responsibility to contact a classmate for class notes or announcements or see me in office hours
- Please arrive to lecture/lab on time

Course Communication

- Email is the primary form of communication (to/from the instructor) for this class
  - You can utilize Inbox from Canvas as well.
- I will respond to emails within two business days
- Include "**EGCP 180**" in the subject of your email
- Send professional emails to the instructor
  - No email "texts"
- You do not need to email to set an appointment during office hours

Student Resources

- Problems with Canvas?
  - You can visit Canvas Resources for Students. You can also visit Canvas Student Guide.
- Look at the syllabus for more information about the:
  - University Learning Center (ULC)
  - Writing Center
  - Software for students
  - Need laptop – Ask?

Conduct

- As members of an academic community, it is our responsibility to provide a safe, inclusive classroom environment that is considerate of others, encourages exploration of ideas, and allows opportunities for everyone to fully engage in classroom discussions, activities, lectures, etc.
- To accomplish this, I ask that each of us refrain from conduct that is disrespectful and/or distracting to others in the classroom

Academic Dishonesty

- Students are encouraged to assist one another and discuss the course materials with your peers
- **The basic principle is tl**
  turn in his/her own ori
  standard of academic i
  - You must clearly cite al
  - Completing an individu
    students and turning ir
    permitted and is acade
- Attempting to take crec
  turning it in as your ow
  dishonesty and is a seri
  academic standards

Academic Dishonesty (Cont.)

- **In this class, unless stated otherwise, all assignments are individual assignments and must be done by the individual turning in the assignment**
- **Files/code should not be transferred (e.g., email, printed, removable drive, etc.) between you and any other student for any reason**
  - Protect your work, you don't know where it will go

Academic Dishonesty (Cont.)

- It is your responsibility to be aware of and follow the CSU Fullerton's academic honesty policy: http://www.fullerton.edu/senate/publications_policies_resolutions/ups/UPS%20300/UPS%20300.021.pdf
- Policies on academic integrity will be strictly enforced and academic dishonesty will not be tolerated
  - An academic dishonesty citation will result in a score of "0 (zero)" for the grade item and a possible final letter grade of "F" in the course along with an entry in the student records

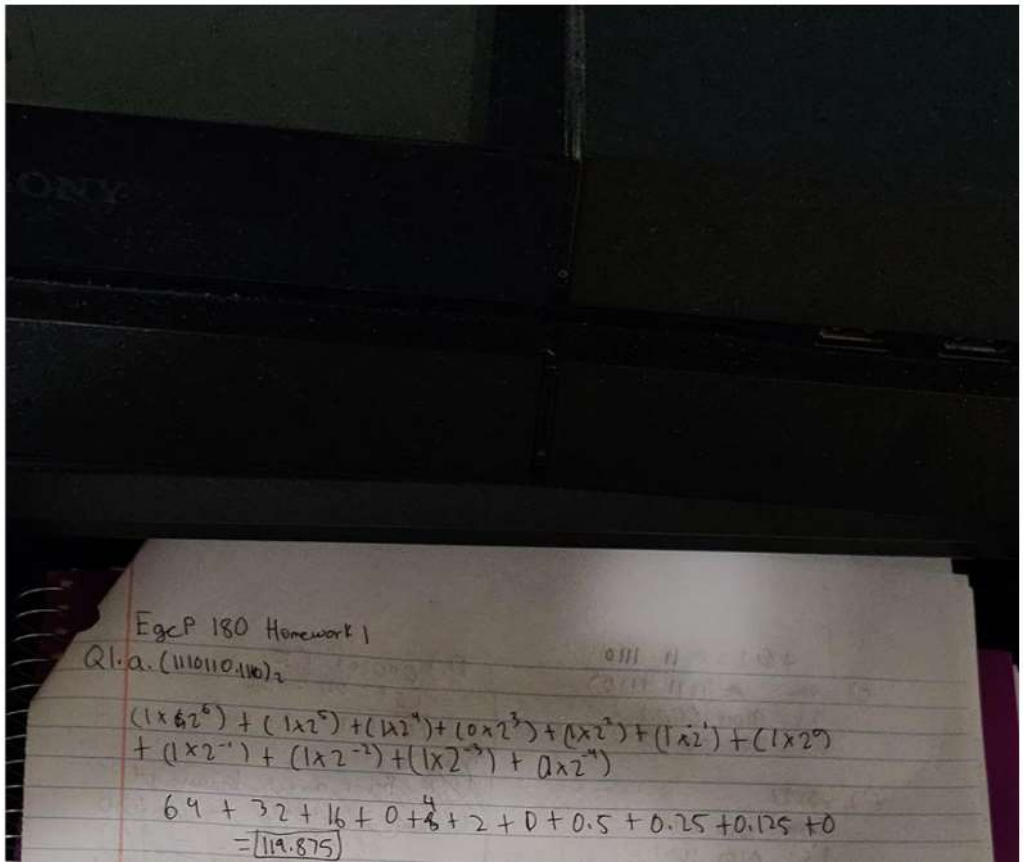
Grading

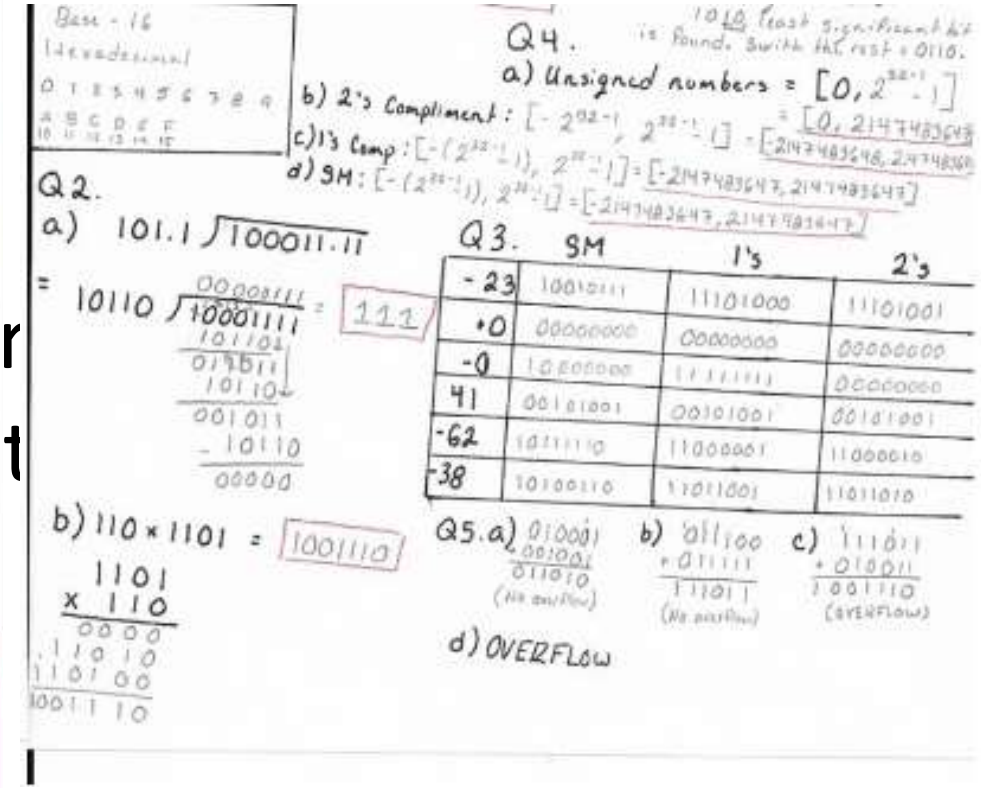
Items	% of Final Grade
Class Participation	5%
Homework	5%
Midterm Exam	20%
Final Exam	25%
Labs	30%
Quizzes	15%

Grading

Letter Grade	% of Total Points
A+	96% & Above
A	93% – 95.99%
A-	88% – 92.99%
B+	85% – 87.99%
B	82% – 84.99%
B-	78% – 81.99%
C+	75% – 77.99%
C	72% – 74.99%
C-	68% – 71.99%
D+	65% – 67.99%
D	62% – 64.99%
D-	58% – 61.99%
F	Less than 58%

HW, Lab Submission





Make sure to add

Your name

Question numbers

Course Tour

- https://csufullerton.instructure.com/courses/3356887
- Community
  - Chat in Canvas
  - Discord
  - Slack
  - IG

Mentimeter Syllabus Trivia

- https://www.menti.com/almbmdprf5vn

Mind Break Time

- https://csuf.padlet.org/jdofe1/2mi74so1ehcm5e6d

Ice breaker - Let your class know you

- Assignment
  - Name
  - Make sure to include your name and major
  - Tell us what are your expectation from the class
  - Fun fact
- Make sure to leave your introduction video by Friday, January 27th, at 11:59 pm.
- Make sure to leave a reply to another member's introduction (at least one) by Sunday, January 29th, at 11:59 pm.
  - Be mindful

$15_{10} \rightarrow 16$

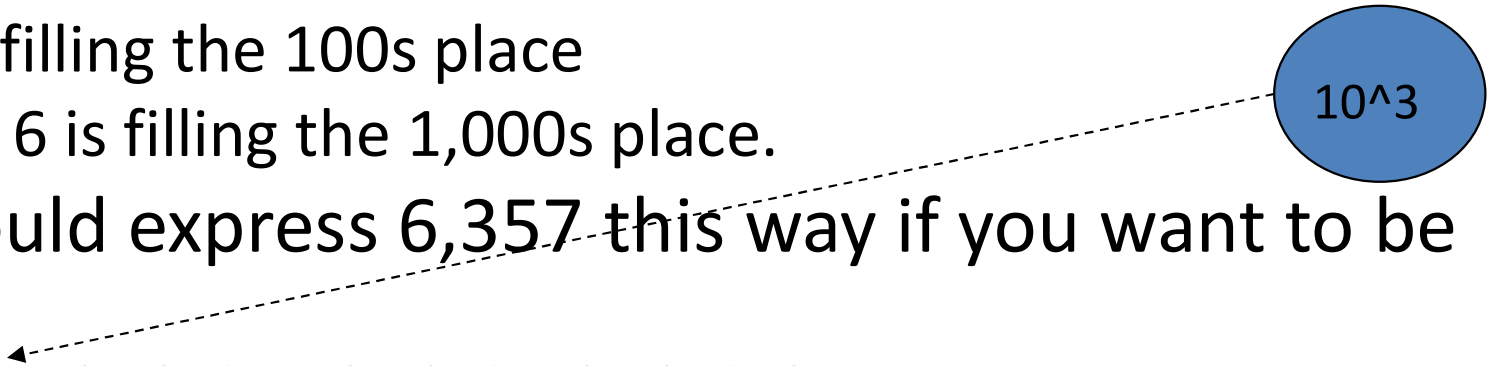
$\frac{15}{16} = Q\ 1\ R\ 15$

Why do you need this class?

- Digital logic design forms the foundation of electrical engineering and computer engineering
- Digital logic is rooted in binary code, which renders information through zeroes and ones
- This system facilitates the design of electronic circuits that convey information, including logic gates with functions that include AND, OR, and NOT commands
- The value system translates input signals into specific outputs
- These functions facilitate computing, robotics, and other electronic applications
- Digital logic design is used to develop hardware, such as circuit boards and microchip processors

Let us start from an arbitrary decimal number

- For example, 6,357 has four digits.
- It is understood that in the number 6,357,
  - the 7 is filling the "1s place,"
  - while the 5 is filling the 10s place,
  - the 3 is filling the 100s place
  - and the 6 is filling the 1,000s place.
- So you could express 6,357 this way if you want to be explicit:



(6 * 1000) + (3 * 100) + (5 * 10) + (7 * 1)
= 6000 + 300 + 50 + 7
= 6357

Let us start from an arbitrary decimal number (Cont.)

- Thus, another way to express the previous number is like this:

$(6 * 10^{\wedge 3}) + (3 * 10^{\wedge 2}) + (5 * 10^{\wedge 1}) + (7 * 10^{\wedge 0})$

$= 6000 + 300 + 50 + 7$

$= 6357$

What you can see from this expression is that each digit is a **placeholder** for the power of the index of that placeholder of base 10, starting from the least significant digit with 10 raised to the power of zero (i.e. counting from the rightmost digit).

The fundamental point

- Modern computers use binary number system, in which there are only zeros and ones (Only two symbols)
- A “bit” to binary is similar a “digit” to a decimal information
- A **bit** has a single binary value, either 0 or 1

You might ask

- Why don’t computers use the base-10 decimal system for numbers, counting and arithmetic?
- Why not 4 based, 7 based?
- Why 2 based?

You might ask

- Why don’t computers use the base-10 decimal system for numbers, counting and arithmetic?
- Why not 4 based, 7 based?
- Why 2 based?

3 | 68

Why Binary?

- We know that the computer doesn't have a real brain inside
- In fact, it is made up mostly of semiconductor materials such as silicon
- Yet, a computer acts in many ways as if it does have a real brain, because it can store (memorize) data

The simplest answer is

- Basically speaking, binary system simplifies information representation and information processing in electronic world
- Binary number system is the easiest one to implement from the hardware point of view
- The binary number system suits a computer extremely well, because it allows simple CPU and memory designs

Hence we use binary in Computers

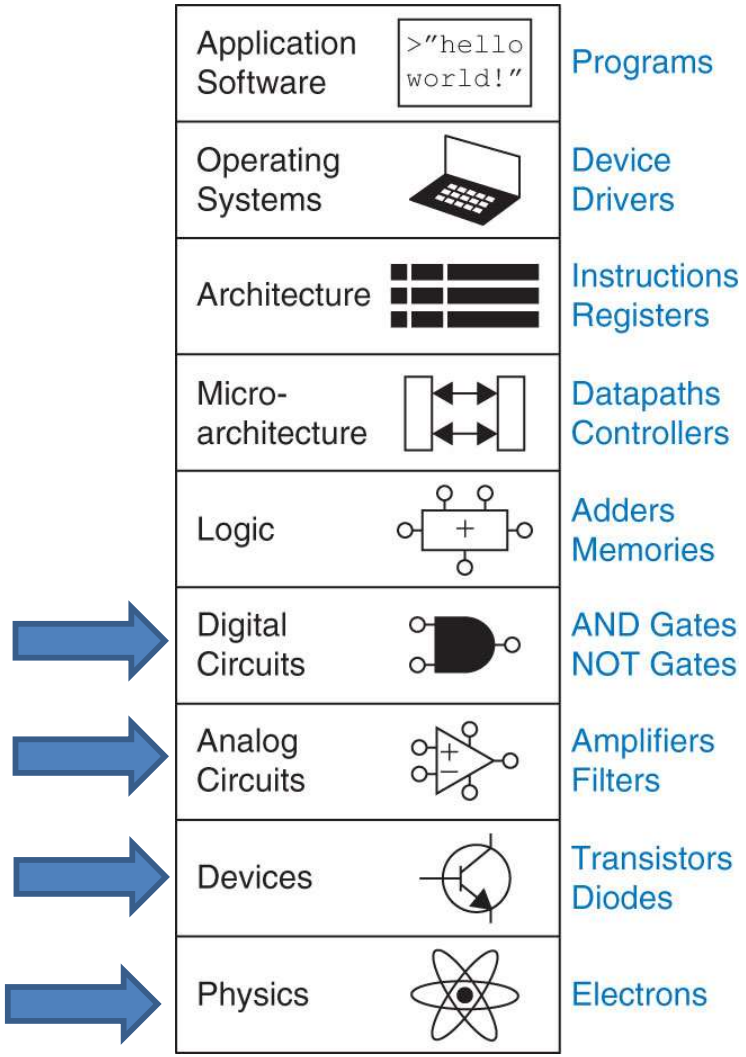
Binary Number System

- Invented in 1689
- Most important logicians, mathematicians and natural philosophers of the Enlightenment

Gottfried Wilhelm (von) Leibniz

Levels of abstraction for an electronic computing system

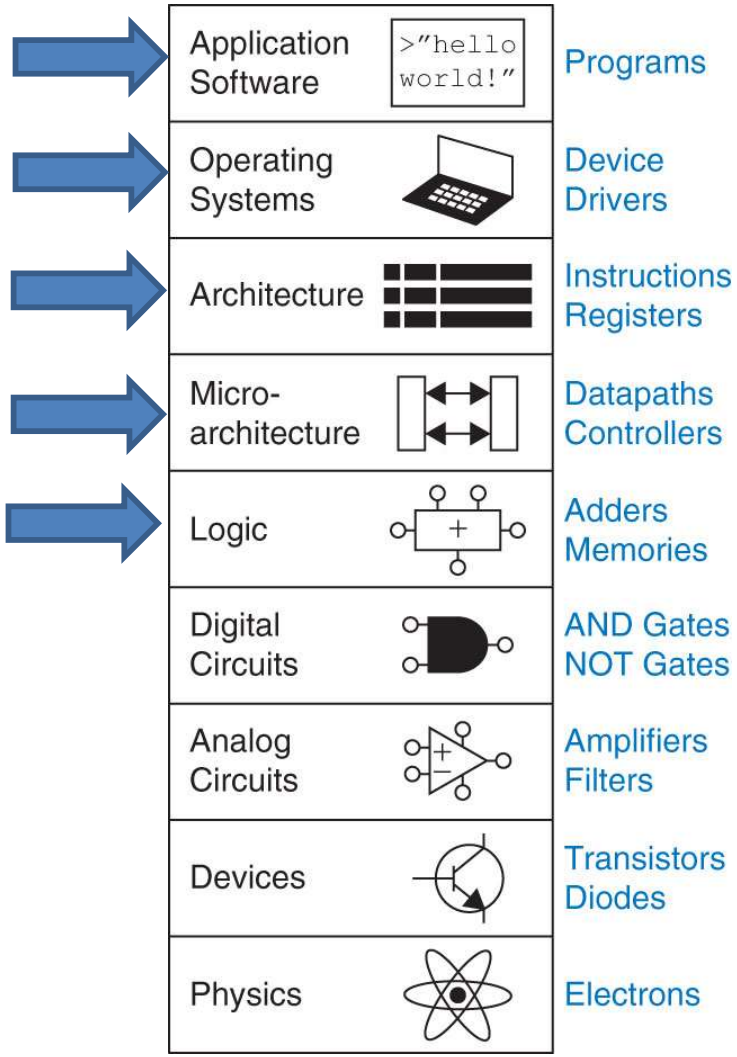
- Abstraction: hiding the details when it is not important
- Motion of electronics – quantum mechanics or Maxwell equation
- Systems are made up of devices and defined by terminals
- Then comes, analog circuits – input and output; continuous range of voltages
- Digital circuits – Logic gates – Discrete ranges ?



(Image by Euroarms Italia. www.euroarms.net 2006.)

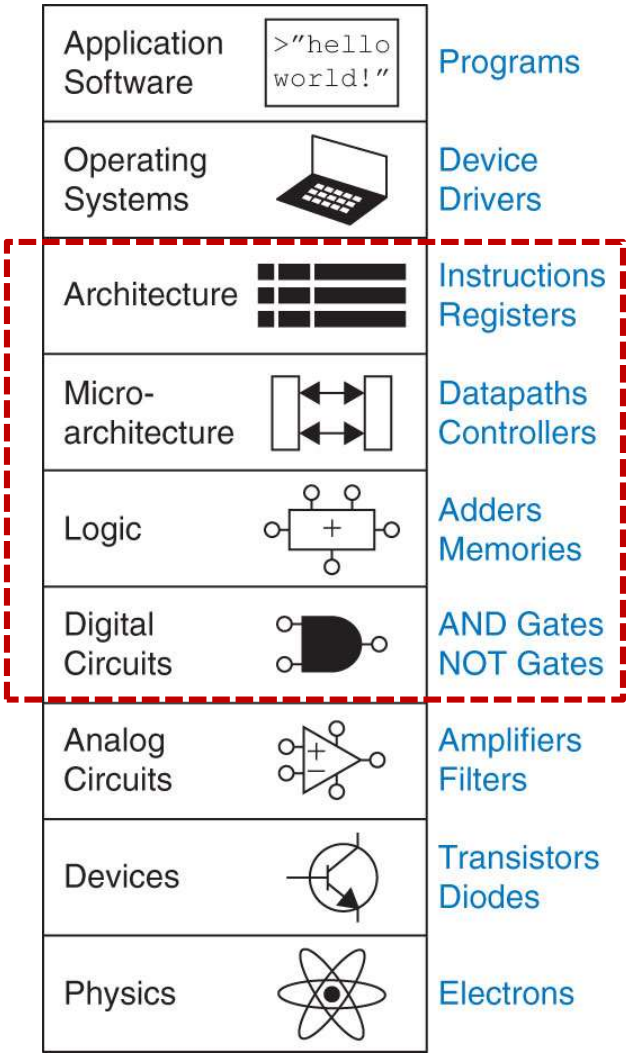
Levels of abstraction for an electronic computing system (Cont.)

- Logic design – complex digital structures
- Microarchitectures – links logic and architecture
- Architecture – describes a computer from programmers' perspective
- Operating system – handles low-level details such as assessing a hard drive or managing memory
- Application software – uses the facilities provided by operating system to solve the problem for user

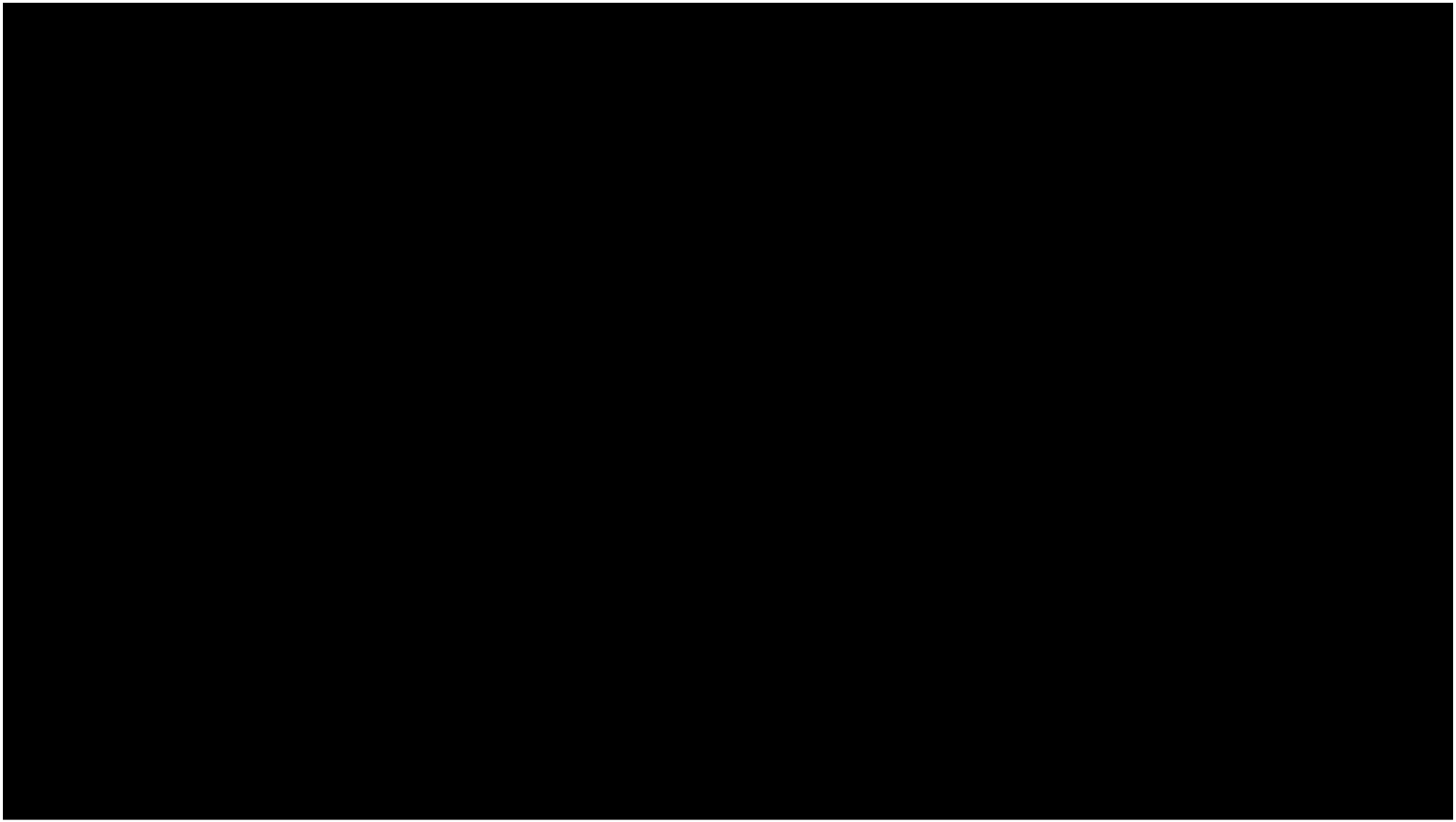


(Image by Euroarms Italia. www.euroarms.net 2006.)

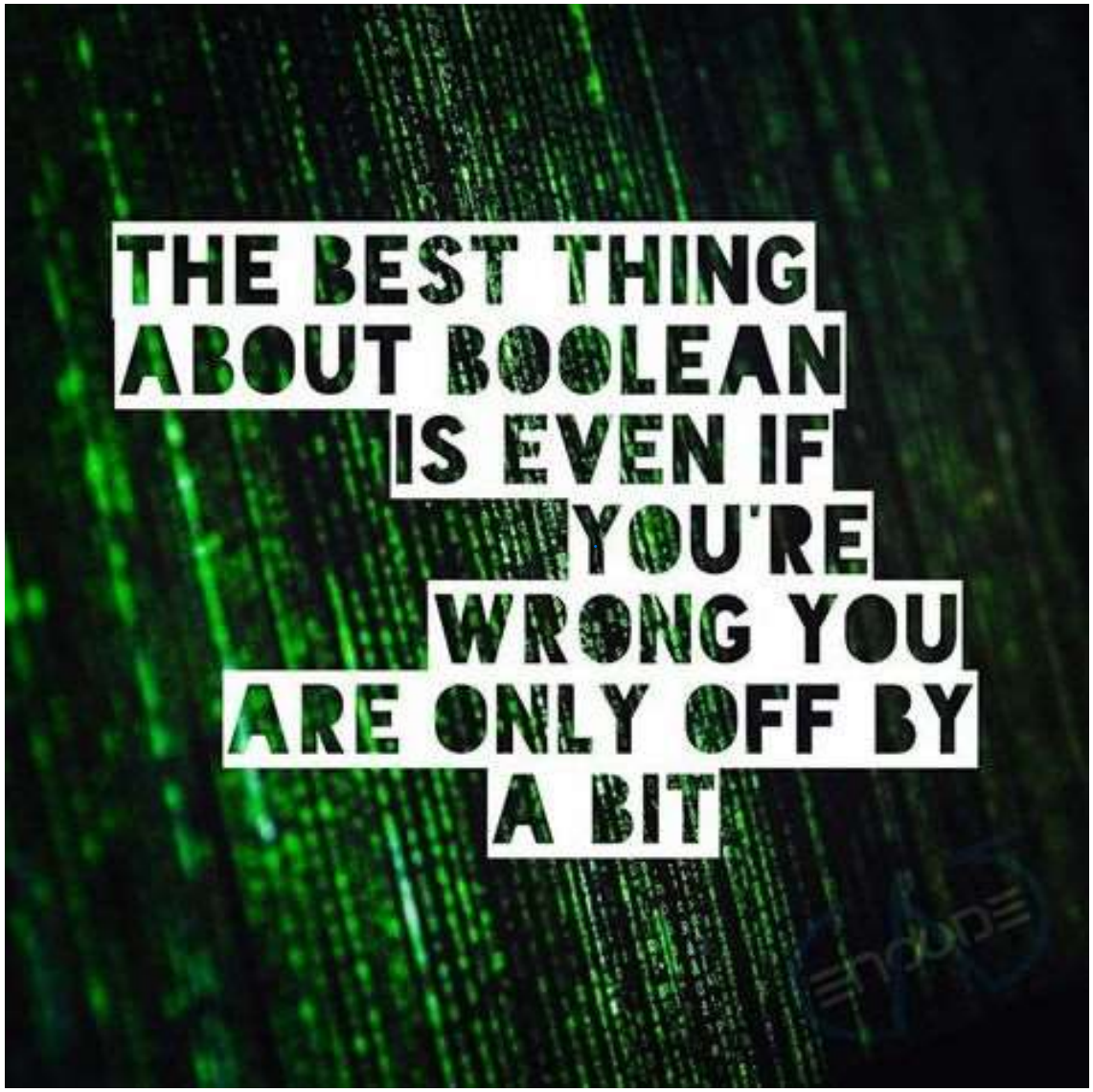
Levels of abstraction for an electronic computing system (Cont.)



(Image by Euroarms Italia. www.euroarms.net 2006.)



Source: https://www.youtube.com/watch?v=ewokFOSxabs&feature=youtu.be



Source: https://www.pinterest.com/pin/511017888955979698