About the Lecturer

- **BSc**
  İTÜ, Computer Engineering Department, 1995

- **MSc**
  İTÜ, Computer Engineering Department, 1997

- **Areas of Interest**
  - Digital Image and Video Analysis and Processing
  - Real-Time Computer Vision Systems
  - Multimedia: Indexing and Retrieval
  - Software Engineering
  - OO Analysis and Design
Welcome to the Course

- **Important Course Information**
  - 10:00-13:00, Friday
  - Course Web Page
  - Join to the group
    - http://groups.yahoo.com/group/bil101e
    - bil101e@yahooogroups.com
Grading Scheme

- 5 Homework (40%)
- A midterm exam (20%)
- A final exam (40%)
- You must follow the official Homework Guidelines (http://www.ce.itu.edu.tr/lisans/kilavuz.html).
- Academic dishonesty including but not limited to cheating, plagiarism, collaboration is unacceptable and subject to disciplinary actions. Any student found guilty will have grade F. Assignments are due in class on the due date. Late assignments will generally not be accepted. Any exception must be approved. Approved late assignments are subject to a grade penalty.
Tell me and I forget.
Show me and I remember.
Let me do and I understand.

—Chinese Proverb
Purpose of the Course

➢ To prepare students to be able to learn the features of various business software tools and apply these tools in efficiently and effectively solving problems.
Course Outline

1. Introduction to CIS
2. Computer Hardware: CPU, memory, storage devices, network devices, peripherals
3. Operating systems: users, files, permissions, commands, applications
4. Basic tools: file managers, editors, web browsers, e-mail agents
5. Word Processing
6. Data Processing
7. Creating Presentations
8. Internet services: addressing, file transfer, remote access
9. Introduction to programming
Course Outline

10. Flow Control
11. Data Abstraction
12. Drawing and Image Manipulation
1

Introduction
Content

▶ Introduction to computer and information system
▶ History of computing
Symbols (e.g. 0,1,...,9,A,B,...,Z,!,+,,-,...)

Data are facts, numbers or individual entities without context or purpose.

000101020305080D1522375990

Credit Card Number? Insurance Number? Lottery?
Data — Information — Knowledge

► Information is data that has been organized into a meaningful context (to aid decision making).

Suppose a newly-born pair of rabbits, one male, one female, are put in a field.

► Rabbits are able to mate at the age of one month so that at the end of its second month a female can produce another pair of rabbits.

► Suppose that our rabbits never die and that the female always produces one new pair (one male, one female) every month from the second month on.
How many pairs will there be in one year?

Knowledge is clear perception/understanding of truth,

\[ a_n = a_{n-1} + a_{n-2} \]
\[ a_0 = 0 \]
\[ a_1 = 1 \]

\[
a_n = \frac{2}{\sqrt{5}} \left( \frac{1+\sqrt{5}}{2} \right)^n - \frac{2}{\sqrt{5}} \left( \frac{1-\sqrt{5}}{2} \right)^n
\]
What is the difference between them?

► Consider water as an example: $\text{H}_2\text{O}$
► In one form, it's a liquid. Change the surrounding conditions and it is a solid. Change them again, and $\text{H}_2\text{O}$ becomes a gas.
► The basic compound remains the same throughout. Only the conditions change.
► In our discussion, the basic compound is data — measures and representations of the world around us.
► Change the conditions — by looking at relationships and patterns that occur in data over time, assigning meaning to what we see — and we've got information.
► Mix-in how to use all that information to do something, we've got knowledge.
What is the difference between them?

► At the root of information is, "to inform."
► Data don't become information until we have successfully linked meaning to them.
► If we fail to build common meaning and understanding, data remain just a bunch of unconnected events.
Information and Entropy

► How much information does data contain?
► Can we measure it?
► Fortunately, yes:

\[ E = - \sum_{\text{each event}} p_i \log(p_i) \]

► Example: Tossing a coin
  – \( P_H = P_T = 0.5 \)
  – \( E = \log 2 \)
Counting

- **Counting** is a very important action in human life.
- All tradings, and balance in the economical system of humanity is based on counting during the evolution of the human social life.
- However, this is not the only important point of the need for computation. In fact, he whole scientific developments, implicitly or explicitly, were built on the concept of counting.
How data is stored and processed?

All data is stored and processed in **binary** form, that is, as a series of 0s and 1s.

01010011000110111101

Each binary digit is called a **bit**.

- The smallest unit of information which can be stored in the computer.
Data Representation

How data is stored and processed?

11100010110001010011000110111101

Bits are grouped into longer units known as bytes to hold more meaningful data.

1 byte = 8 bits

A computer word defines the number of bits which can be stored in a memory cell

The length of a word might be different on different computer.
# Binary Number

## Counting in decimal

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>9</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>10^3</td>
<td>10^2</td>
<td>10^1</td>
<td>10^0</td>
<td></td>
</tr>
</tbody>
</table>

One thousand, nine hundred and eighty nine

\[(1 \times 10^3) + (9 \times 10^2) + (8 \times 10^1) + (9 \times 10^0) = 1989\]

## Counting in binary

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>0</th>
<th>0</th>
<th>1</th>
<th>1</th>
<th>0</th>
<th>0</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>2^7</td>
<td>2^6</td>
<td>2^5</td>
<td>2^4</td>
<td>2^3</td>
<td>2^2</td>
<td>2^1</td>
<td>2^0</td>
<td></td>
</tr>
</tbody>
</table>

Binary Numbers

\[(1 \times 2^7) + (0 \times 2^6) + (0 \times 2^5) + (1 \times 2^4) + (1 \times 2^3) + (0 \times 2^2) + (0 \times 2^1) + (1 \times 2^0) =\]

153 in base10
Examples: Binary Numbers

Try converting these numbers from binary to decimal:

\[10 = (1 \times 2^1) + (0 \times 2^0)\]
\[= 2 + 0 = 2\]

\[111 = (1 \times 2^2) + (1 \times 2^1) + (1 \times 2^0)\]
\[= 4 + 2 + 1 = 7\]

\[11110 = (1 \times 2^4) + (1 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (0 \times 2^0)\]
\[= 16 + 8 + 4 + 2 + 0\]
\[= 30\]
Data Representation

How data is represented in binary form?

Number:

- Sign of a number
- Value of a number
How data is processed?

Number:

In a binary representation, the leftmost bit is a sign bit followed by the magnitude bits.

The sign bit represents the sign of the number.

- 0 implies a positive number
- 1 implies a negative number
Data Representation

► How data is processed?

Number — Examples:

Represented in 8-bit memory,

\[
\begin{align*}
127 & \quad 01111111 \\
+127 & \quad 10111111
\end{align*}
\]

Represented in 16-bit memory,

\[
\begin{align*}
32767 & \quad 1111111111111111 \\
-32767 & \quad 1111111111111111
\end{align*}
\]
Data Representation

How data is processed?

Number — Examples:

Represented in 8-bit: 01111111 +127

How to represent +127 in 16-bit memory?

```
0 0 0 0 0 0 0 1 1 1 1 1 1 1 1
```

\[
00000001111111 = 0 \times 2^{14} + 0 \times 2^{13} + 0 \times 2^{12} + 0 \times 2^{11} + 0 \times 2^{10} + 0 \times 2^9 + 0 \times 2^8 + 0 \times 2^7 + 1 \times 2^6 + 1 \times 2^5 + 1 \times 2^4 + 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 = 127
\]
Data Representation

► Decimal (base=10)
   1973

► Binary (base=2)
   11110110101

► Hexadecimal (base=16)
   111 1011 0101 \(\Rightarrow\) 7B5

► Octal (base=8)
   11 110 110 101 \(\Rightarrow\) 3665
Data Representation

- 1 bit
- 1 Byte = 8 b
- 1 Kilo Byte [KB] = 1024 B
- 1 Mega Byte [MB] = 1024 KB = 1048576 B
  \[ 2^{10} \text{ KB} = 2^{20} \text{ B} \]
- 1 Giga Byte [GB] = 2^{10} MB = 2^{20} KB = 2^{30} B
- 1 Tera Byte [TB] = 2^{10} GB = 2^{20} MB = 2^{30} KB = 2^{40} B
- 1 Peta Byte [PB] = 2^{10} TB = 2^{20} GB = 2^{30} MB = 2^{40} KB
- 1 Exa Byte [EB] = 2^{10} PB = 2^{20} TB = 2^{30} GB = 2^{40} MB
Hardware — Software

Hardware

- Memory
- CPU
- Hard Driver
- Secondary Storage
- Input/Output
Hardware vs. Software

- For computer hardware to work it must follow a set of instructions that is supplied to it. These instructions or programs are referred to as **software**.
- Some instructions are referred to as the **Operating System Software**, which control the basic input/output and memory operations of the computer.
- **Application Software** are programs that work with the Operating system to perform specific tasks.
Programs to control computer operations are called Operating Systems (OS)

- Instructions on loading and executing applications and transferring data loaded into main memory on startup (booting)
- Examples: Unix, Windows XP
Application Software

- Computer programs written to perform specified tasks.
- They work in tandem with specific Operating Systems
  - Word Processing - facilitate document writing
  - Spreadsheets - numerical manipulation of data
  - Database - storage and retrieval of related data
  - Electronic mail - communication via e-mail