

Computer Architecture  
Lecture Week 1 (Part I)

# Introduction to Computer Architecture

Artem Burmyakov

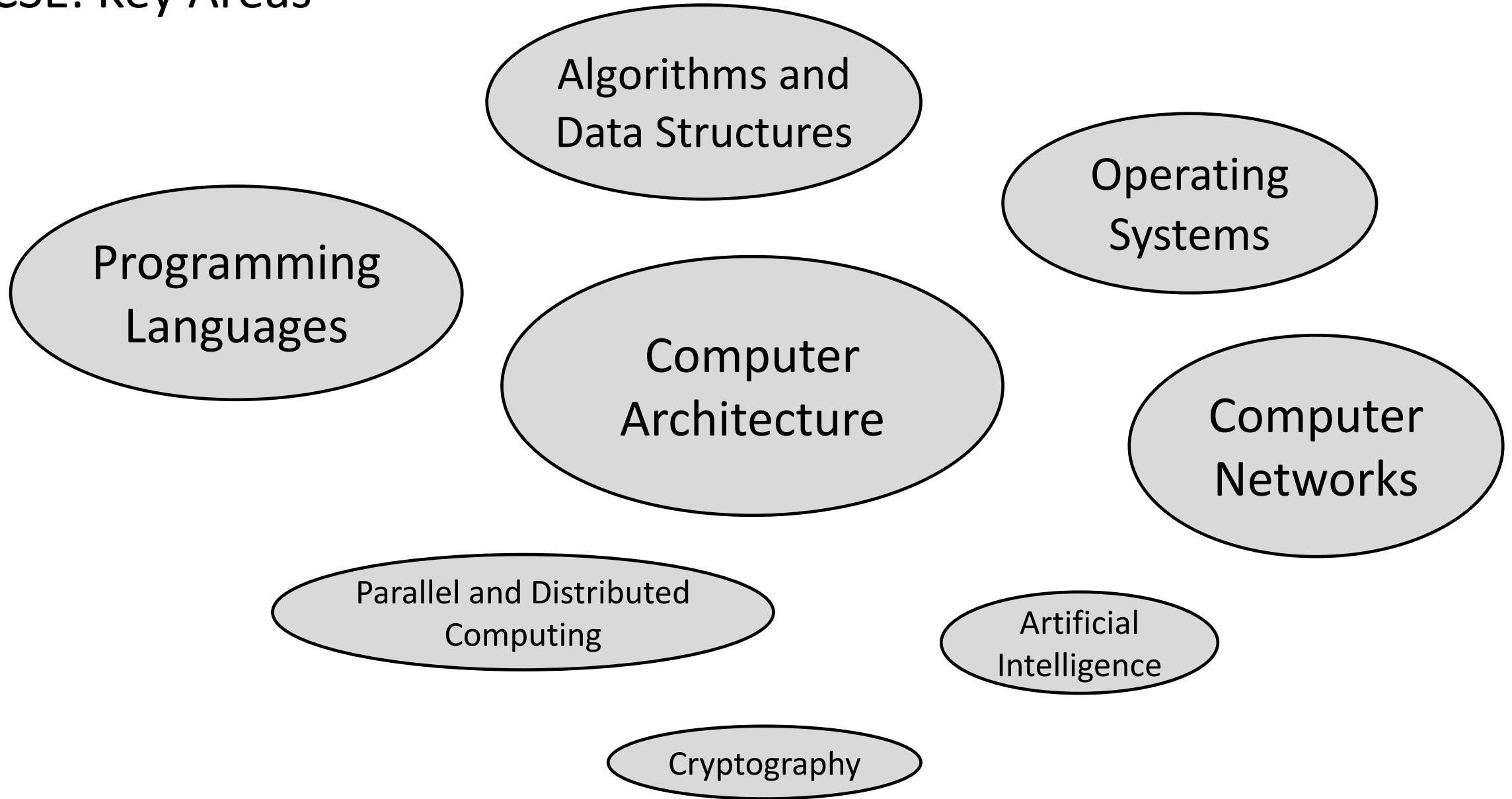
September 04, 2025



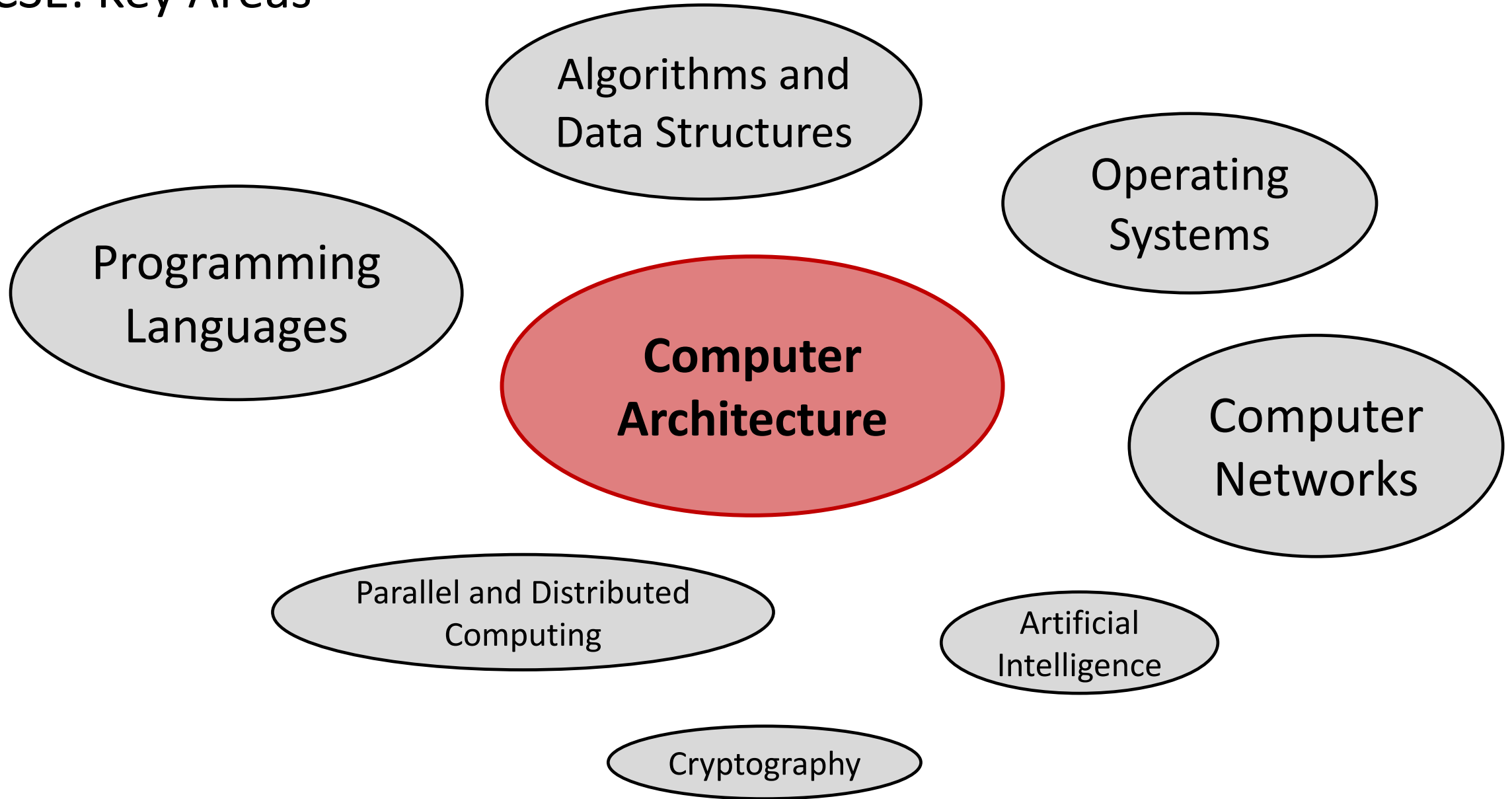
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# **Computer Science and Engineering (CSE): Key Areas**

# CSE: Key Areas



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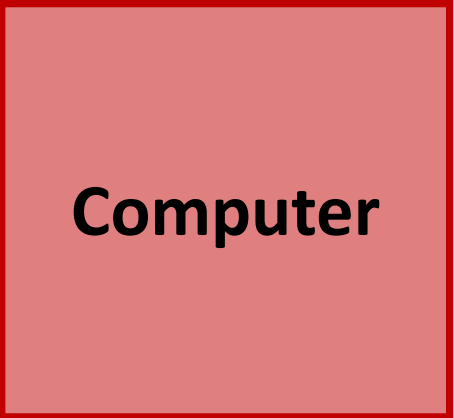
**What is a “computer”?**

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**A machine that is programmed to automatically perform sequences of arithmetic/logic instructions with some input data and to output result** *[Wikipedia]*

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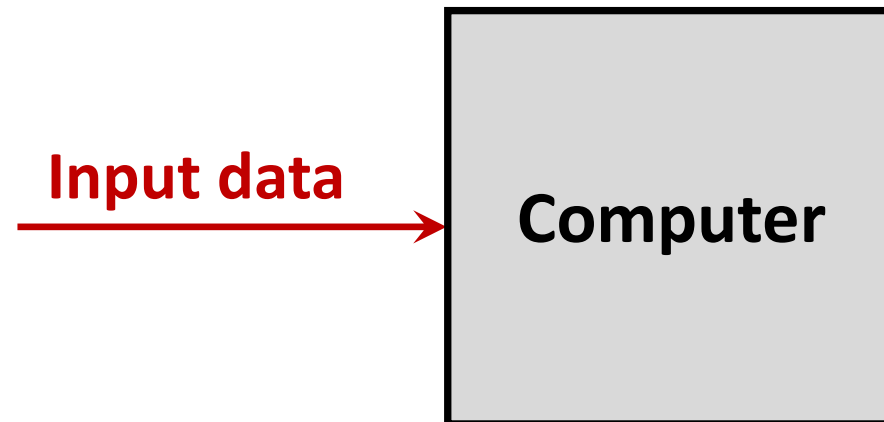
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**Computer**

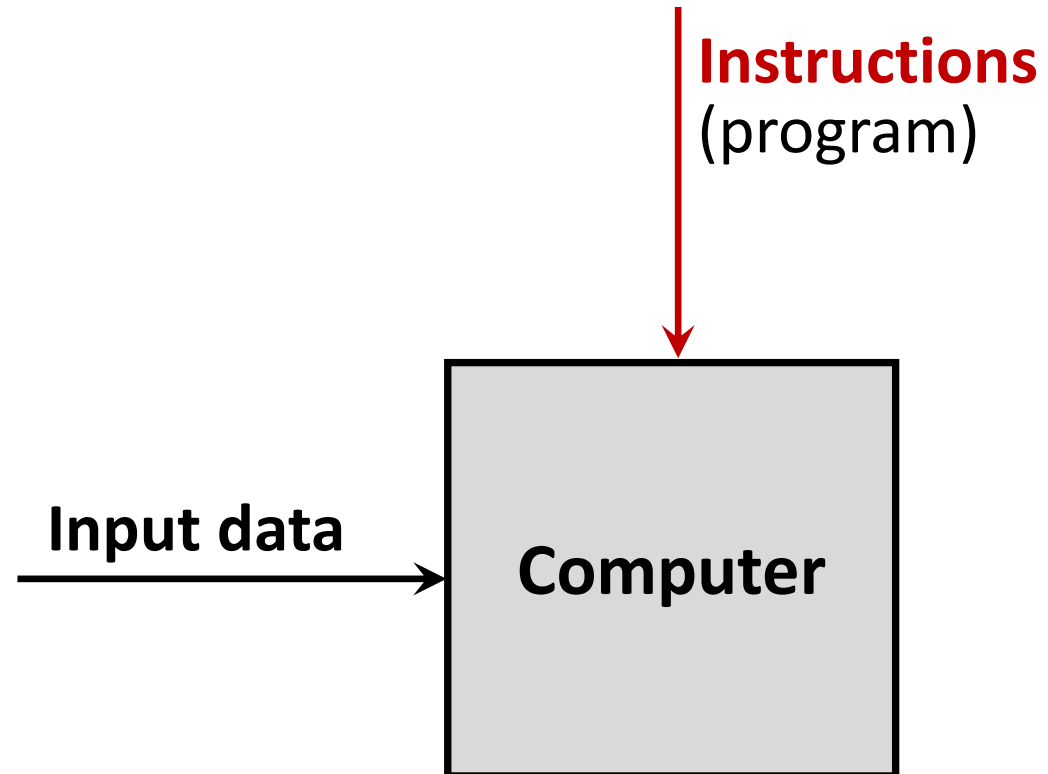
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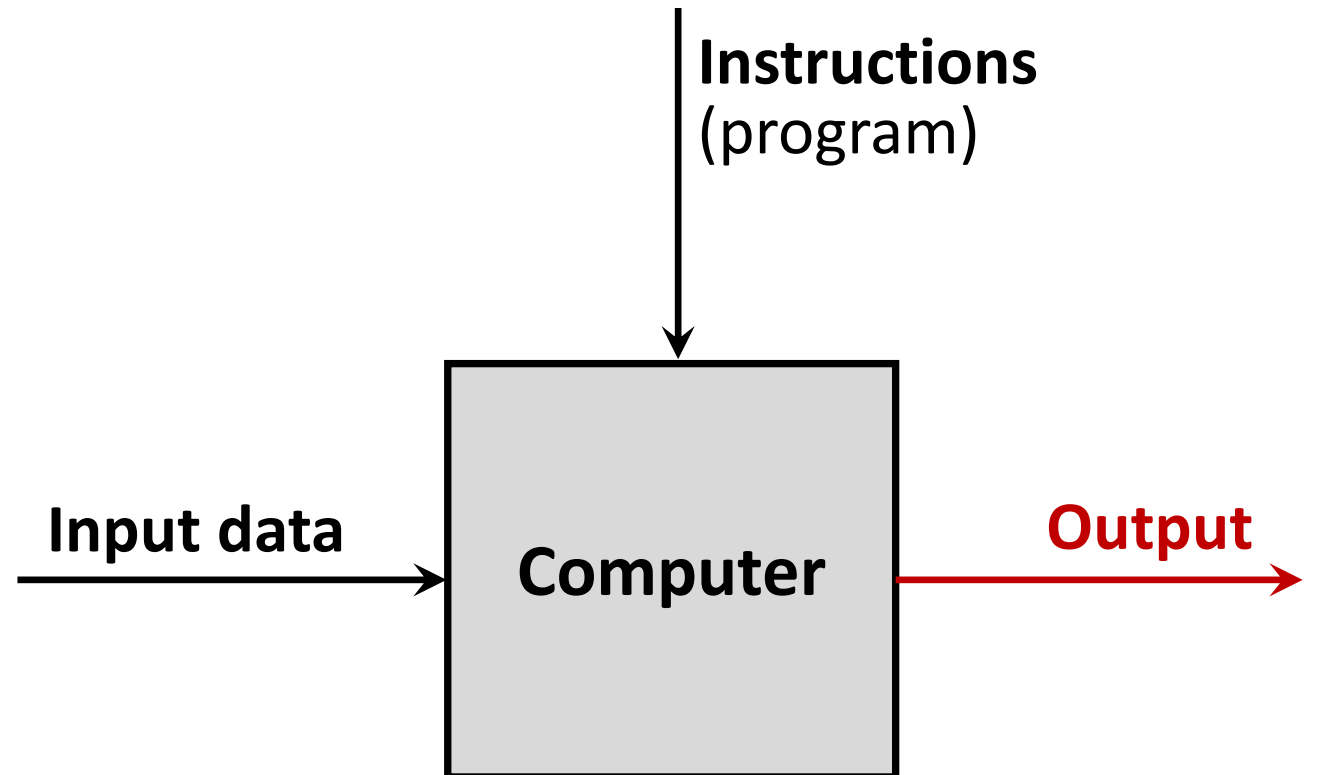
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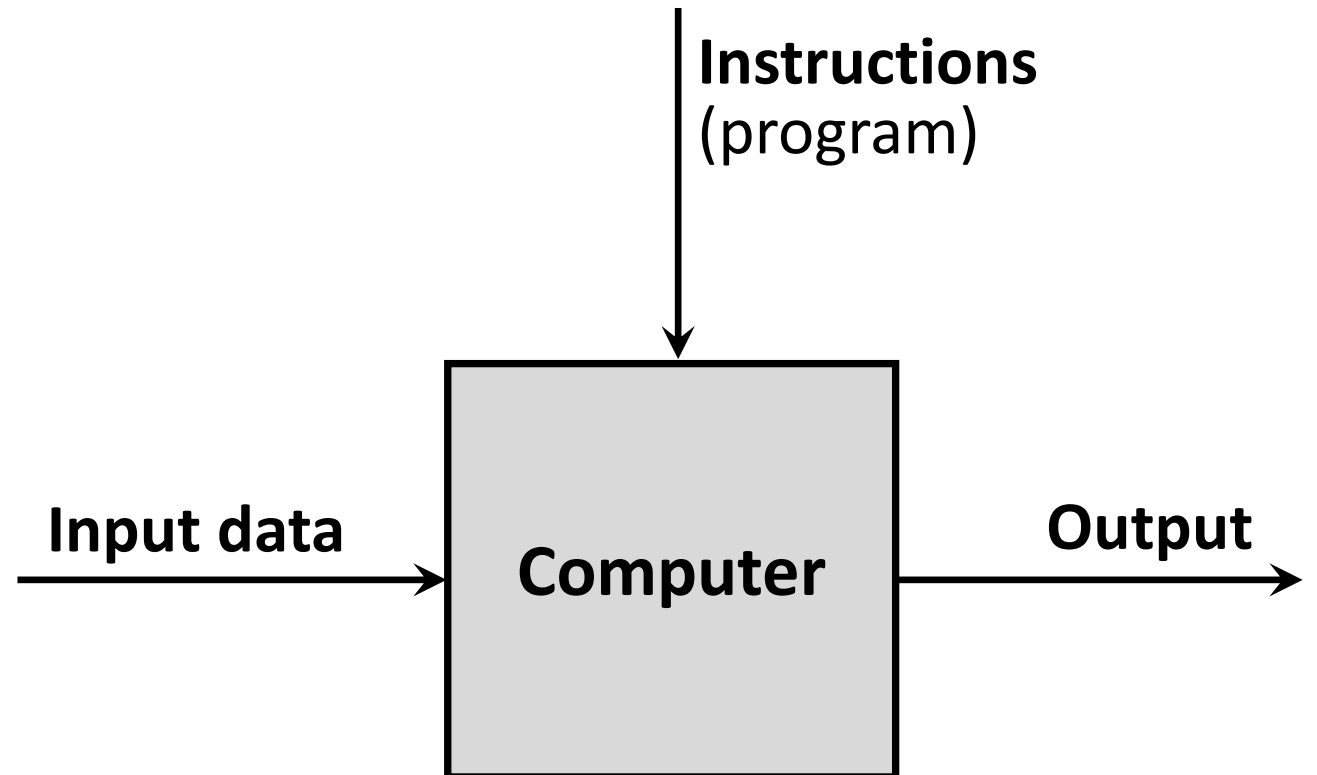
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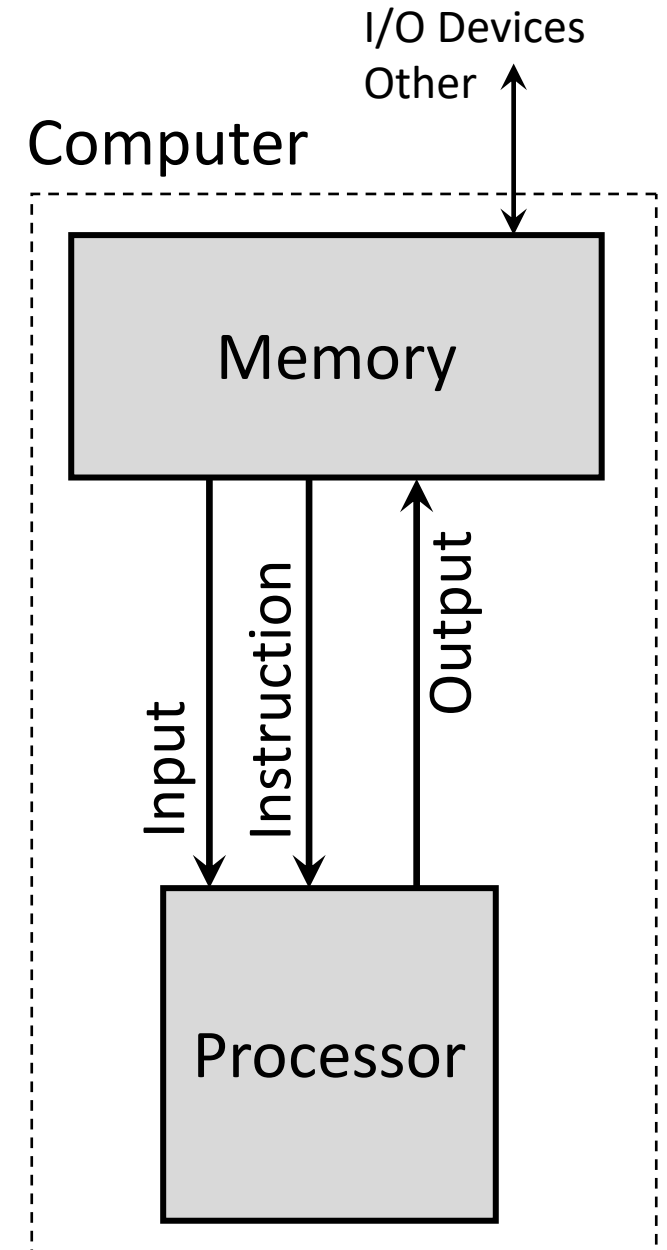
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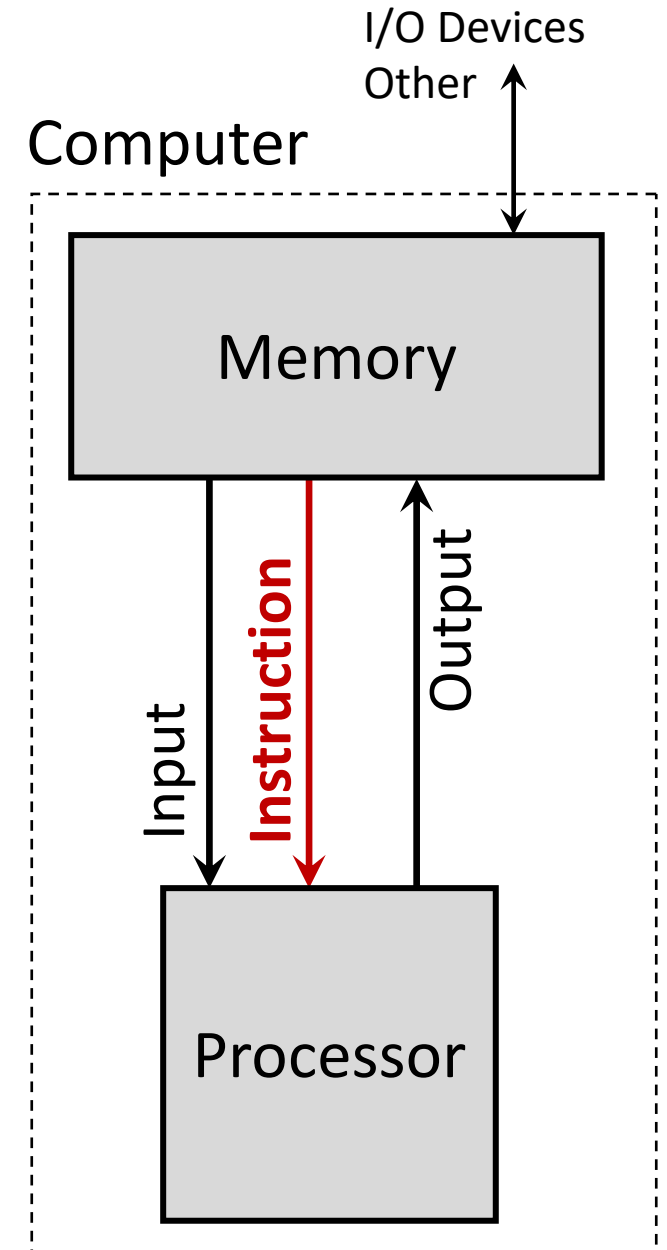
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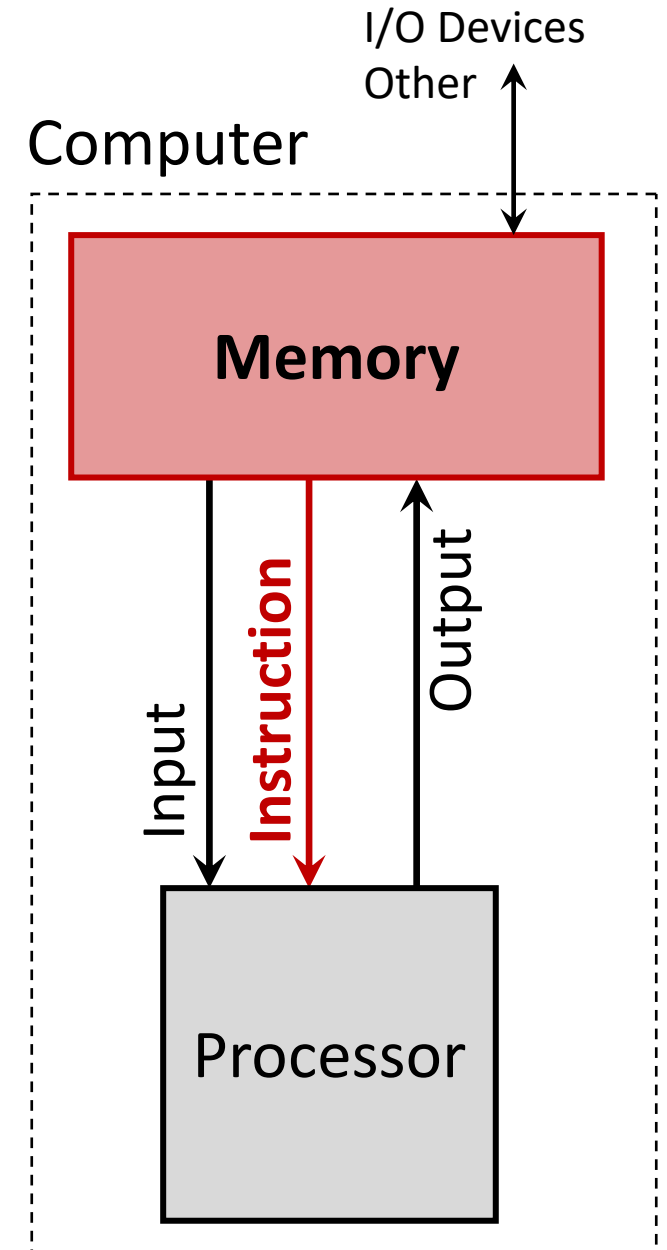
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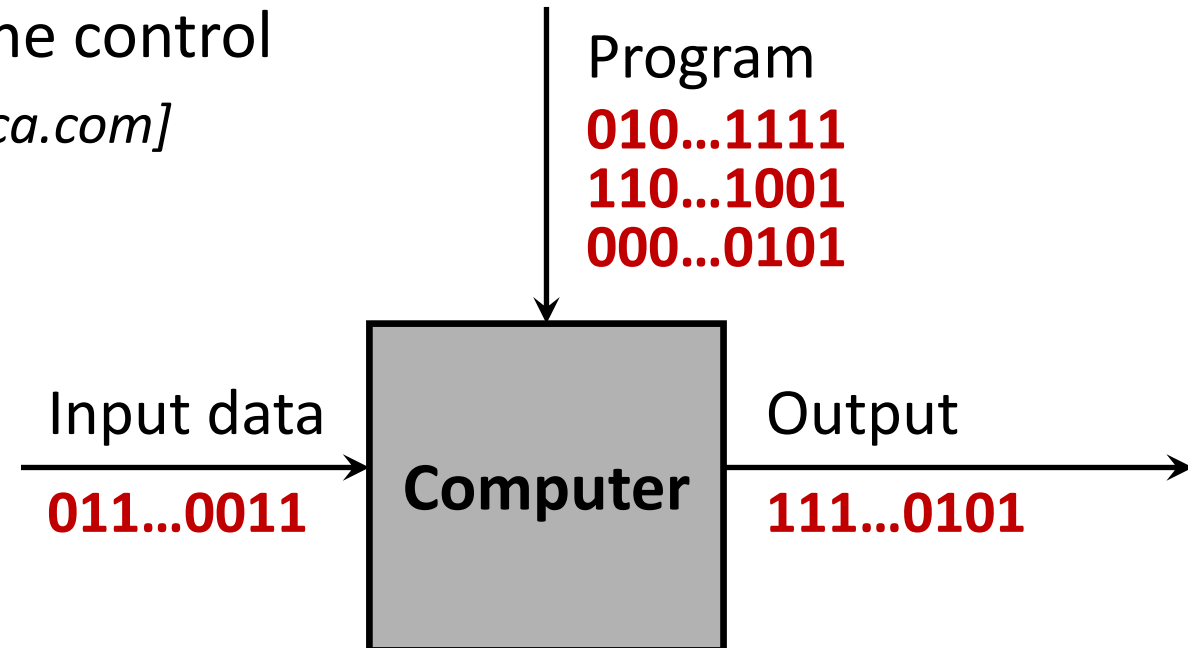
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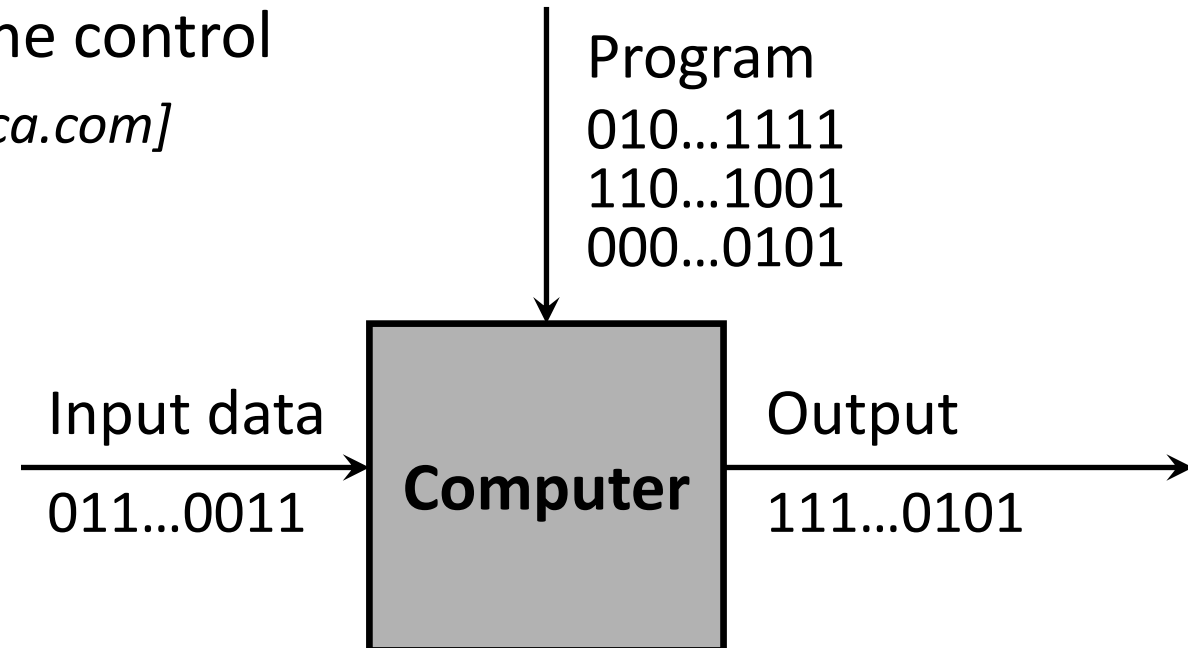


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# What is an “Architecture of a Computer”?

# Computer Architecture is:

- **Hardware organization of computer systems**



# Computer Architecture is:

- Hardware organization of computer systems
- **Hardware/Software interaction principles**



```
1 #include <stdio.h>
2
3 int calculate_sum(int a[5]) {
4     int s = 0;
5     for (int i = 0; i < 5; i++) s += a[i];
6     return s;
7 }
8
9 int main() {
10     int numbers[5];
11     for (int i = 0; i < 5; i++) {
12         scanf("%d", &numbers[i]);
13     }
14     ...
```

# Computer Architecture

- Hardware organization of
- Hardware/Software interaction
- **Performance-related components**



System Information File Edit Window Help

Hardware Overview:

|                             |                                             |
|-----------------------------|---------------------------------------------|
| Model Name:                 | MacBook Pro                                 |
| Model Identifier:           | MacBookPro16,1                              |
| Processor Name:             | 6-Core Intel Core i7                        |
| Processor Speed:            | 2.6 GHz                                     |
| Number of Processors:       | 1                                           |
| Total Number of Cores:      | 6                                           |
| L2 Cache (per Core):        | 256 KB                                      |
| L3 Cache:                   | 12 MB                                       |
| Hyper-Threading Technology: | Enabled                                     |
| Memory:                     | 16 GB                                       |
| System Firmware Version:    | 2075.140.4.0.0 (iBridge: 22.16.16083.0.0,0) |
| OS Loader Version:          | 583~2210                                    |
| Serial Number (system):     | C02CN0JJMD6M                                |
| Hardware UUID:              | A887F2B1-050A-5883-A03B-4DB7E745656B        |
| Provisioning UDID:          | A887F2B1-050A-5883-A03B-4DB7E745656B        |
| Activation Lock Status:     | Enabled                                     |

Hardware

- ATA
- Apple Pay
- Audio
- Bluetooth
- Camera
- Card Reader
- Controller
- Diagnostics
- Disc Burning
- Ethernet
- Fibre Channel
- FireWire
- Graphics/Displays
- Memory
- NVMeExpress
- PCI
- Parallel SCSI
- Power
- Printers
- SAS
- SATA
- SPI
- Storage
- Thunderbolt/USB4
- USB

Network

- Firewall
- Locations
- Volumes
- Wi-Fi

Software

- Accessibility
- Applications
- Developer

## **Computer Architecture is:**

- Hardware organization of computer systems
- Hardware/Software interaction principles
- Performance-related computer aspects

## **Objectives for studying Computer Architecture?**

## **Computer Architecture is:**

- Hardware organization of computer systems
- Hardware/Software interaction principles
- Performance-related computer aspects

## **Computer Architecture explains:**

- **Key computer components and programs execution principles**

## **Computer Architecture is:**

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## **Computer Architecture explains:**

- Key computer components and programs execution principles
- **Hardware circuit design**

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- Hardware circuit design
- Efficient programs implementation for specific hardware
- **Computer hardware customization for specific programs**

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## **Computer Architecture explains:**

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- Hardware circuit design
- Efficient programs implementation for specific hardware
- Computer hardware customization for specific programs
- **Computers principles relevant for other areas (e.g. Operating Systems)**

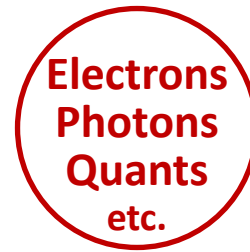
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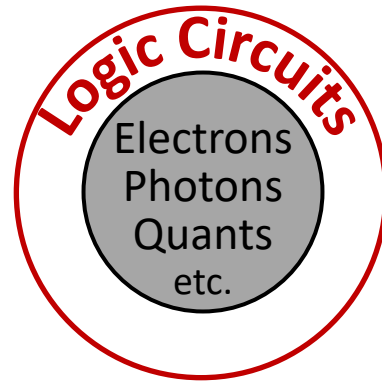
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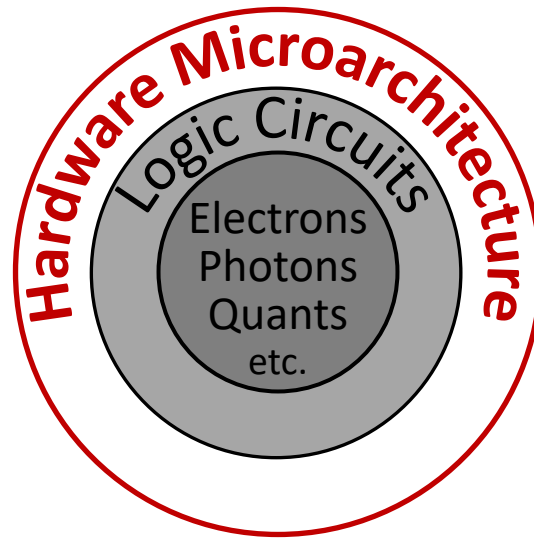
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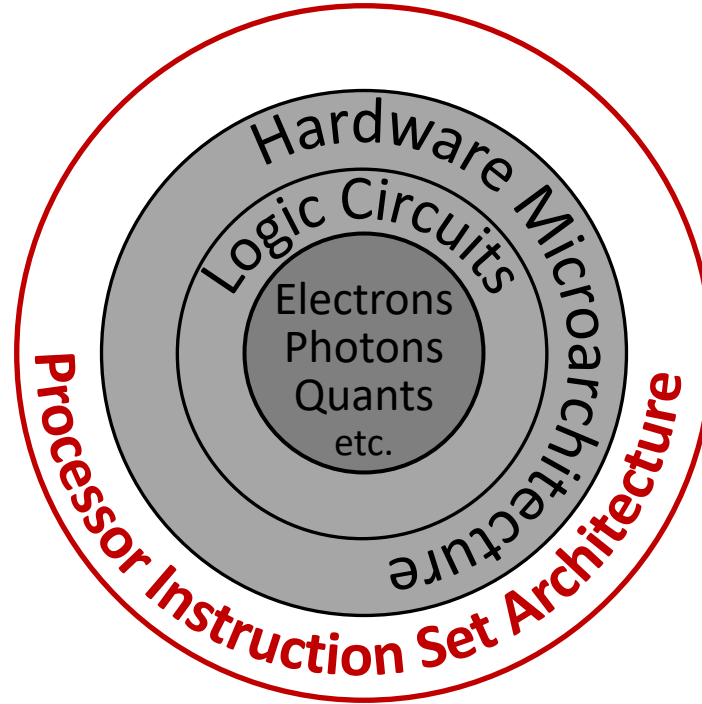
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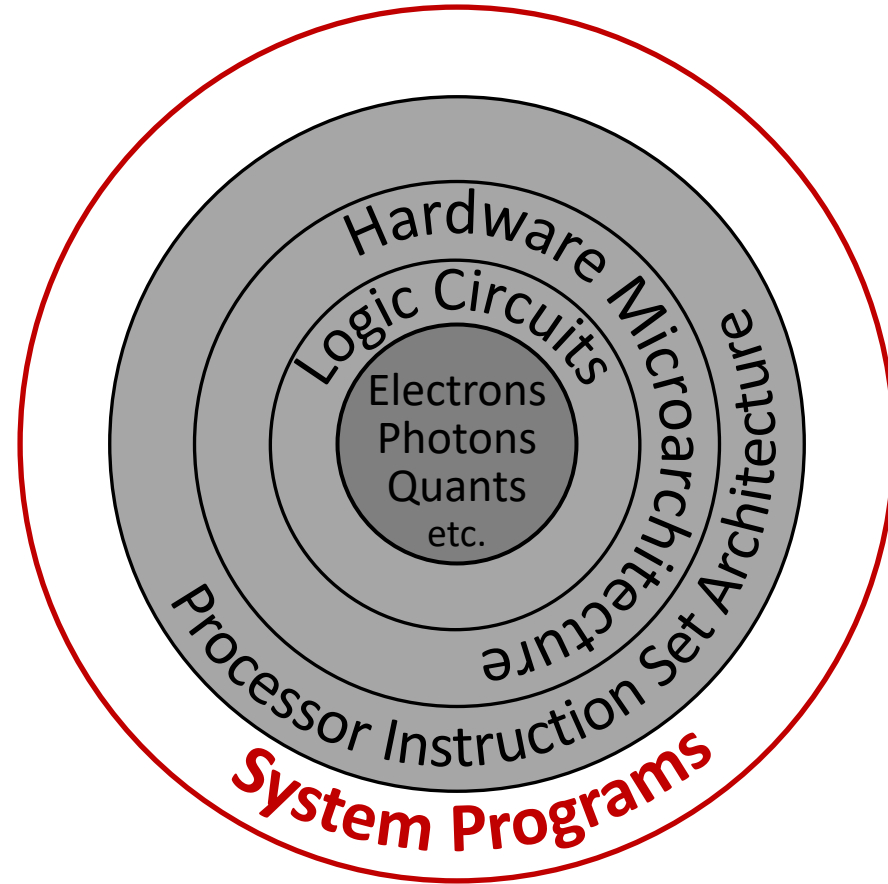
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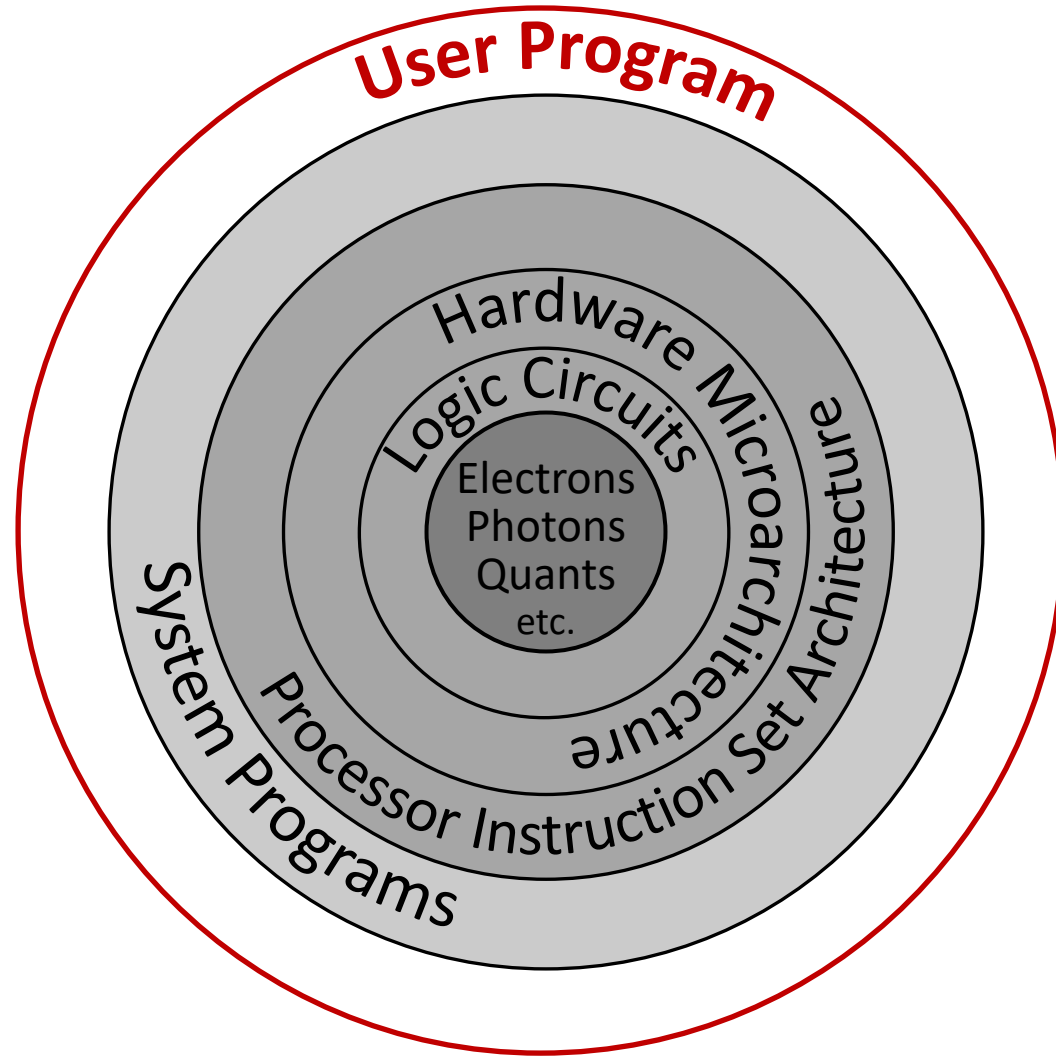
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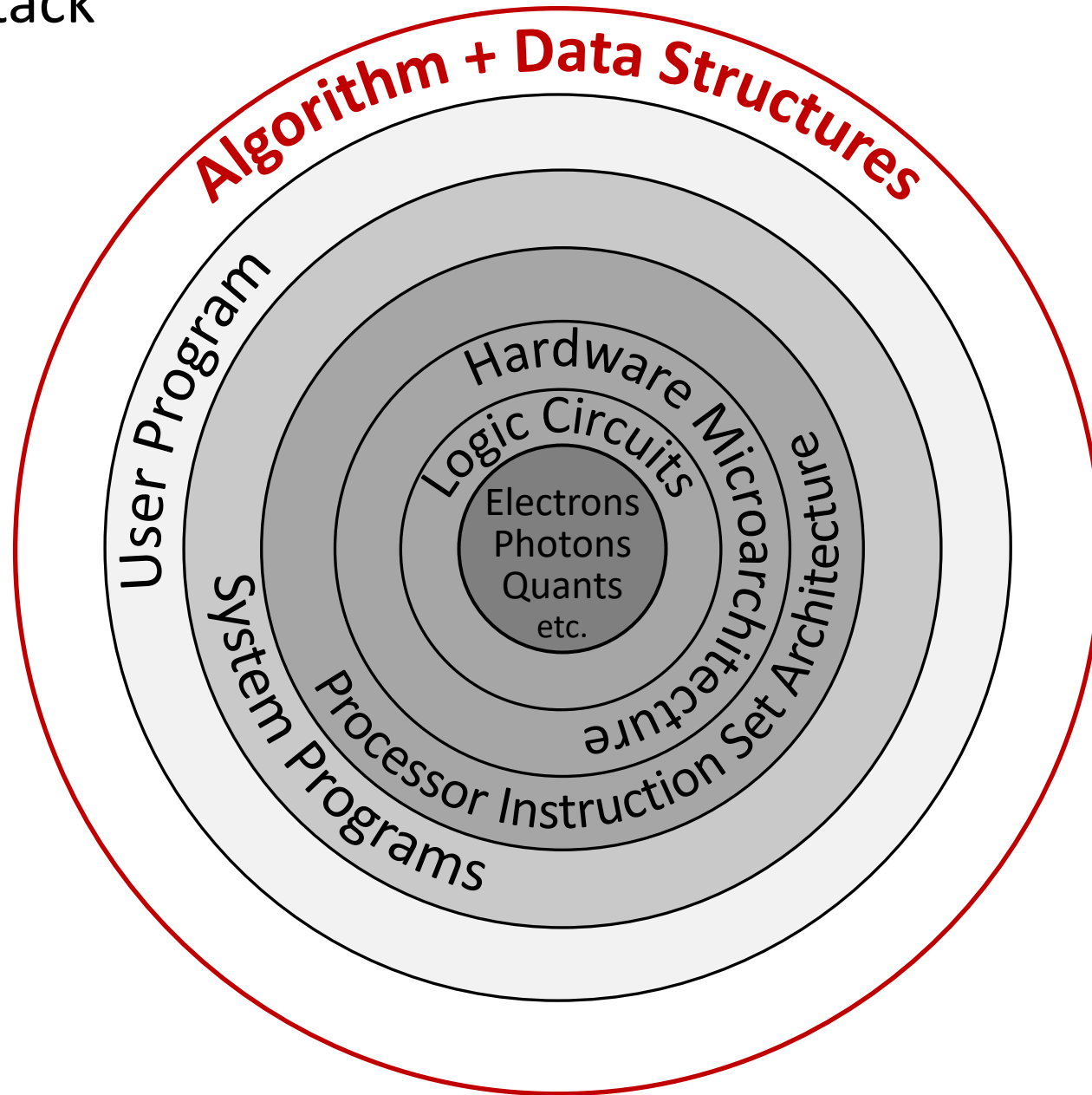
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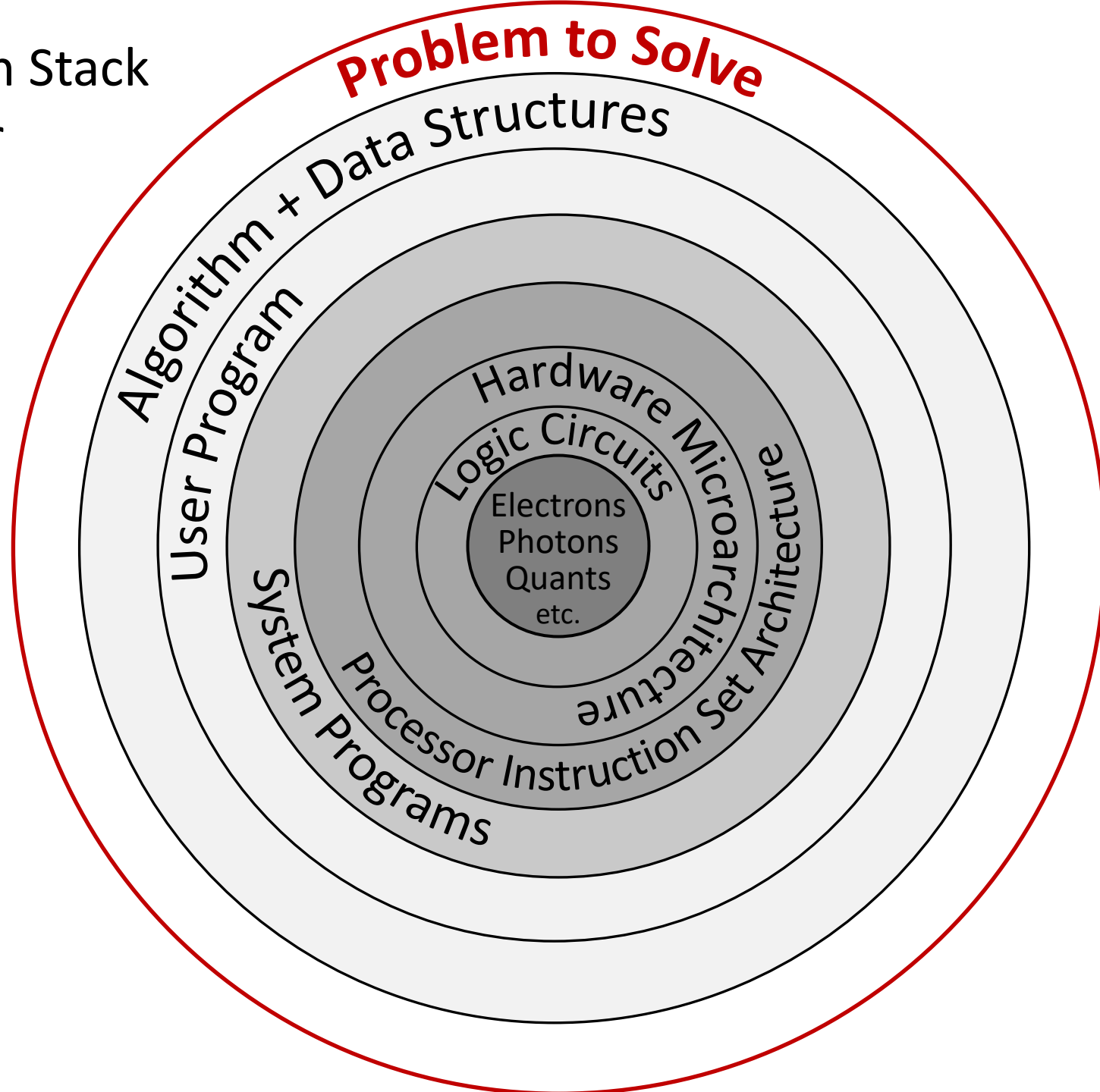
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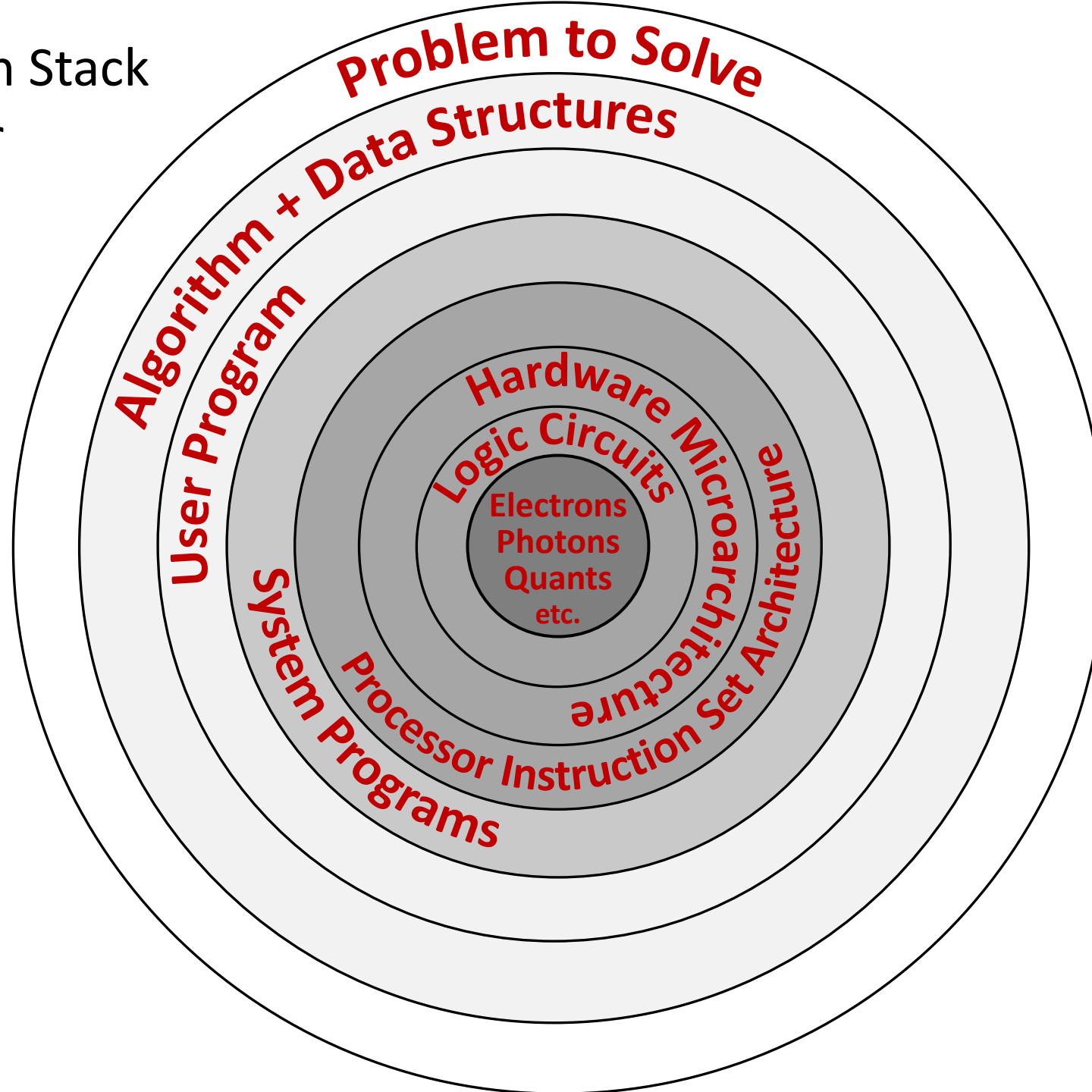
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# Problem Solution Stack with a Computer



# Problem Solution Stack with a Computer



# Course Outline

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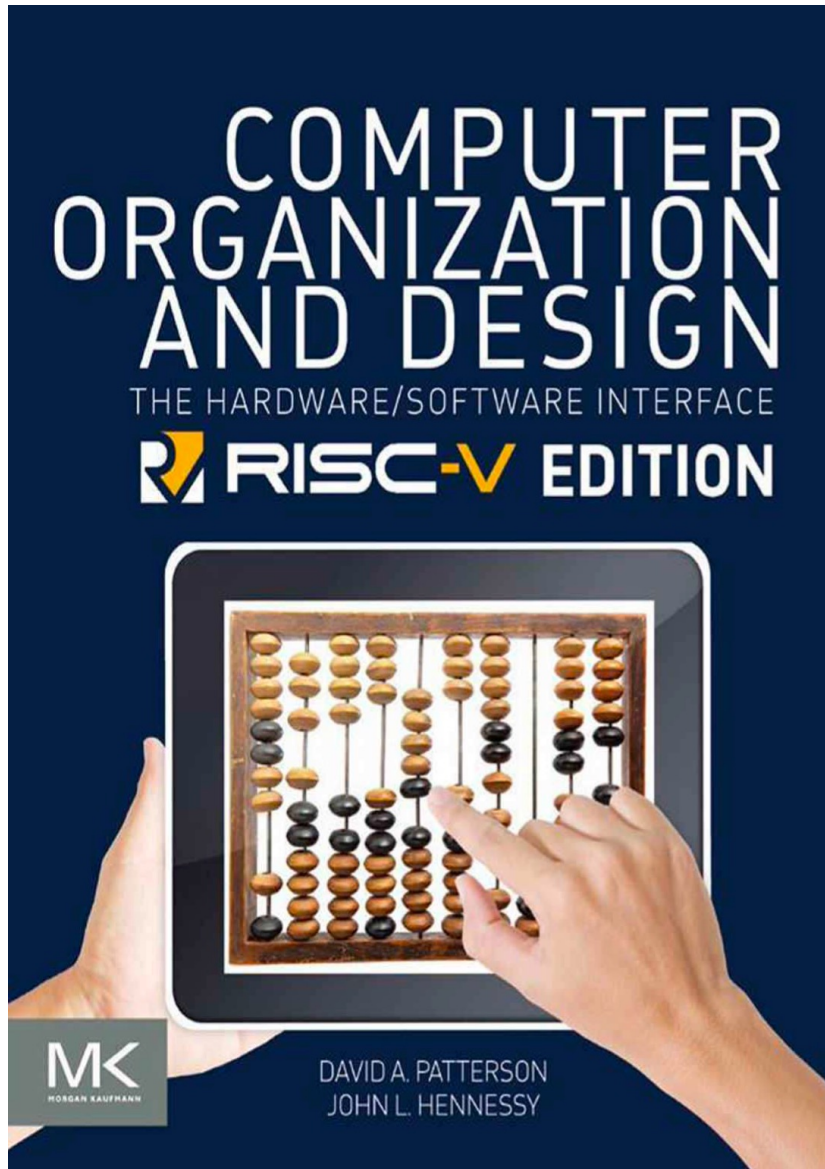
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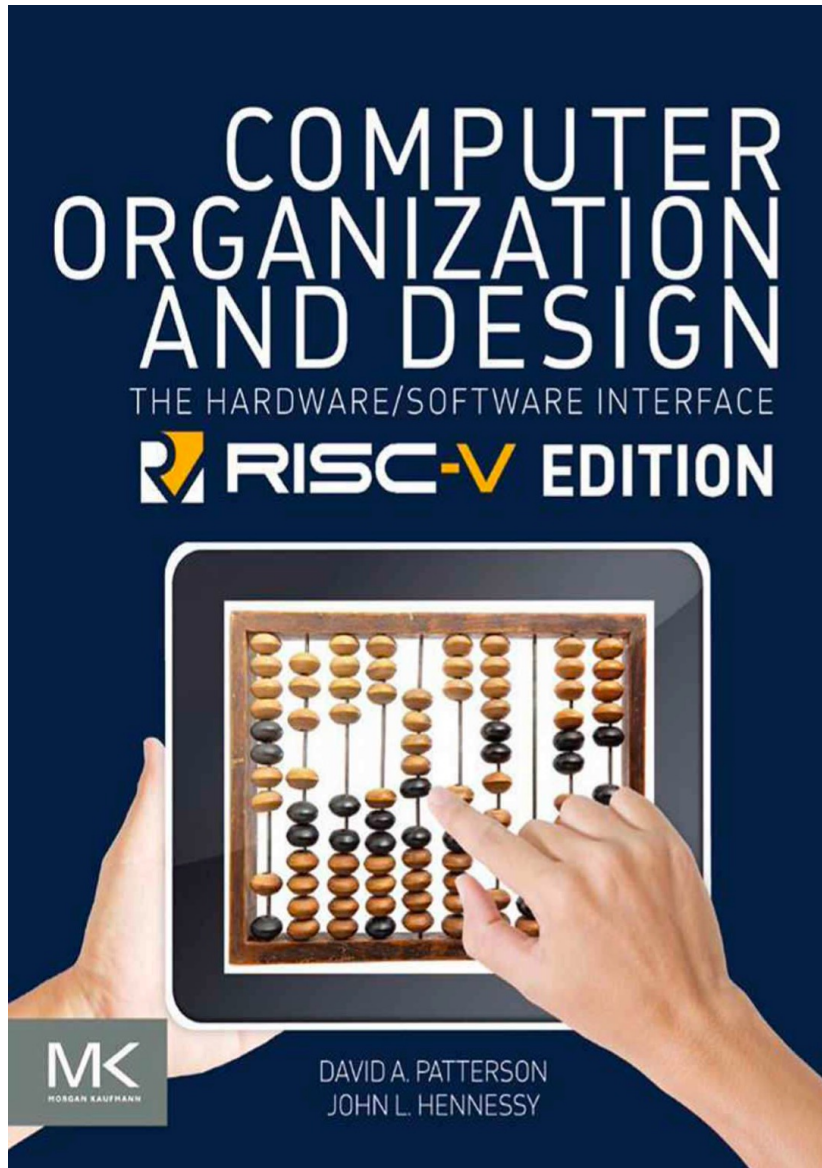
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# Our Major Course Book



(1st ed. 1993)

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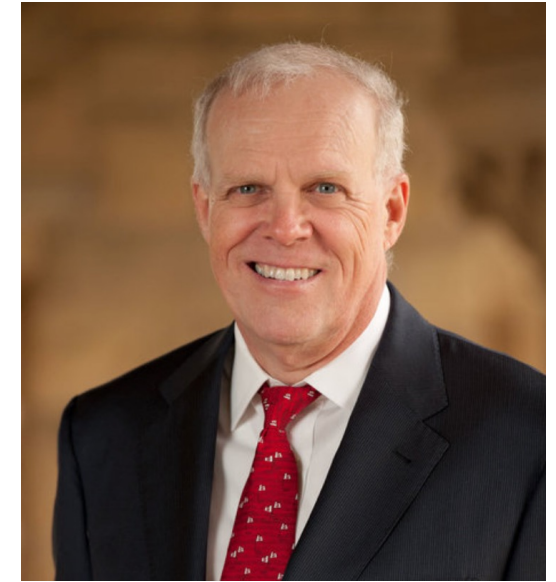


(1st ed. 1993)



David A. Patterson

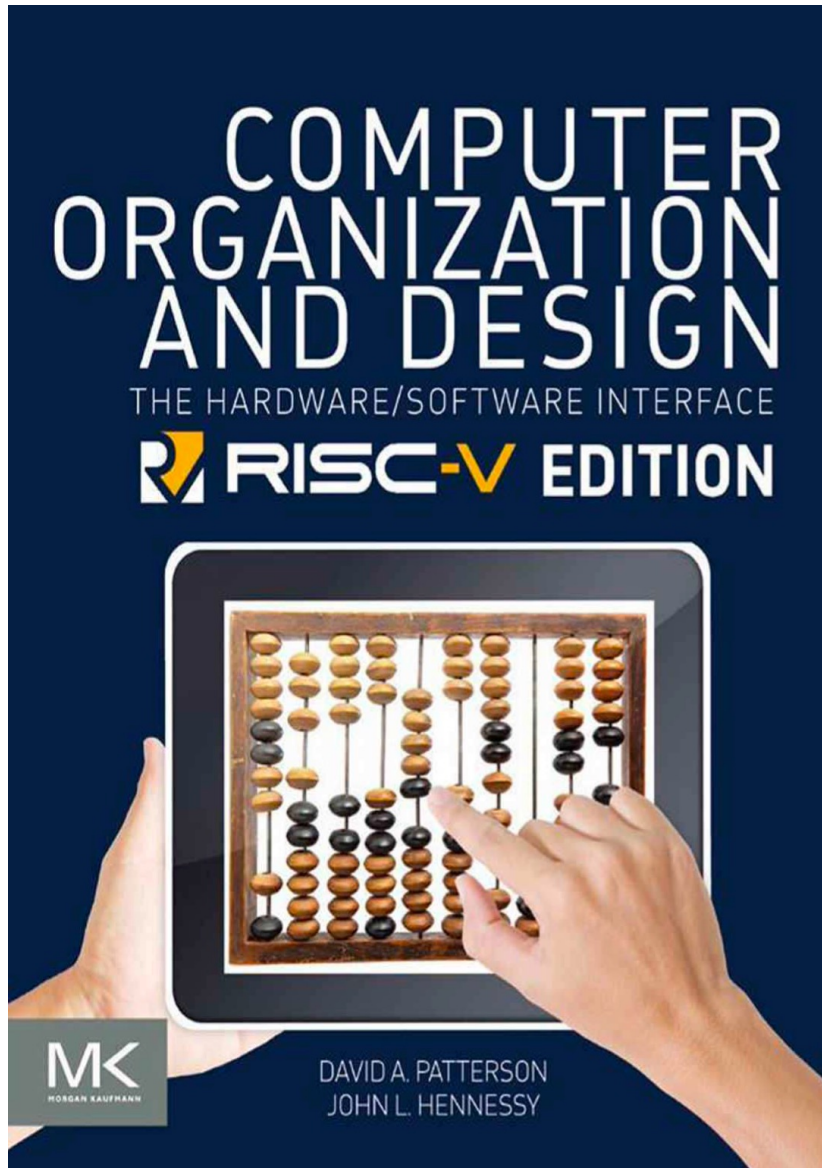
University of California, Berkley  
Distinguished Software Engineer,  
Google



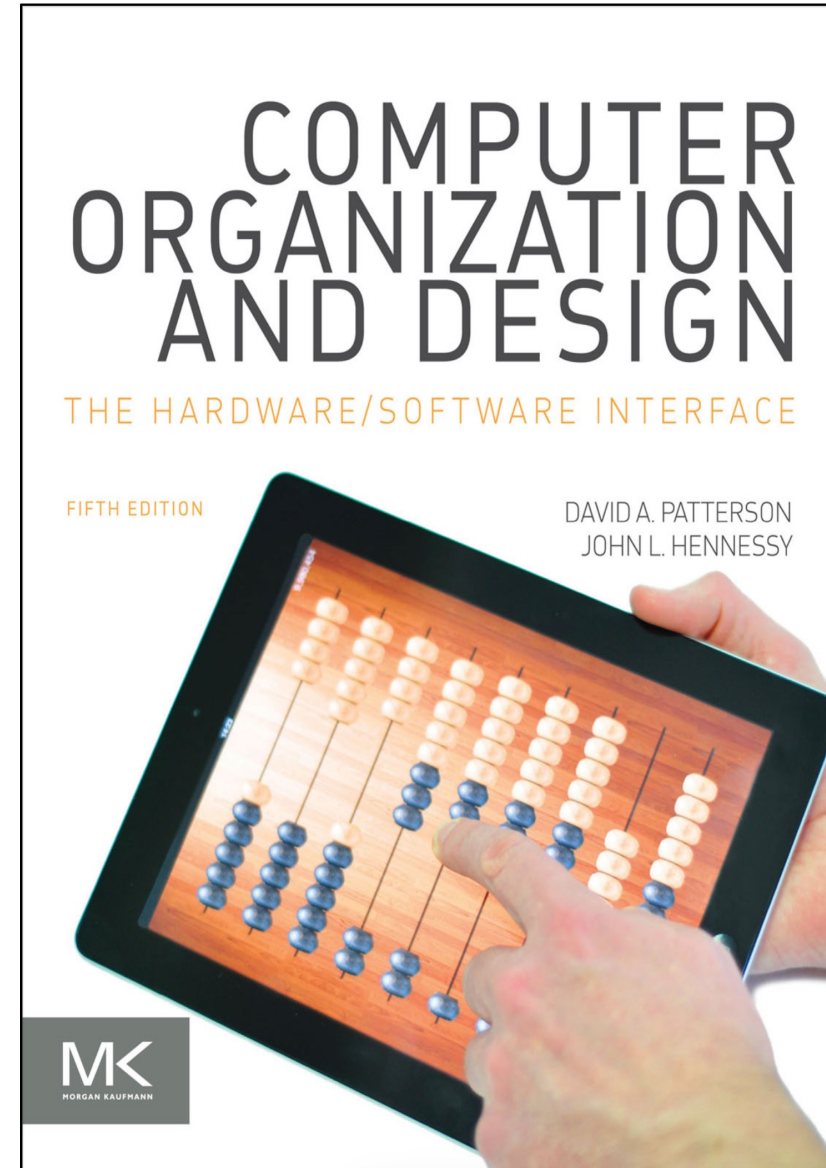
John L. Hennessy

Stanford University  
Chairman of Alphabet Inc.

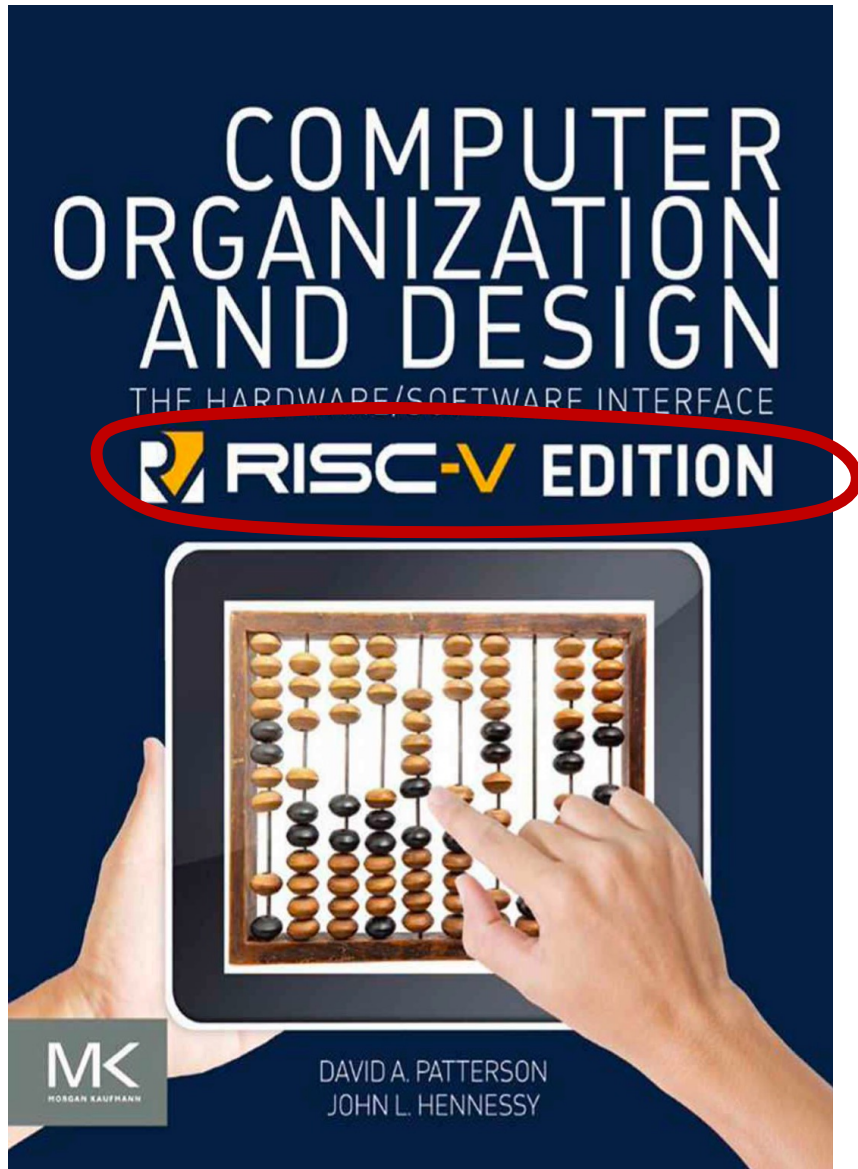
## Our Major Course Book



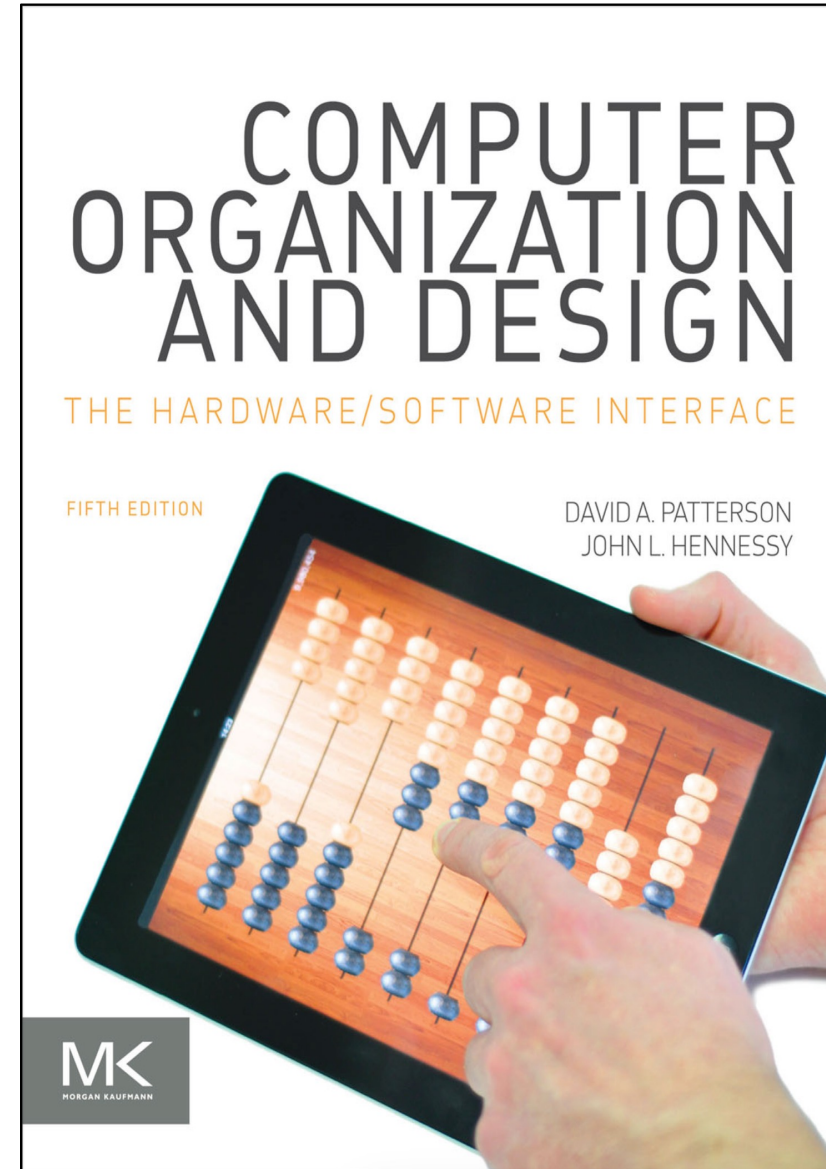
## Older Book Version



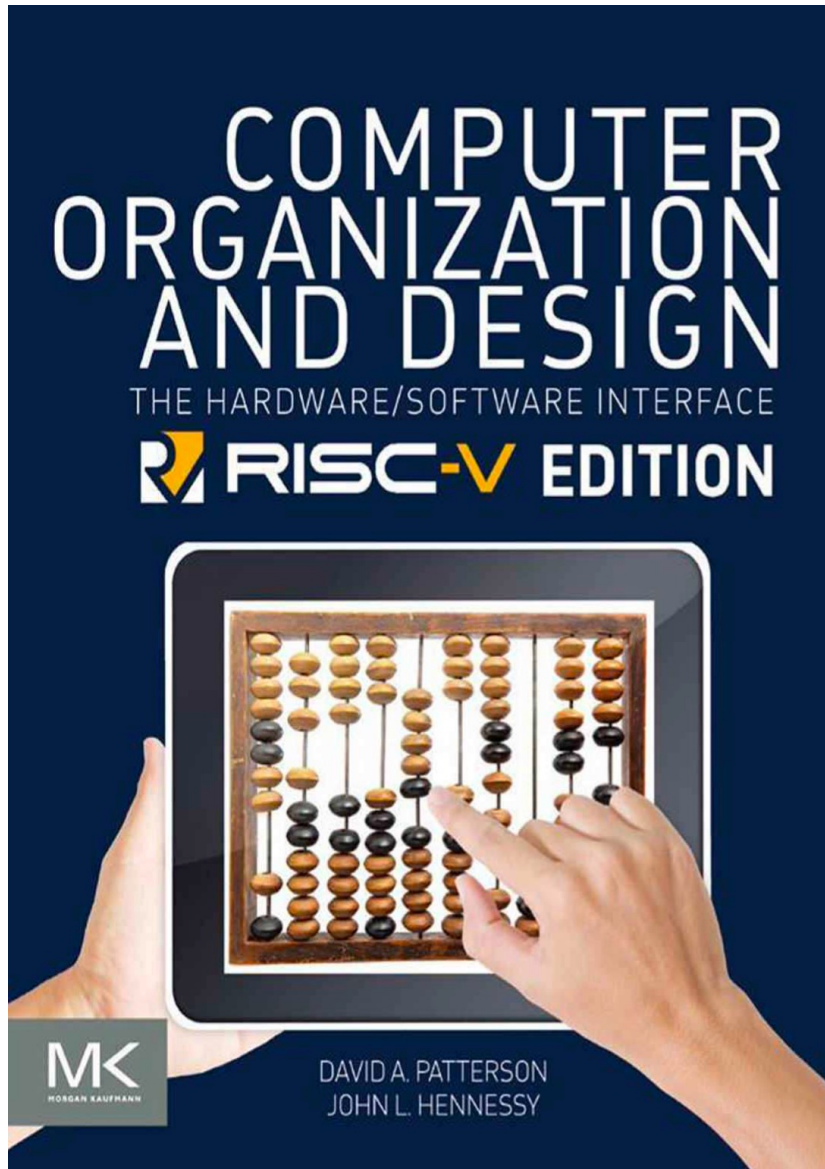
## Our Major Course Book



## Older Book Version

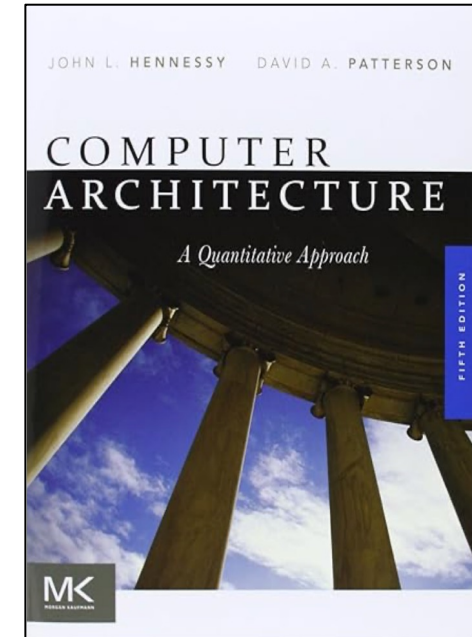
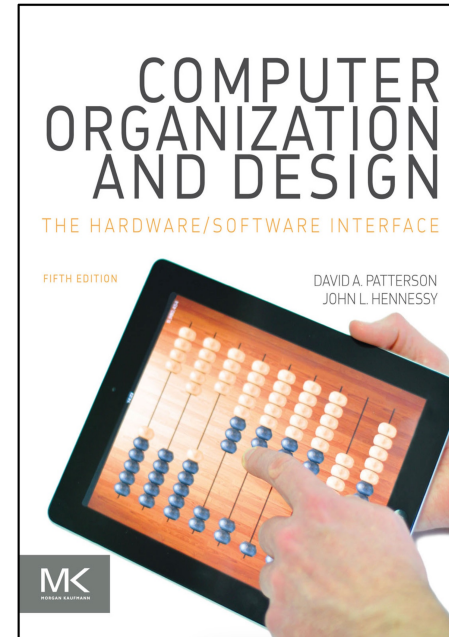


## Our Major Course Book



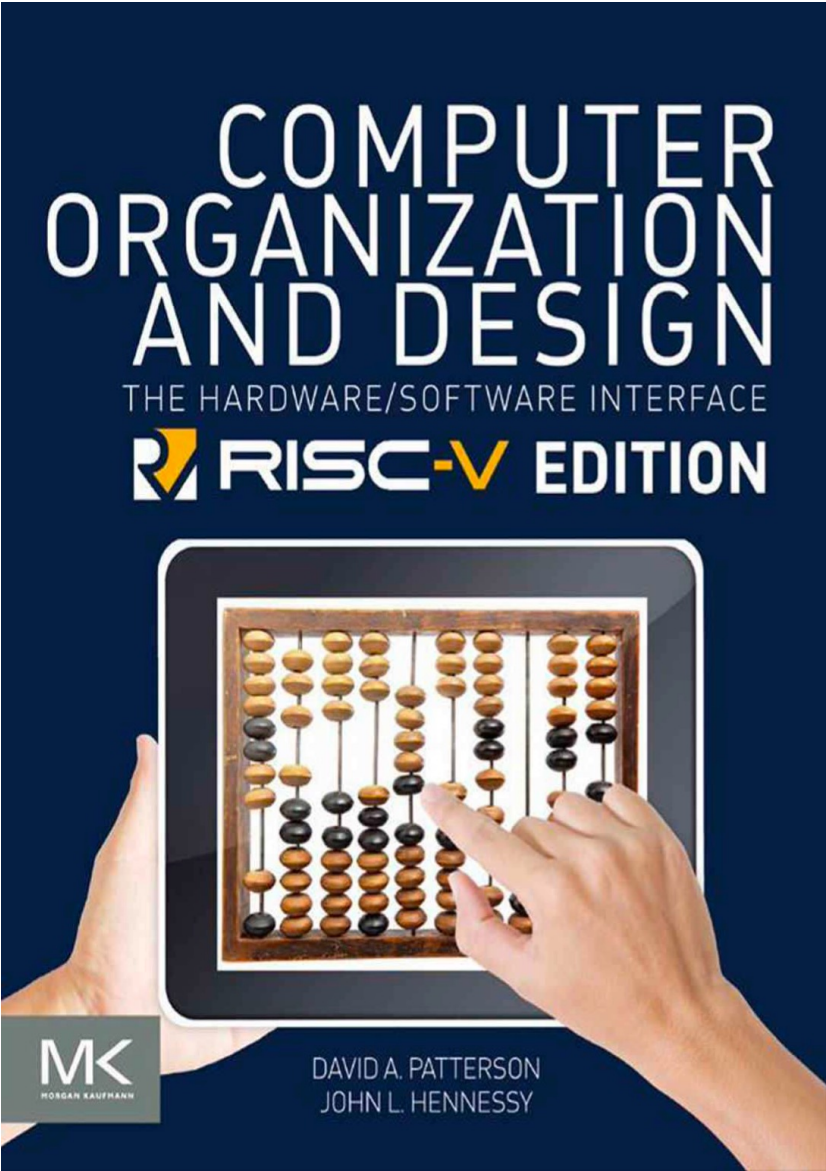
(1st ed. 1993)

## Other Well-Known Books



(1st ed. 1990)

# Our Major Course Book



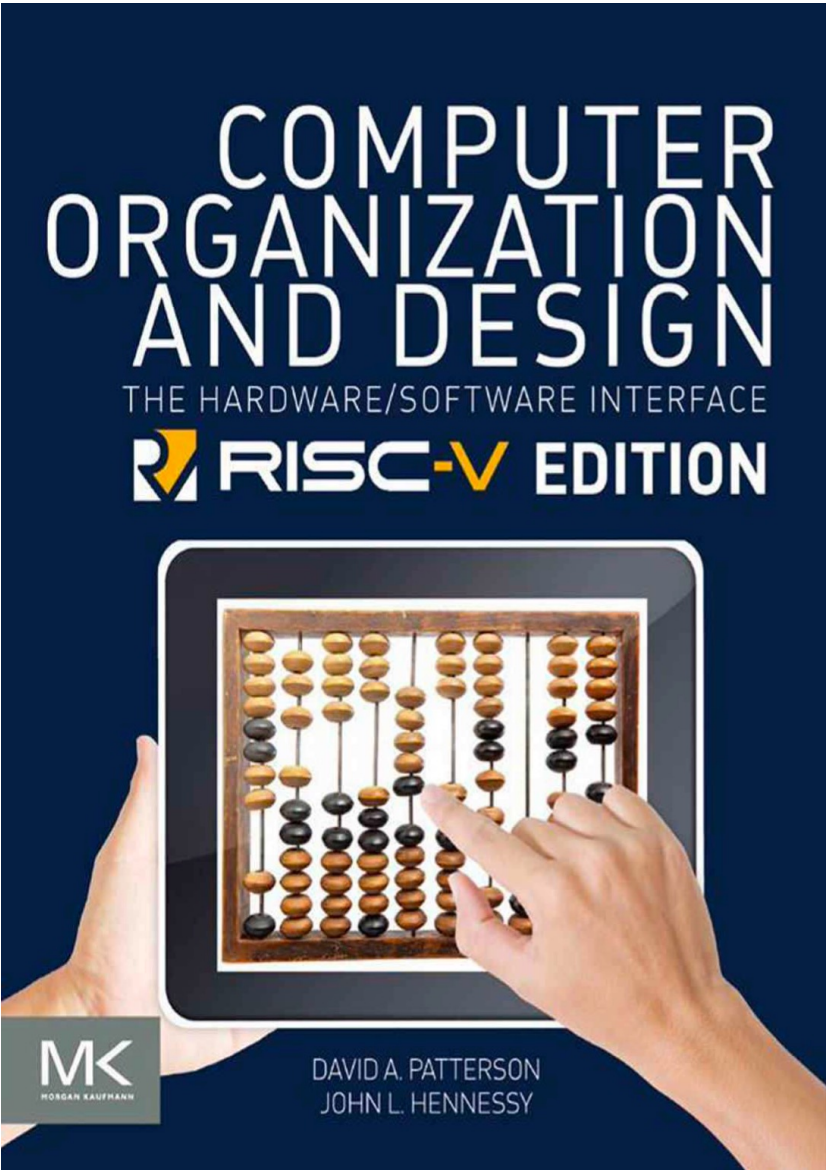
(1st ed. 1993)

# Other Well-Known Books



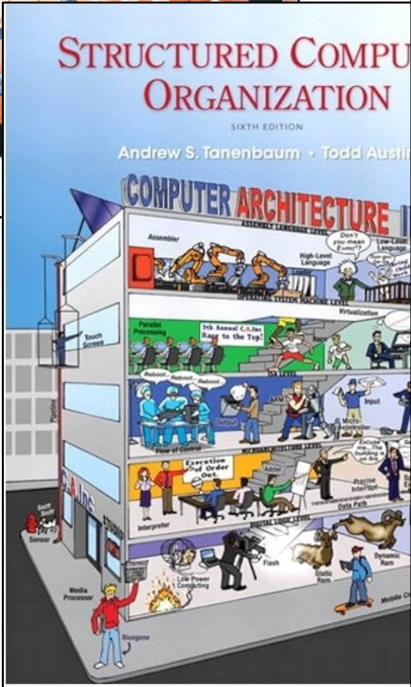
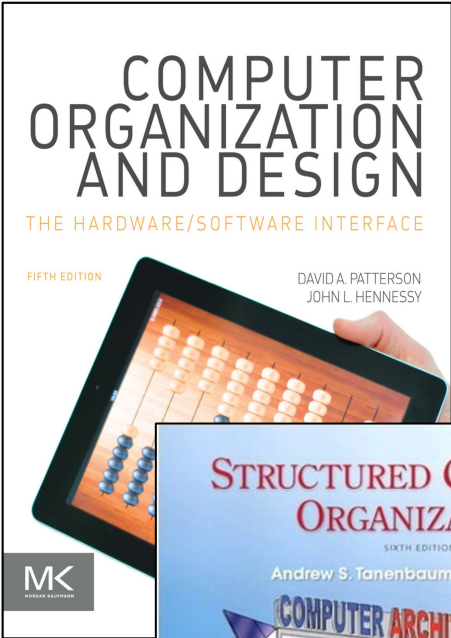
(Tanenbaum; 1st ed. 1976)

# Our Major Course Book

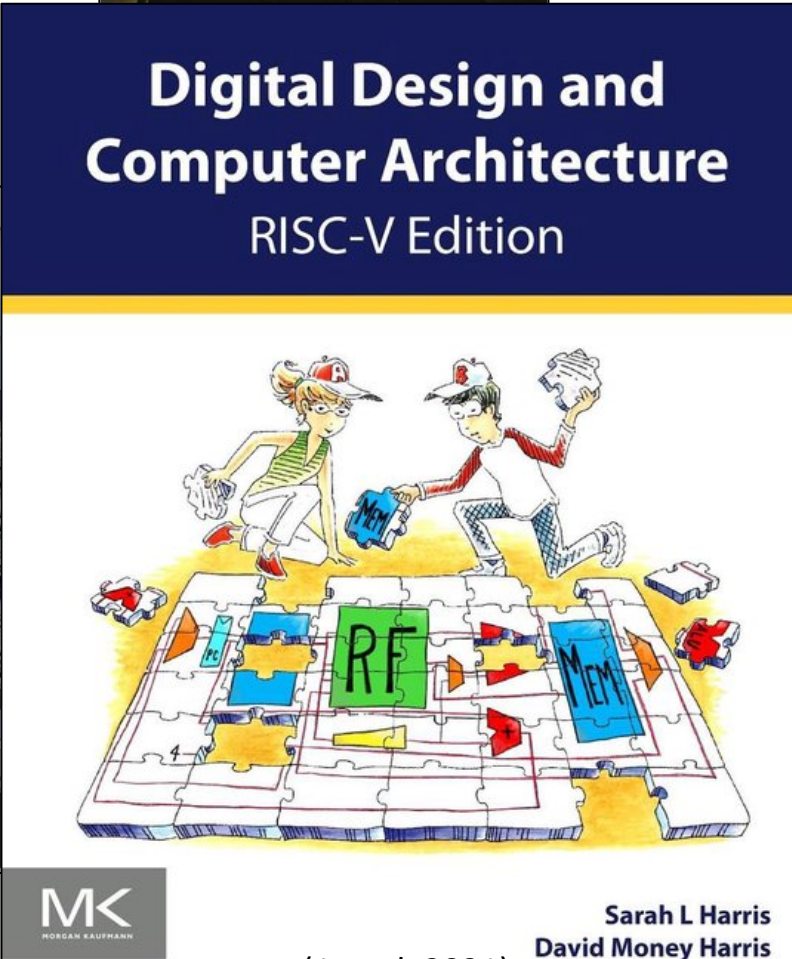


(1st ed. 1993)

# Other Well-Known Books



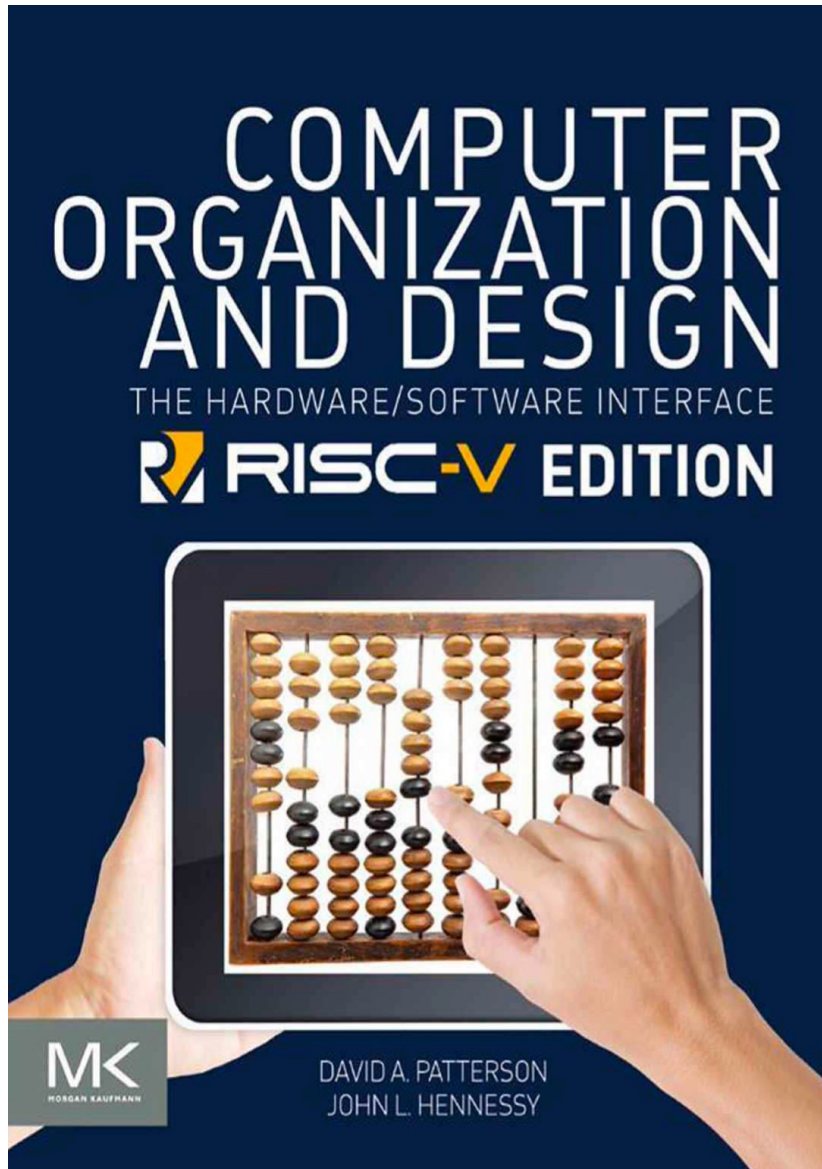
(Tanenbaum; 1st ed. 1976)



(1st ed. 2021)

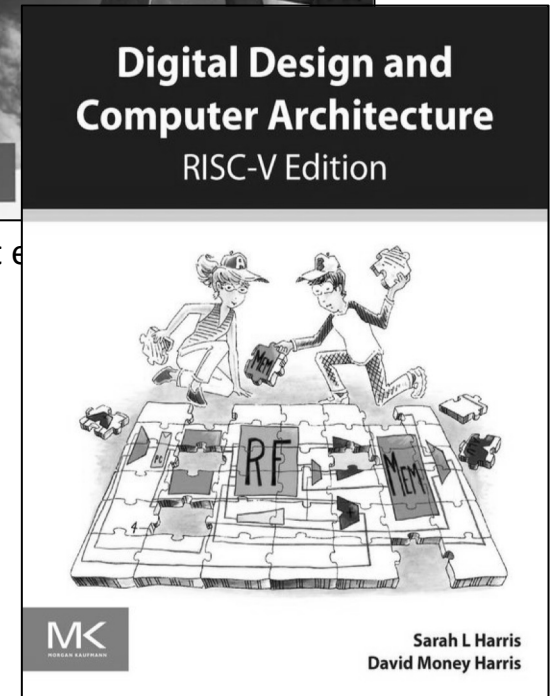
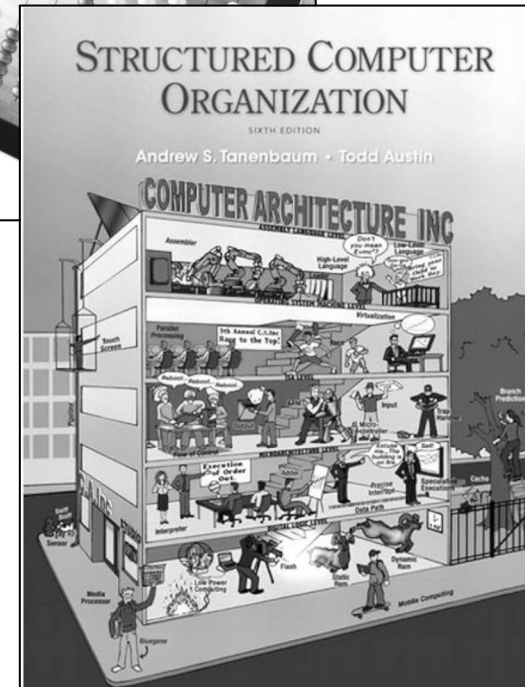
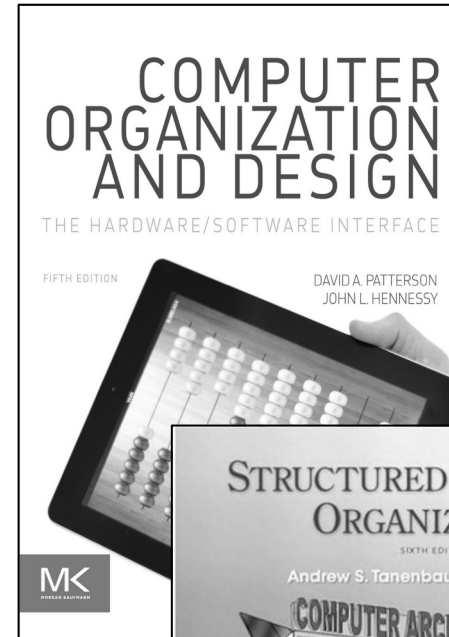
Sarah L Harris  
David Money Harris

# Our Major Course Book



(1st ed. 1993)

# Other Well-Known Books



# Course Grading Policy

| Course Component                                                                                                   | Weight to Final Grade |
|--------------------------------------------------------------------------------------------------------------------|-----------------------|
| <b>Regular quizzes</b><br>(considering only 4 best quizzes)                                                        | <b>5%</b>             |
| <b>Lab assignments</b><br>(all labs must be delivered;<br>late delivery with no justification is penalised by 50%) | <b>15%</b>            |
| <b>Midterm Exam</b>                                                                                                | <b>20%</b>            |
| <b>Final exam</b> (written format, no oral part)                                                                   | <b>60%</b>            |
| <b>Optional FPGA project</b> (extra points)                                                                        | <b>At most 2%</b>     |

# Acknowledgment

Over years, the following people have contributed to this lecture material:

- Alexander Tormasov
- Giancarlo Succi
- Muhammad Fahim
- Yuri Panchul
- Artem Burmyakov