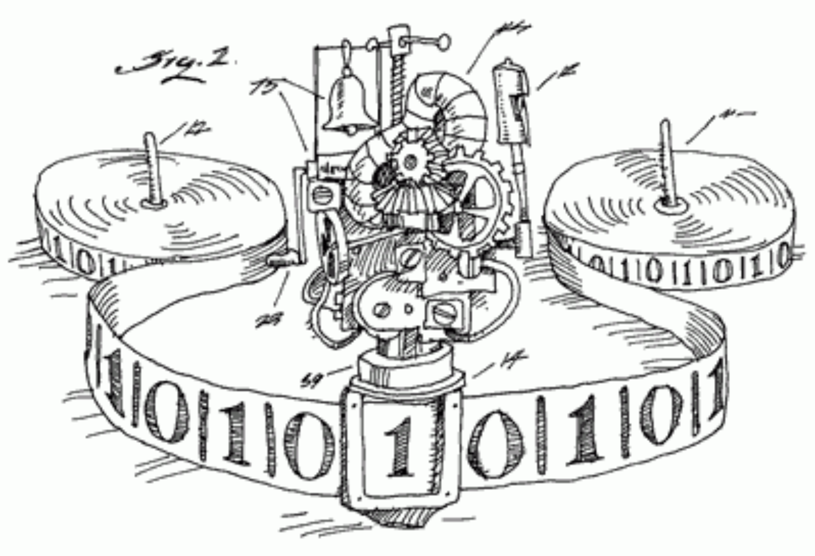
INFO 101 – Introduction to Computing and Security

[2020 - Week 1 / 1]



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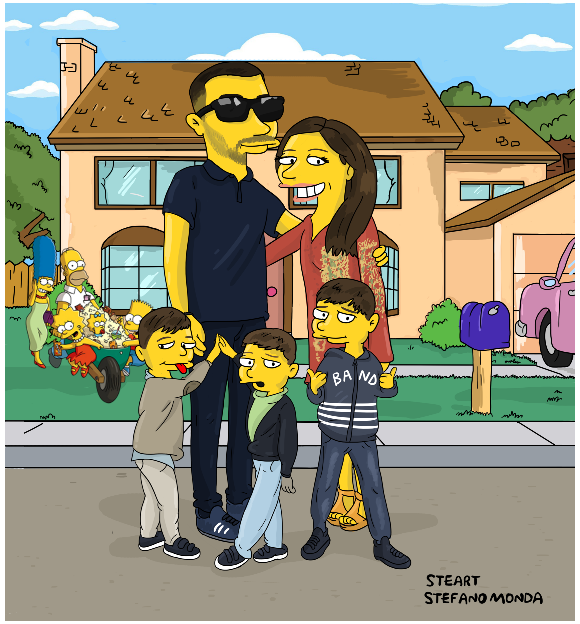

Rui Maranhao

Porto, Portugal

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WORLD MAP
Europe
ARCTIC OCEAN
Greenland (Denmark)
Baffin Bay
Beaufort Sea
Alaska (USA)
Canada
Hudson Bay
Labrador Sea
Gulf of Alaska
Arctic Circle
United States of America
NORTH PACIFIC OCEAN
NORTH ATLANTIC OCEAN
Mexico
Gulf of Mexico
Cuba
The Bahamas
Haiti
Dominican Rep.
Bermuda (U.K.)
Puerto Rico (U.S)
St. Kitts & Nevis
Antigua and Barbuda
Dominica
St. Lucia
Barbados
Grenada
Trinidad & Tobago
Jamaica
Belize
Guatemala
Honduras
El Salvador
Nicaragua
Costa Rica
Caribbean Sea
Tropic of Cancer
Hawaii Islands (U.S.)
Kiribati
Equator
Venezuela
Colombia
Guyana
Suriname
French Guiana (Fr.)
Ecuador
Galapagos (Ecuador)
Peru
Brazil
Bolivia
Paraguay
Chile
Uruguay
Argentina
Tropic of Capricorn
French Polynesia
Easter (Chile)
Falkland Islands (U.K.)
South Georgia (U.K.)
South Sandwich (U.K.)
SOUTH PACIFIC OCEAN
SOUTH ATLANTIC OCEAN
Trindade (Brazil)
St Helena (U.K.)
Ascension (U.K.)
Weddell Sea
Prime Meridian
Iceland
Jan Mayen (Norway)
Faroe Islands (Denmark)
Norwegian Sea
Svalbard (Norway)
Franz Josef Land
Kara Sea
Barents Sea
October Revolution
Laptev Sea
Kotelny
East Siberian Sea
Wrangel
Bering Sea
Norway
Sweden
Finland
Estonia
Latvia
Lithuania
Belarus
Denmark
North Sea
United Kingdom
Ireland
Poland
Germany
Ukraine
France
San Marino
Monaco
Andorra
Vatican City
Italy
Spain
Portugal
Romania
Bulgaria
Greece
Malta
Turkey
Georgia
Armenia
Azerbaijan
Black Sea
Caspian Sea
Aral Sea
Mediterranean Sea
Morocco
Tunisia
Algeria
Libya
Egypt
Israel
Syria
Iraq
Iran
Kuwait
Bahrain
Qatar
U.A.E.
Saudi Arabia
Oman
Yemen
Red Sea
Canary Islands (Spain)
Western Sahara
Mauritania
Mali
Niger
Chad
Sudan
Eritrea
Djibouti
Ethiopia
Somalia
Cabo Verde
Senegal
The Gambia
Sierra Leone
Liberia
Côte d'Ivoire
Burkina Faso
Nigeria
Central African Rep.
South Sudan
Gabon
Congo
Dem. Rep. of the Congo
Uganda
Kenya
Burundi
Tanzania
Seychelles
Comoros
Angola
Zambia
Zimbabwe
Malawi
Mozambique
Madagascar
Mayotte (Fr.)
Mauritius
Reunion (Fr.)
Namibia
Botswana
Swaziland
South Africa
Lesotho
São Tomé and Principe
Russia
Kazakhstan
Uzbekistan
Turkmenistan
Kyrgyzstan
Tajikistan
Afghanistan
Pakistan
Mongolia
China
North Korea
South Korea
Japan
Sea of Japan (East Sea)
Sea of Okhotsk
East China Sea
Taiwan
Nepal
Bhutan
India
Bangladesh
Myanmar (Burma)
Laos
Thailand
Vietnam
Cambodia
Philippines
Philippine Sea
Arabian Sea
Bay of Bengal
Sri Lanka
Maldives
Andaman & Nicobar Is. (India)
Malaysia
Brunei
Singapore
Sumatra
Indonesia
Java
Timor-Leste
Papua New Guinea
Palau
Guam (U.S)
Northern Mariana Islands (U.S)
Federated States of Micronesia
Marshall Islands
Nauru
Solomon Islands
Tuvalu
Kiribati
Wallis and Futuna (Fr.)
Samoa
Fiji
Tonga
Vanuatu
New Caledonia (Fr.)
Coral Sea
Cocos Is. (Aus.)
Christmas (Aus.)
INDIAN OCEAN
PACIFIC OCEAN
Australia
Great Australian Bight
Tasman Sea
Tasmania
New Zealand
North Island
South Island
SOUTHERN OCEAN
Antarctic Circle
ANTARCTICA
1. Netherlands
2. Belgium
3. Luxembourg
4. Switzerland
5. Slovenia
6. Croatia
7. Bosnia and Herzegovina
8. Czech Republic
9. Slovakia
10. Austria
11. Hungary
12. Serbia
13. Moldova
14. Macedonia (FYROM)
15. Albania
16. Cyprus
17. Lebanon
18. Guinea-Bissau
19. Guinea
20. Ghana
21. Togo
22. Benin
23. Cameroon
24. Equatorial Guinea
25. Rwanda
26. Cambodia
27. Panama
28. Malawi
29. Liechtenstein
30. Montenegro
31. Kosovo
32. Palestinian Territories
33. St. Vincent & the Grenadines
0 2,000 4,000 Miles
0 2,000 4,000 6,000 8,000 Kilometers
N
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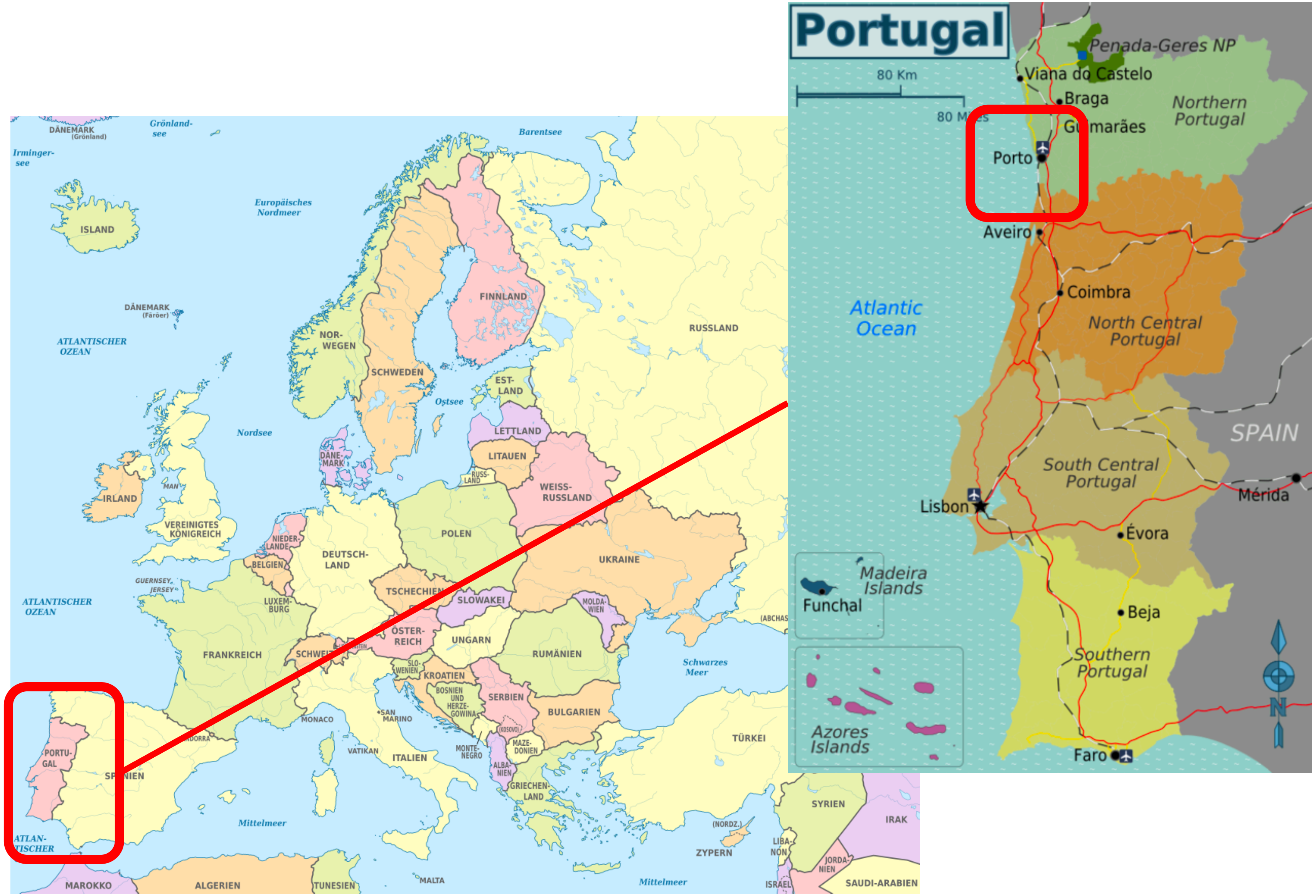
Portugal
80 Km
80 Miles
Penada-Geres NP
Viana do Castelo
Braga
Guimarães
Northern Portugal
Porto
Aveiro
Coimbra
North Central Portugal
Atlantic Ocean
SPAIN
South Central Portugal
Mérida
Lisbon
Évora
Madeira Islands
Funchal
Beja
Southern Portugal
Azores Islands
Faro
N
DÄNEMARK (Grönland)
Grönland-see
Irminger-see
Barentsee
ISLAND
Europäisches Nordmeer
DÄNEMARK (Färöer)
FINNLAND
RUSSLAND
NOR-WEGEN
ATLANTISCHER OZEAN
SCHWEDEN
EST-LAND
Ostsee
Nordsee
LETTLAND
DÄNE-MARK
LITAUEN
RUSS-LAND
IRLAND
MAN
WEISS-RUSSLAND
VEREINIGTES KÖNIGREICH
NIEDER-LANDE
POLEN
DEUTSCH-LAND
BELGIEN
UKRAINE
GUERNSEY, JERSEY
LUXEM-BURG
TSCHECHIEN
SLOWAKEI
MOLDA-WIEN
ATLANTISCHER OZEAN
ÖSTER-REICH
UNGARN
FRANKREICH
SCHWEIZ
RUMÄNIEN
Schwarzes Meer
SLO-WENIEN
KROATIEN
BOSNIEN UND HERZE-GOWINA
SERBIEN
BULGARIEN
MONACO
SAN MARINO
KOSOVO
PORTU-GAL
SPANIEN
MONTE-NEGRO
MAZE-DONIEN
TÜRKEI
VATIKAN
ITALIEN
ALBA-NIEN
GRIECHEN-LAND
SYRIEN
IRAK
Mittelmeer
ATLAN-TISCHER
(NORDZ.)
ZYPERN
LIBA-NON
JORDA-NIEN
MAROKKO
ALGERIEN
TUNESIEN
MALTA
Mittelmeer
ISRAEL
SAUDI-ARABIEN

Organizational Topics

Schedule

Class 1						
	Mon	Tue	Wed	Thu	Fri	Sat
	T 14:30 – 16:10 Room 112 Feiyun building		T 14:30 – 16:10 Room 107 Feiyun building	L 18:30 – 10:10 Room 110 Feiyun building		

Class 2						
	Mon	Tue	Wed	Thu	Fri	Sat
	T 16:30 – 18:10 Room 112 Feiyun building		T 16:30 – 18:10 Room 107 Feiyun building	L 10:30 – 12:10 Room 110 Feiyun building		

Instructor Information

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Dr. Haitao Zhang

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Course outcome

- List the basic principles behind computing and the underlying computing infrastructure comprising hardware and software
- List the basic components behind a computing device and describe some of their characteristics
- Explain basic concepts of computer networks including how the Internet and the Web work
- Discuss emerging computer technology concepts including cloud computing, DevOps, and the Internet of Things
- Perform some basic programming and understand its limitations
- Perform basic steps to protect personal data from theft and understand the reasons behind security issues

Attendance (course participation)

- This course is designed to be delivered as a lecture and workshop / laboratory sessions.
- The experience of the workshop / laboratory is available only through class attendance, participation, interaction, and application of principles. For this reason: **attendance will be taken in both the lecture and the lab and this attendance is part of the class participation grade.**
- The labs are specifically designed to teach you the principles in an interactive experimental manner. Students are responsible for all material and assignments covered in their absence. **Students are responsible for the work that is due.**

Grading

Course Grading and Grading Scale	
Grading Scale	Under all normal conditions the following course grading scale will be applied
• 45% - Assignments • 10% - Class attendance (participation) • 45% - Exam	• 96% - 100% A+ • 93% - 95.99% A • 90% - 92.99% A- • 87% - 89.99% B+ • 83% - 86.99% B • 80% - 82.99% B- • 77% - 79.99% C+ • 73% - 76.99% C • 70% - 72.99% C- • 67% - 69.99% D+ • 60% - 66.99% D • 59.99% F

Motivation

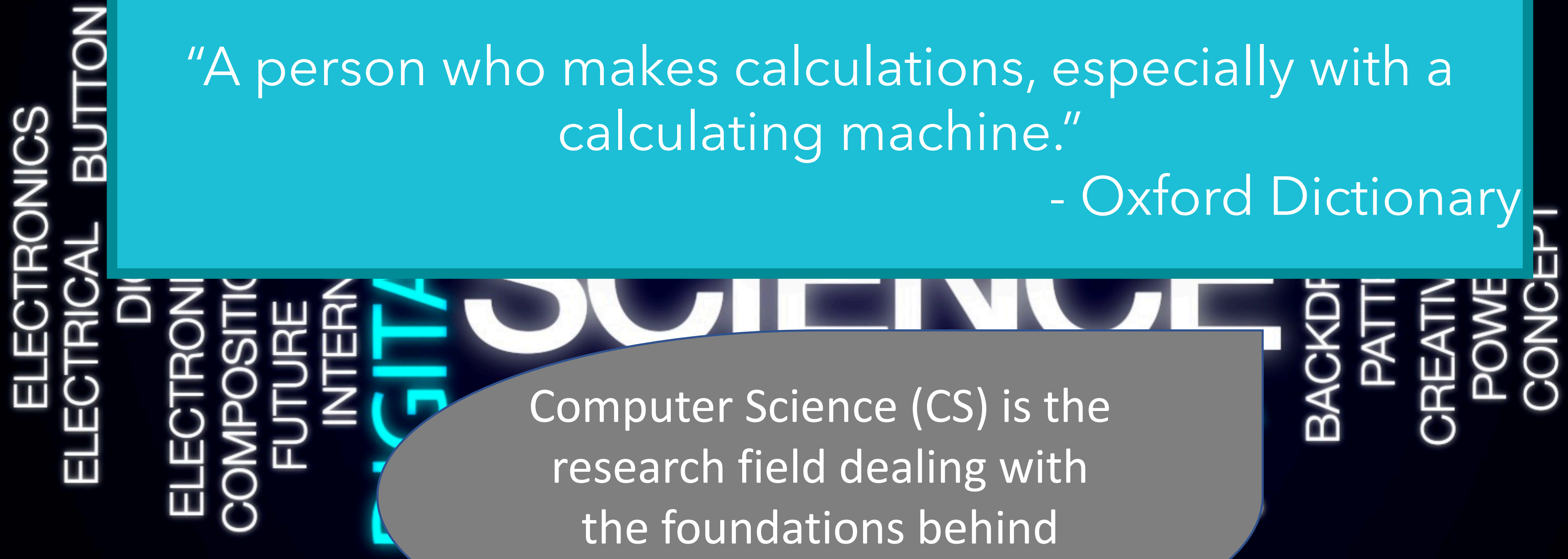
13
Sources: Wikipedia, Amazon, Apple

COMPUTER

"An electronic device for storing and processing data, typically in binary form, according to instructions given"

"A person who makes calculations, especially with a calculating machine."

- Oxford Dictionary



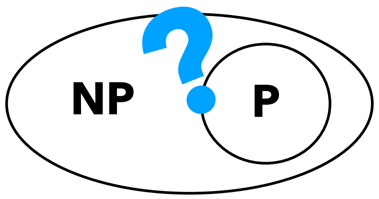
Computer Science (CS) is the research field dealing with the foundations behind computing

APPLIED CS

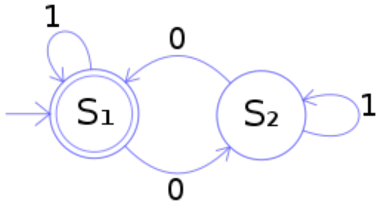
THEORETICAL CS

- Computability/Complexity
- Languages/Automaton Theory
- Logic
- Theory of programming languages

NP = P?



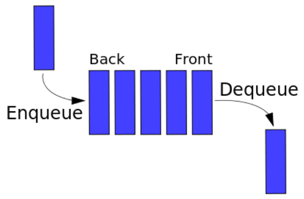
Deterministic Automaton



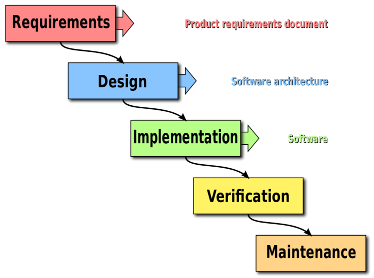
PRACTICAL CS

- Operating Systems
- Data structures and algorithms
- Software Engineering
- Programming language development

Queues



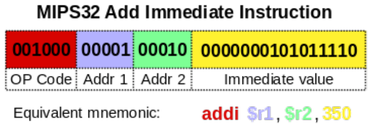
Waterfall



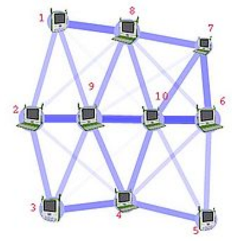
TECHNICAL CS

- Integrated circuits
- Computer architectures
- Communication networks
- Signal processing

Machine code



Routing

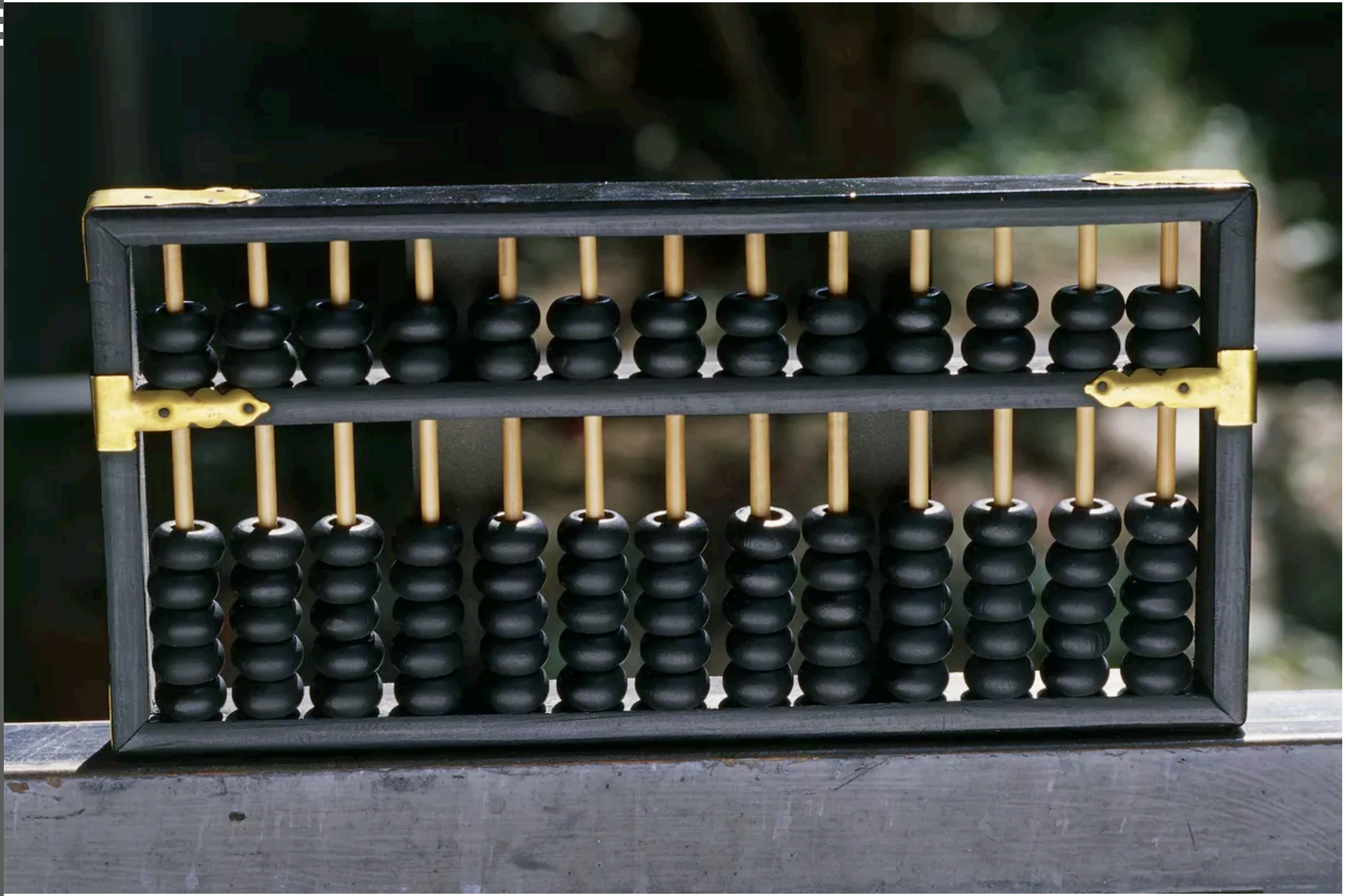


Source: Wikipedia

History of Computing

2000 BC

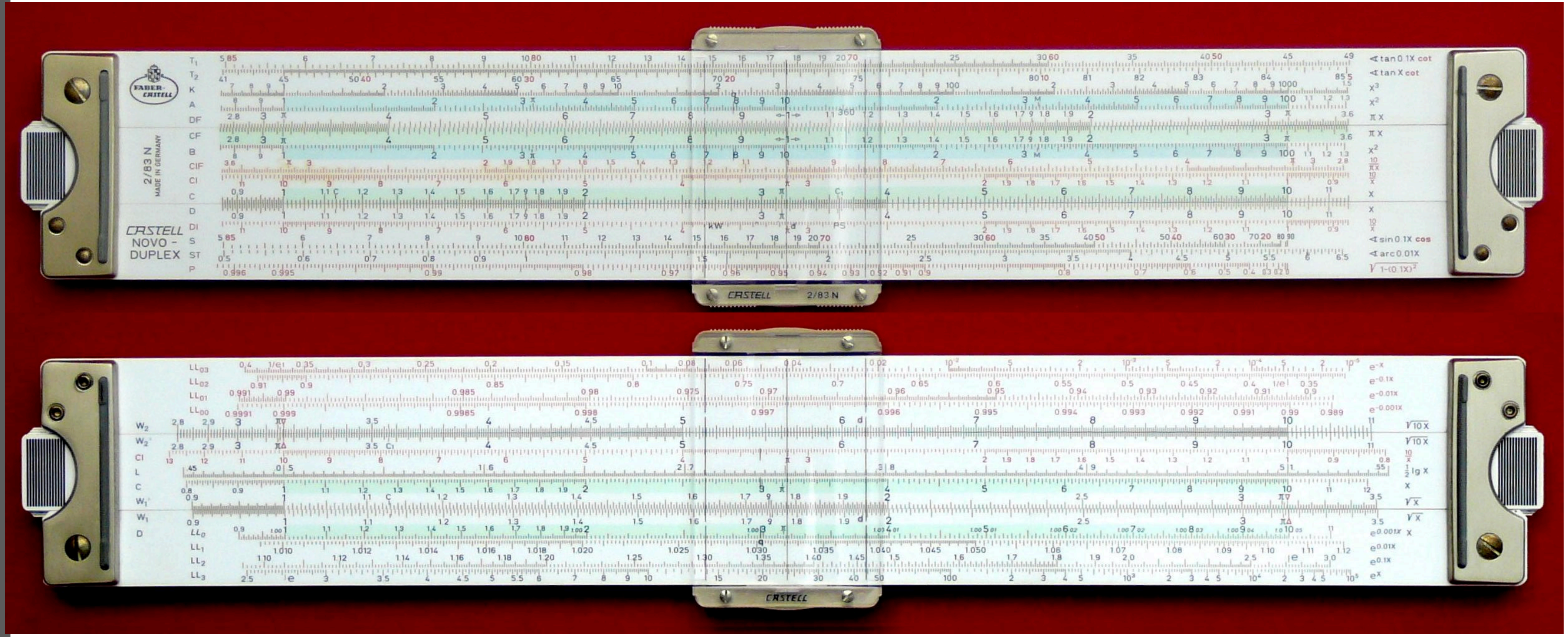
ABACUS



Source: Wikipedia

Slide rule

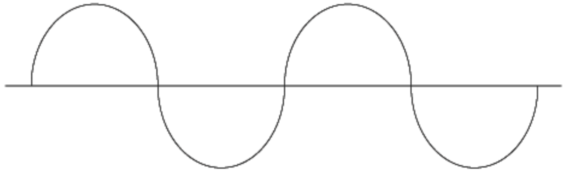
1620



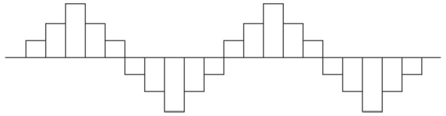
Source: Wikipedia

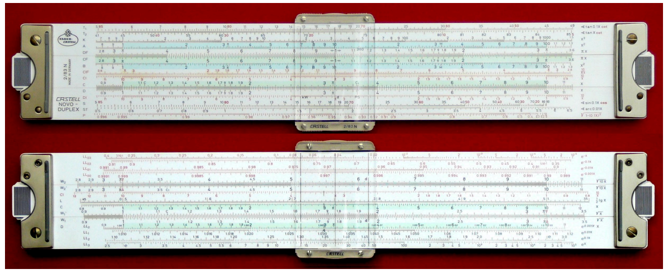
ANALOG VS. DIGITAL

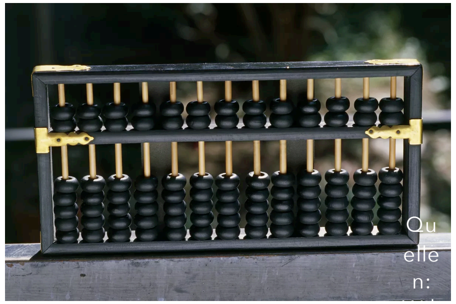
➤ continous values



➤ discrete values

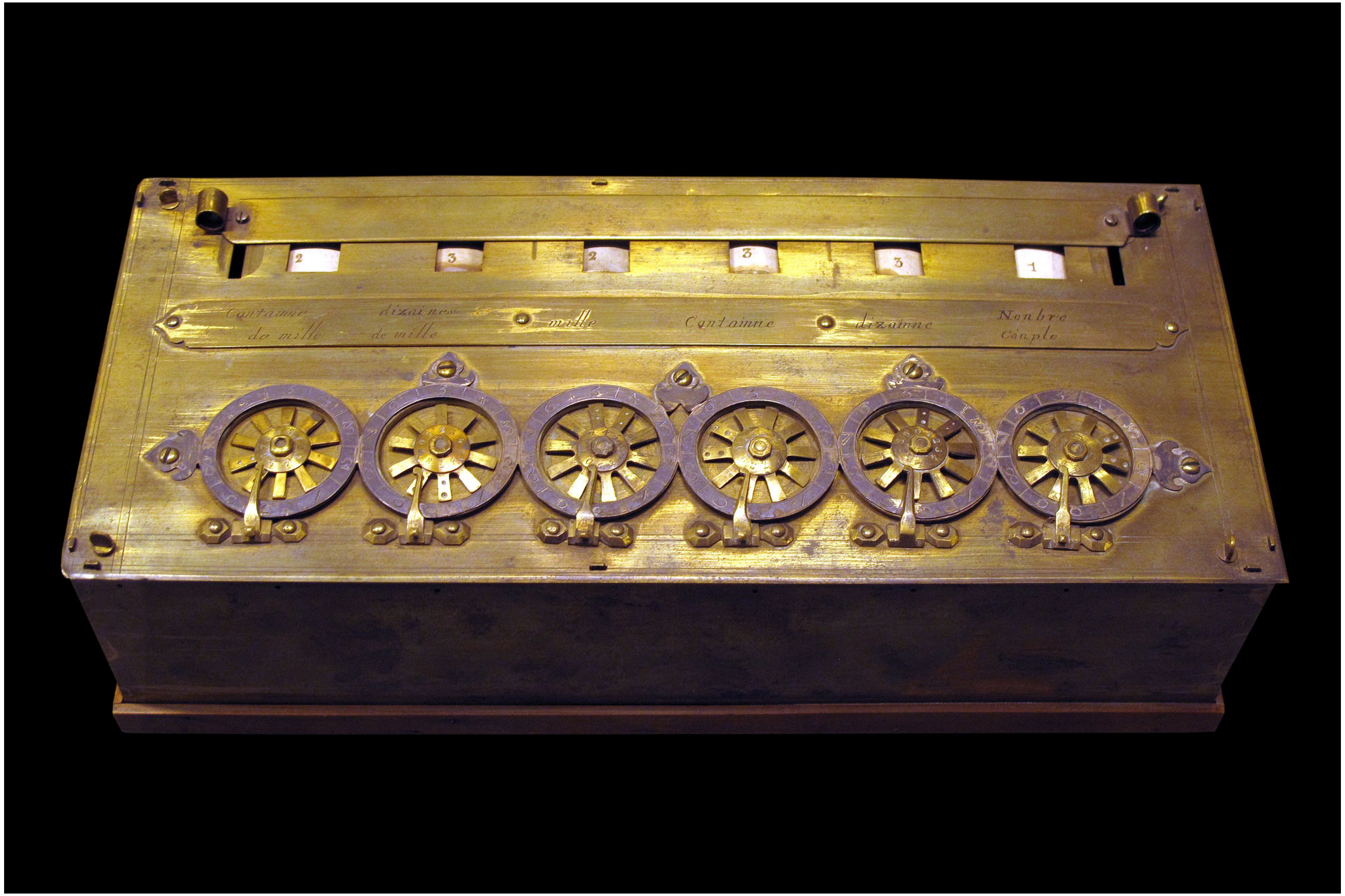






Pascal‘s Calculator

1642



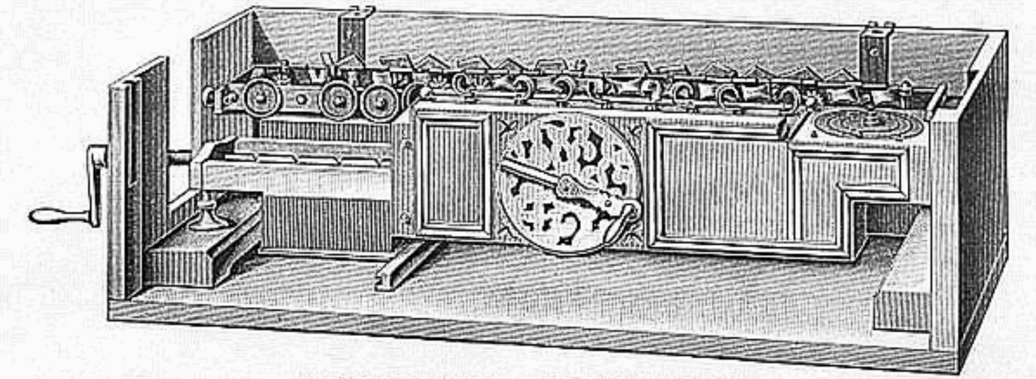
Source: Wikipedia

Leibniz‘s Calculator

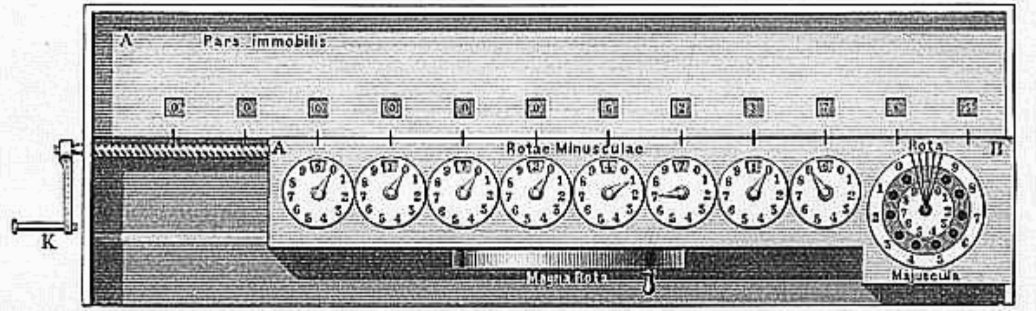
1694

„Es ist unwürdig, die Zeit von hervorragenden Leuten mit knechtischen Rechenarbeiten zu verschwenden, weil bei Einsatz einer Maschine auch der Einfältigste die Ergebnisse sicher hinschreiben kann.“ - Gottfried Wilhelm Leibniz

“It is unworthy of wasting the time of excellent people with servile calculations, because when using a machine even the simplest can safely write down the results.”



2. Rechenmaschine von Leibniz (1673, Hannover).



3. Leibnizsche Rechenmaschine, geometrische Zeichnung.

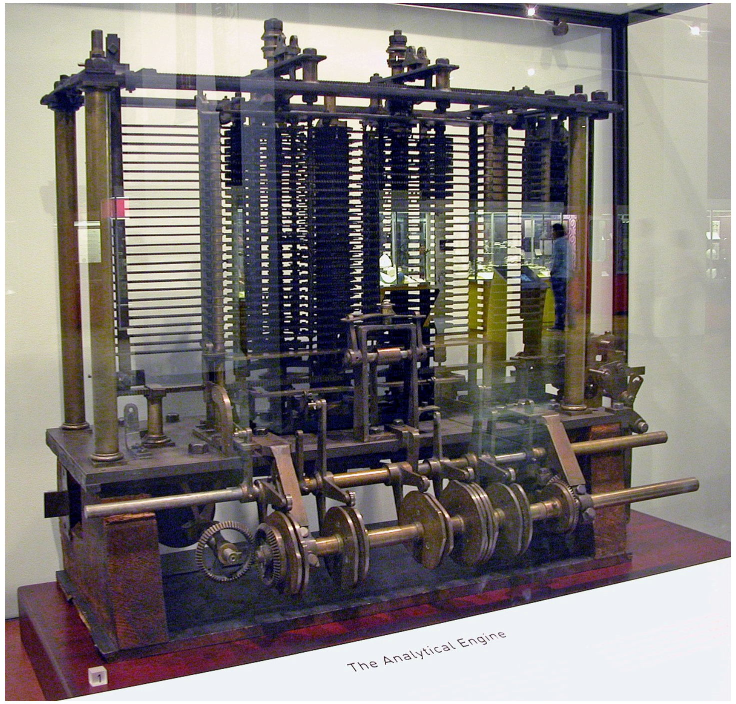
Source: Wikipedia

Quellen: Wikipedia

ANALYTICAL ENGINE (Charles Babbage)

1837

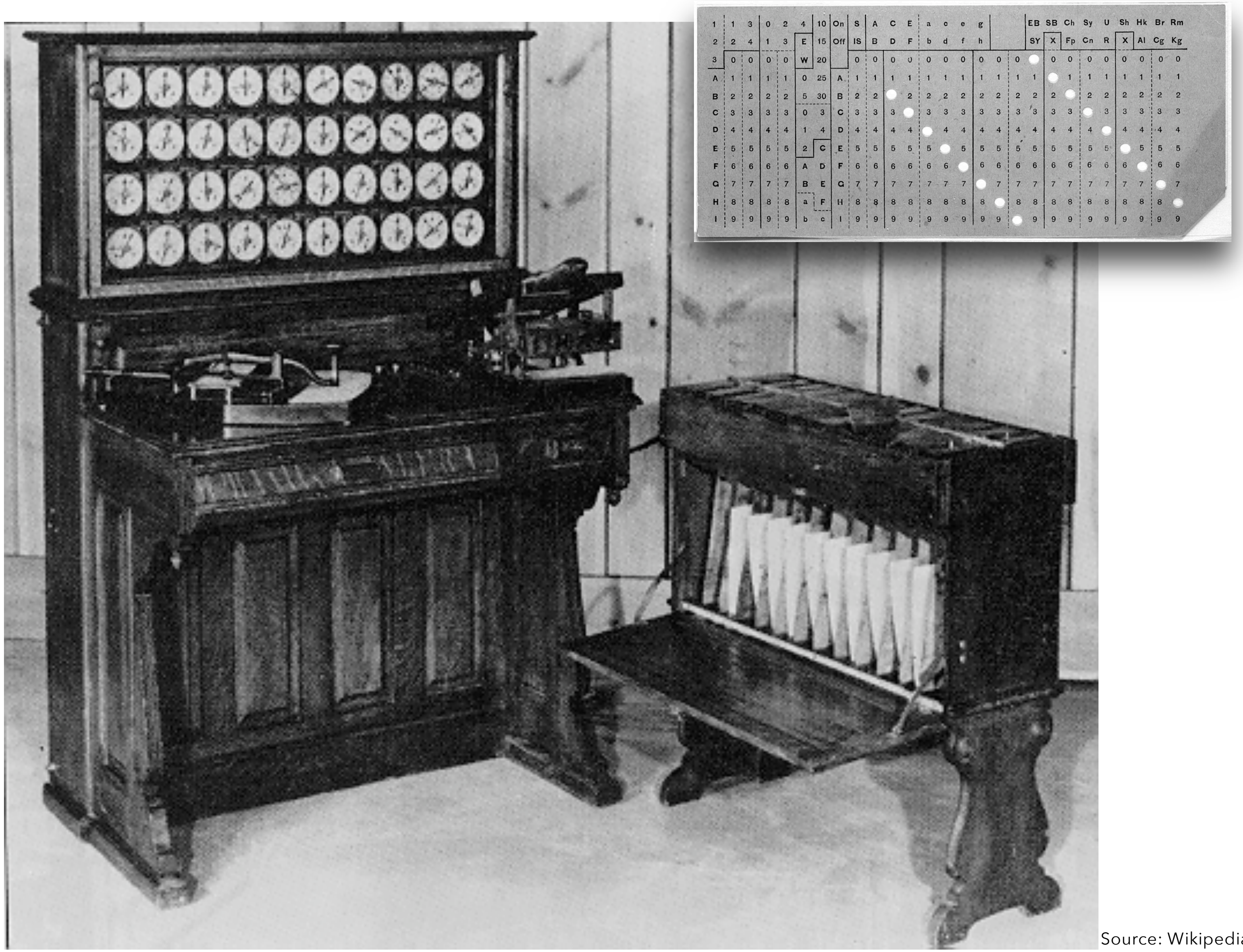
- Mechanical calculator for general tasks and applications
- First programming language
- First algorithm (a process or a sequence of rules that have to be followed during calculation to solve a provlem)



Source: Wikipedia

US Census (Herman Hollerith)

1890

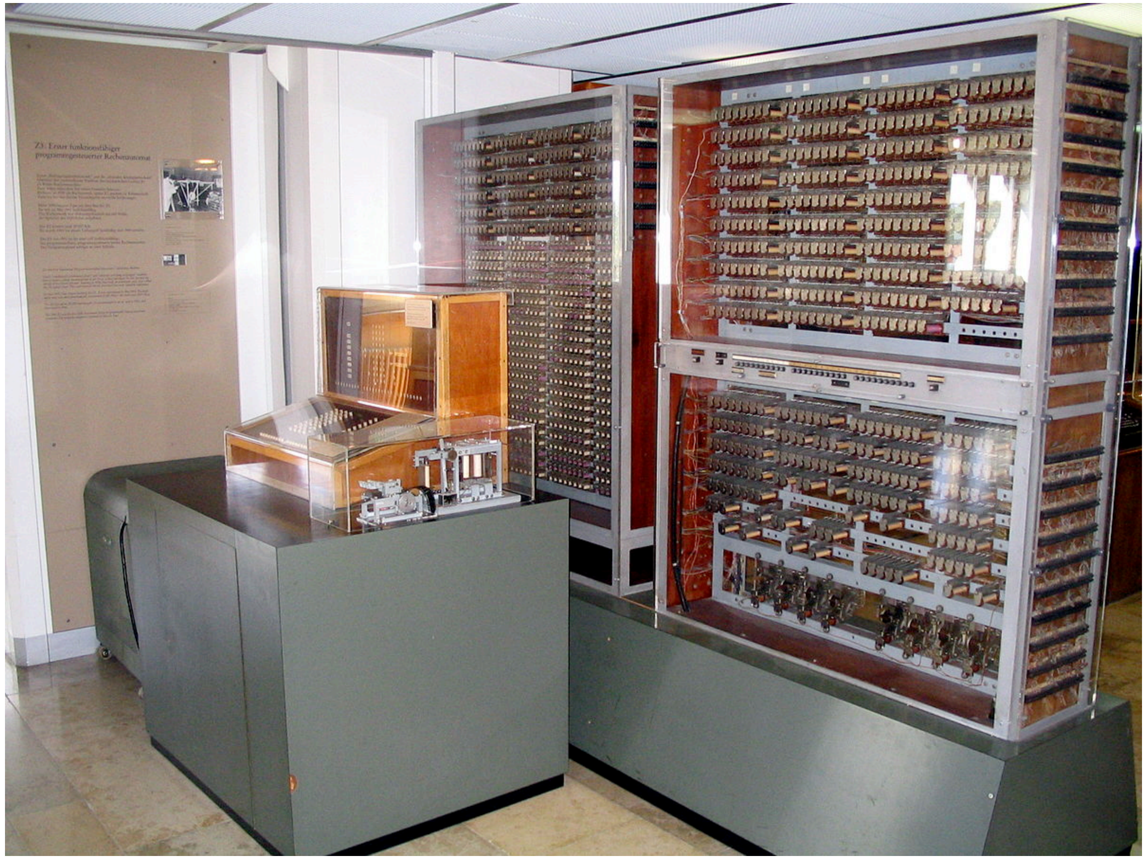


Source: Wikipedia

Z3 (Konrad ZUSE)

1941

- First universally programmable digital computer
- Electro-mechanic computer using relais



Source: Wikipedia

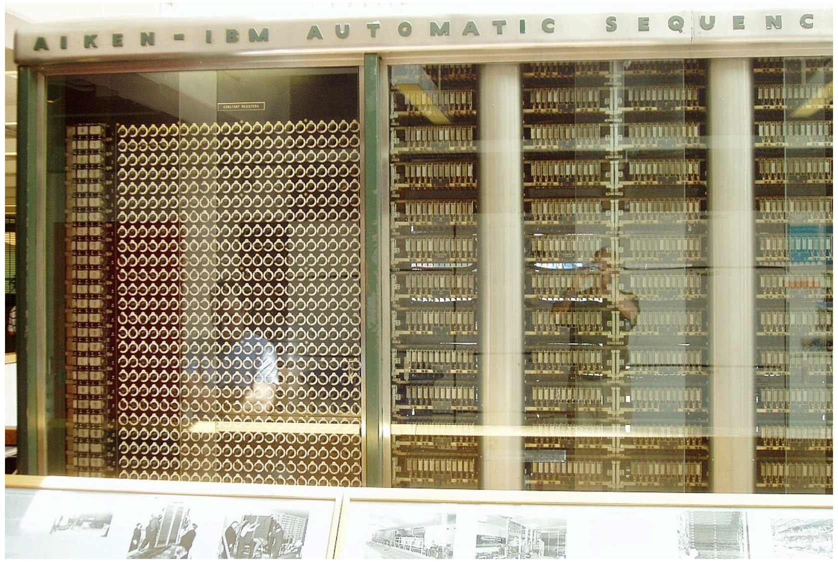
Havard Mark 1 (Howard Aiken)

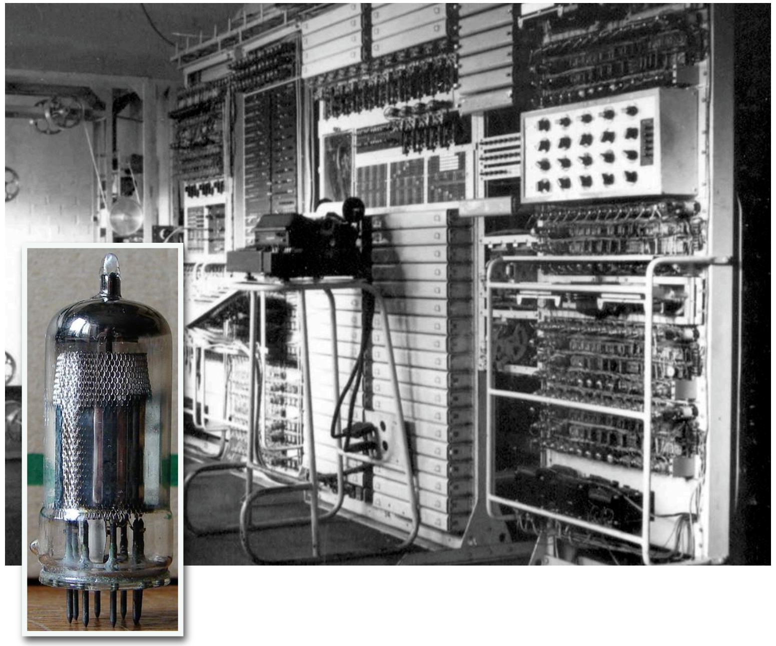
COLOSSUS (TOMMY FLOWERS)

1944

- Electro-mechanic components
- Used in the Manhatten project
- Programming using punch cards

- Tube computer
- For decyphering messages
- Programing using cables

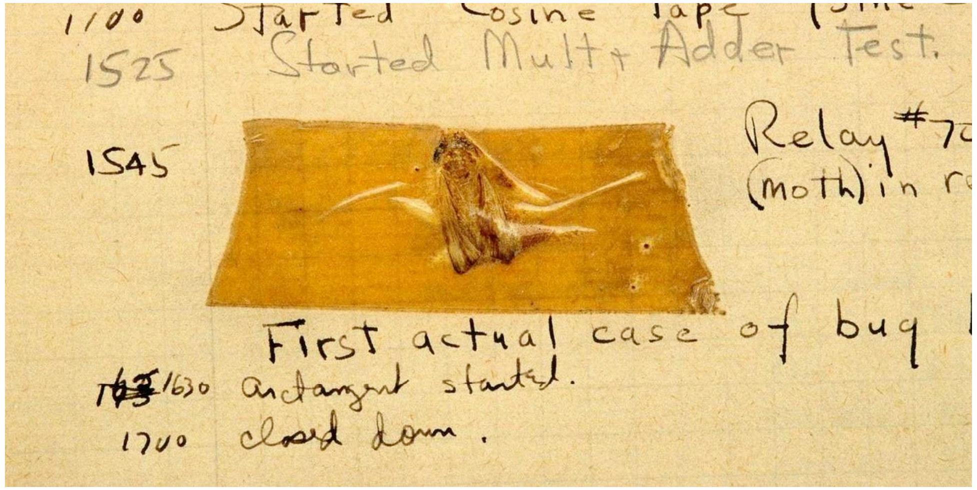




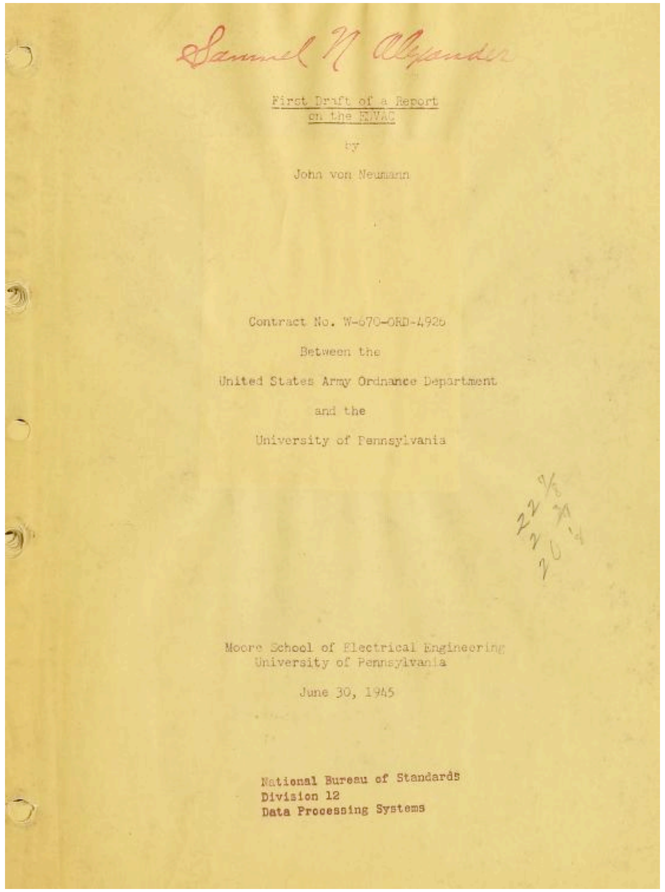
Source: YouTube, Wikipedia

“First CASE OF A BUG”

1945



Source: https://www.businessinsider.com/


Samuel N Alexander

First Draft of a Report
on the EDVAC

by

John von Neumann

Contract No. W-670-ORD-4926

Between the

United States Army Ordnance Department

and the

University of Pennsylvania

Moore School of Electrical Engineering
University of Pennsylvania

June 30, 1945

National Bureau of Standards
Division 12
Data Processing Systems

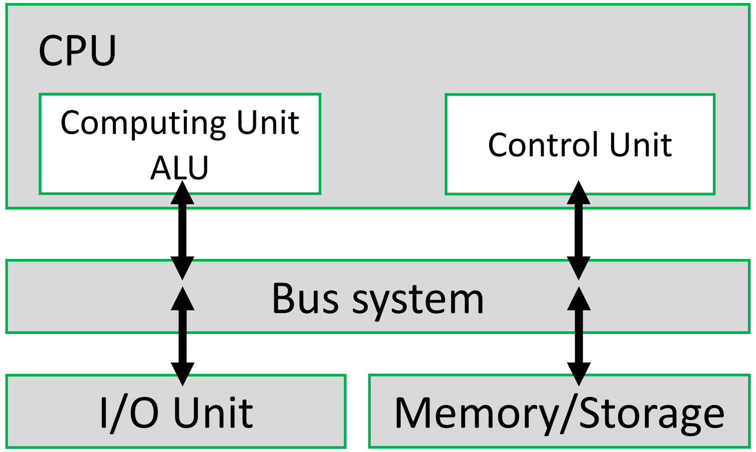
VON NEUMANN ARCHITECTURE

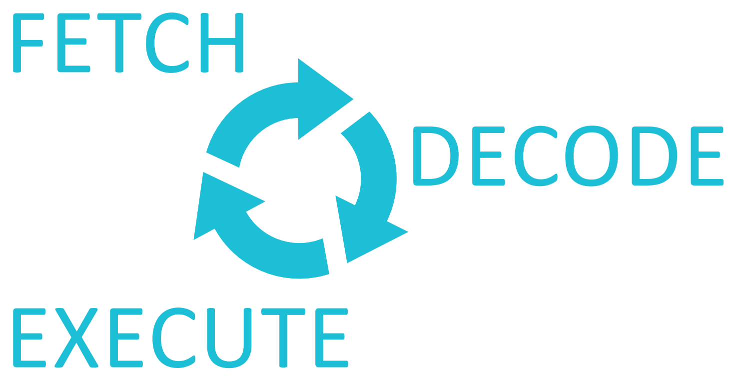
Source: Wikipedia

VON NEUMANN ARCHITECTURE

1945

- Previously developed computer had fixed programs
  - Wiring
  - Punch cards
- Von-Neumann-Architectur (stored programs):
  - One memory for programs and data
  - Data and programs are treaten equivalently
  - Components:
    - CPU
    - Memory
  - Fast change of programs possible

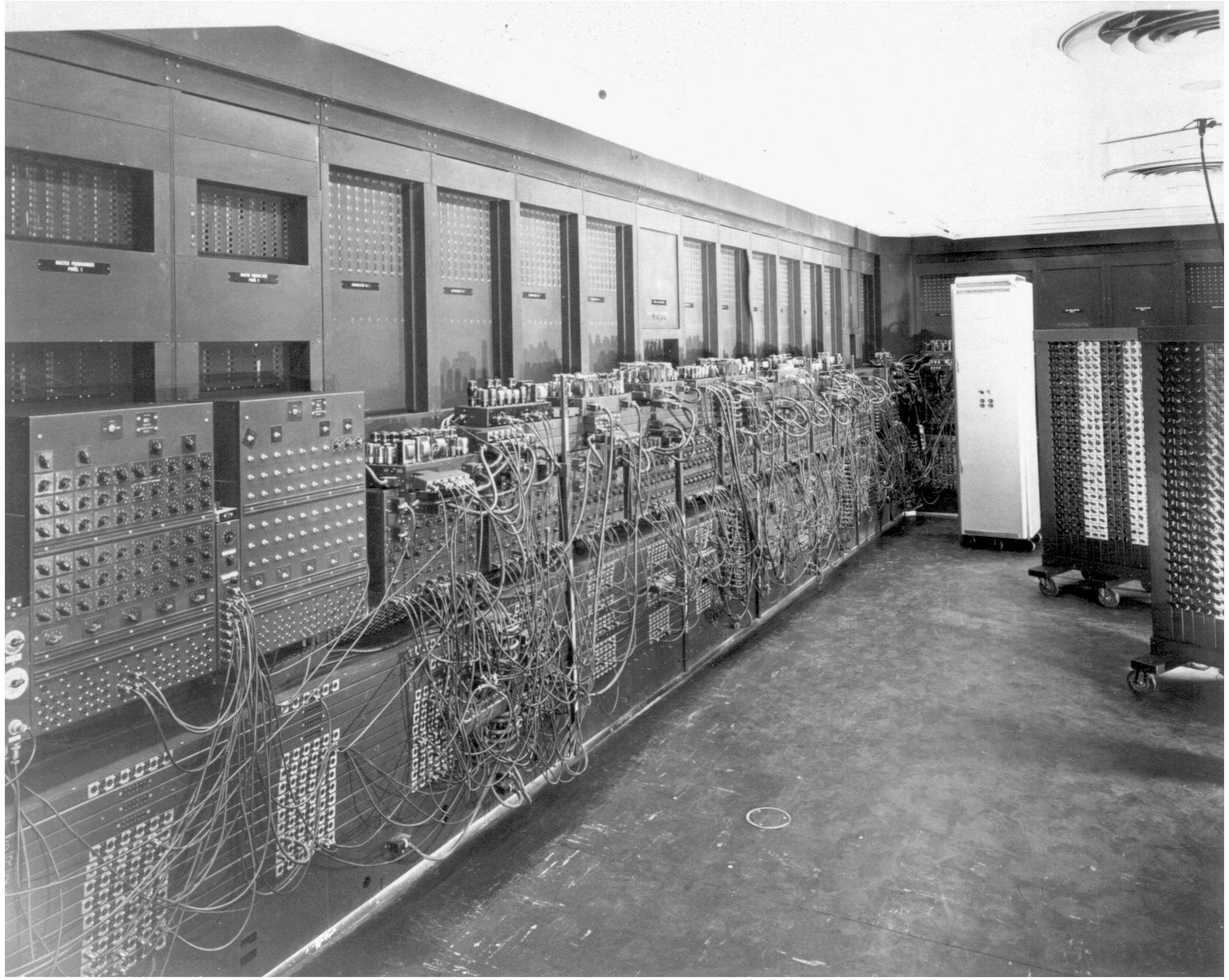




ENIAC (Eckert & Mauchly)

1946

- Electronic Numerical Integrator and Computer
- First electronic computer

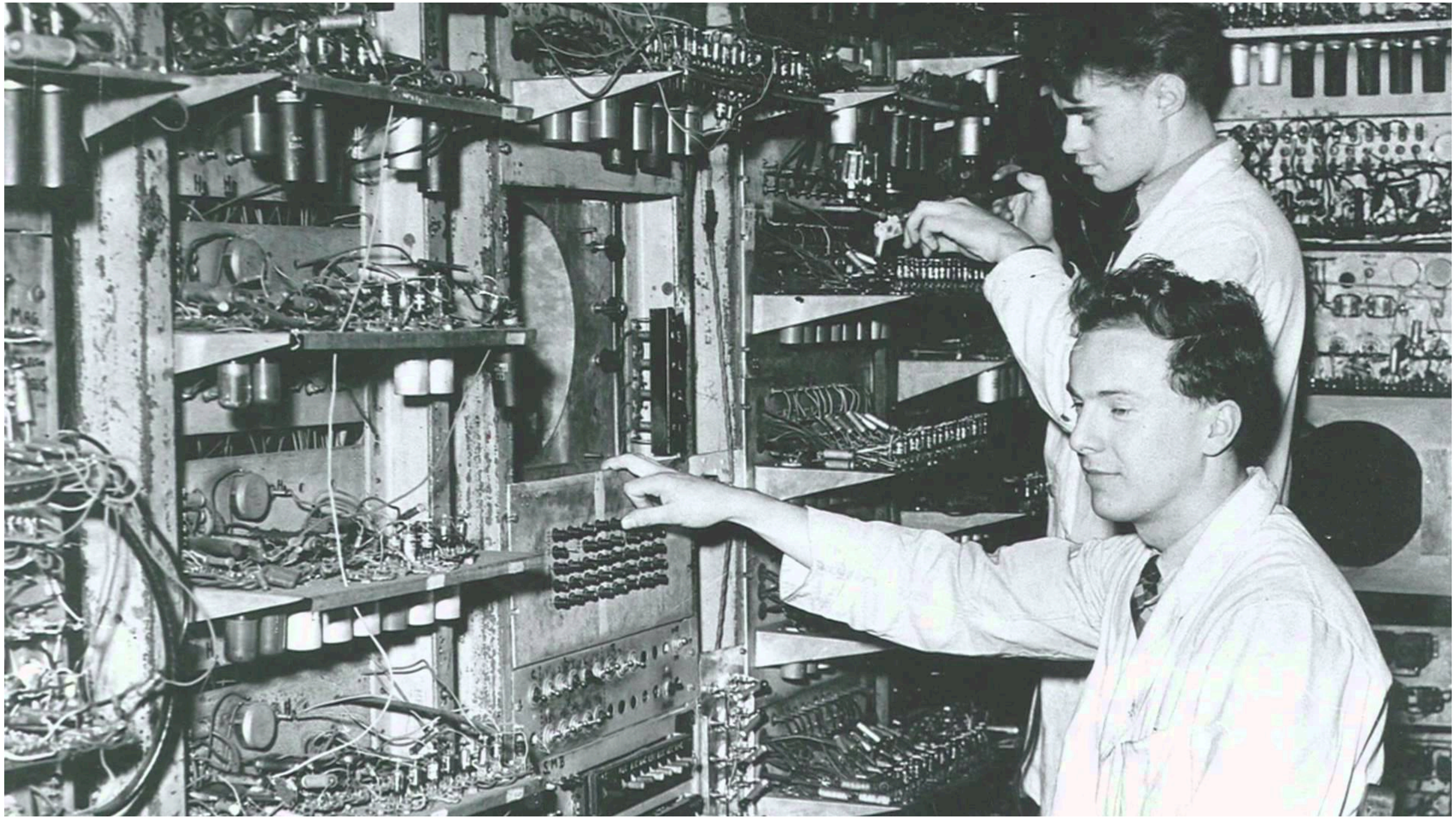


Source: Pintrest

MANCHESTER BABY (Williams)

- First von Neumann Computer

1948



Source: YouTube

UNIVAC 2

1951

- Universal Automatic Computer
- First commercially available computer (~40 pieces sold)
- Used magnetic tapes as external memory/storage

Source: http://time.com/

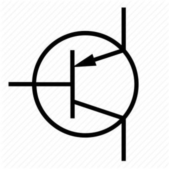
1950s

ASSEMBLER and COMPILER

- Computers use only 1 and 0 (machine code)
- Support programs

```
MONITOR FOR 6802 1.4          9-14-80  TSC ASSEMBLER  PAGE    2

 C000                    ORG    ROM+$0000 BEGIN MONITOR
 C000 8E 00 70  START    LDS    #STACK

                *****************************************
                * FUNCTION: INITA - Initialize ACIA
                * INPUT: none
                * OUTPUT: none
                * CALLS: none
                * DESTROYS: acc A

 0013           RESETA   EQU    %00010011
 0011           CTLREG   EQU    %00010001

 C003 86 13     INITA    LDA A  #RESETA   RESET ACIA
 C005 B7 80 04           STA A  ACIA
 C008 86 11              LDA A  #CTLREG   SET 8 BITS AND 2 STOP
 C00A B7 80 04           STA A  ACIA

 C00D 7E C0 F1           JMP    SIGNON    GO TO START OF MONITOR

                *****************************************
                * FUNCTION: INCH - Input character
                * INPUT: none
                * OUTPUT: char in acc A
                * DESTROYS: acc A
                * CALLS: none
                * DESCRIPTION: Gets 1 character from terminal

 C010 B6 80 04  INCH     LDA A  ACIA      GET STATUS
 C013 47                 ASR A            SHIFT RDRF FLAG INTO CARRY
 C014 24 FA              BCC    INCH      RECIEVE NOT READY
 C016 B6 80 05           LDA A  ACIA+1    GET CHAR
 C019 84 7F              AND A  #$7F      MASK PARITY
 C01B 7E C0 79           JMP    OUTCH     ECHO & RTS

                *****************************************
                * FUNCTION: INHEX - INPUT HEX DIGIT
                * INPUT: none
                * OUTPUT: Digit in acc A
                * CALLS: INCH
                * DESTROYS: acc A
                * Returns to monitor if not HEX input

 C01E 8D F0     INHEX    BSR    INCH      GET A CHAR
 C020 81 30              CMP A  #'0       ZERO
 C022 2B 11              BMI    HEXERR    NOT HEX
 C024 81 39              CMP A  #'9       NINE
 C026 2F 0A              BLE    HEXRTS    GOOD HEX
 C028 81 41              CMP A  #'A
 C02A 2B 09              BMI    HEXERR    NOT HEX
 C02C 81 46              CMP A  #'F
 C02E 2E 05              BGT    HEXERR
 C030 80 07              SUB A  #7        FIX A-F
 C032 84 0F     HEXRTS   AND A  #$0F      CONVERT ASCII TO DIGIT
 C034 39                 RTS

 C035 7E C0 AF  HEXERR   JMP    CTRL      RETURN TO CONTROL LOOP
```

IBM 608



- First transistor-based computer for the public market

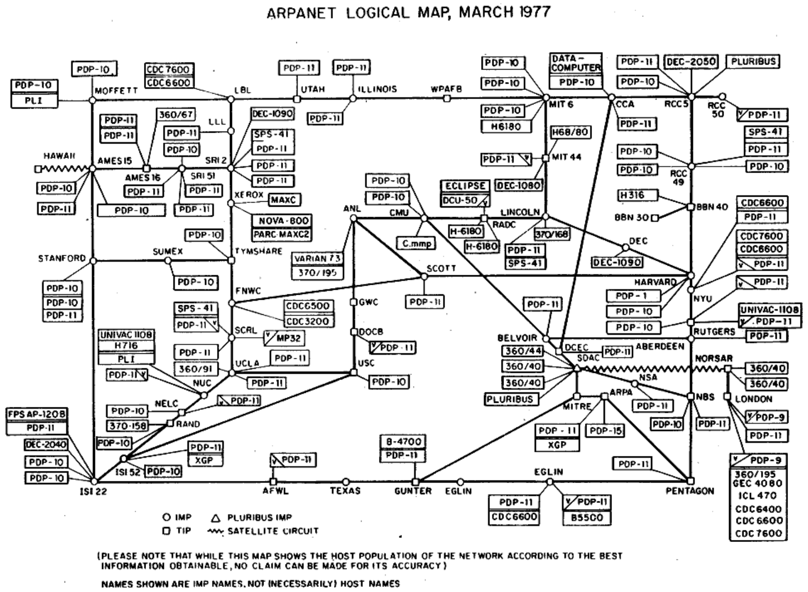
Sources: YouTube, Wikipedia

APOLLO PROGRAM and the Intenet

1960s

- Integrated Circuits
- Apollo Guidance Computer (AGC)

- Arpanet for connecting universities and research facilities

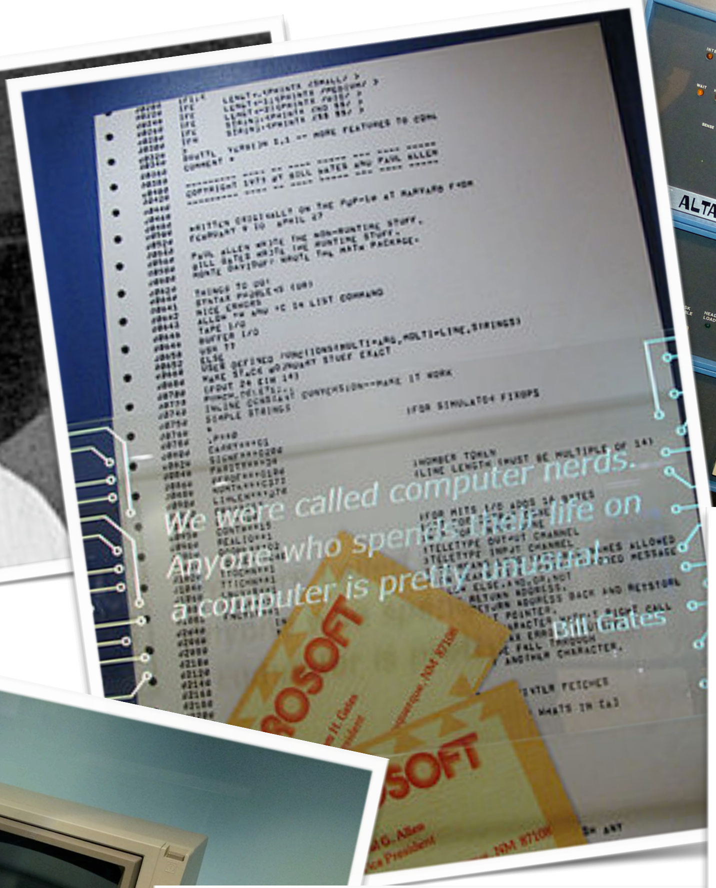


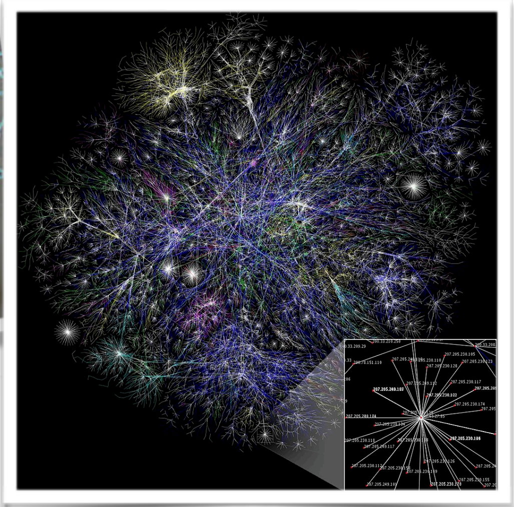
"The number of transistors of an integrated circuit of fixed size double every two years." - Gordon Moore (Moore's Law)

1970s to 1990s

UNIX

ALTAIR 8800





INTERNET & WWW

APPLE 1 AND 2

IBM PERSONAL COMPUTER

Source: Wikipedia

Information Systems

Definition & Purpose

- An **Information System** (IS) is a set of components arranged to collect data, process it, and convert it into information.

- Provide **timely**, **integrated**, **accurate**, and **useful information** (for decision making)

  - **Note**: timely and accurate information is hard to provide! Example: Hospital (*Who is responsible for updating information regarding free beds in emergency units and when*?)

Data

- *„... **facts** and statistics collected together for reference or analysis."*
- *„the quantities, characters, or **symbols on which operations are performed by a computer**, which may be stored and transmitted in the form of electrical signals and recorded on magnetic, optical, or mechanical recording media. "*

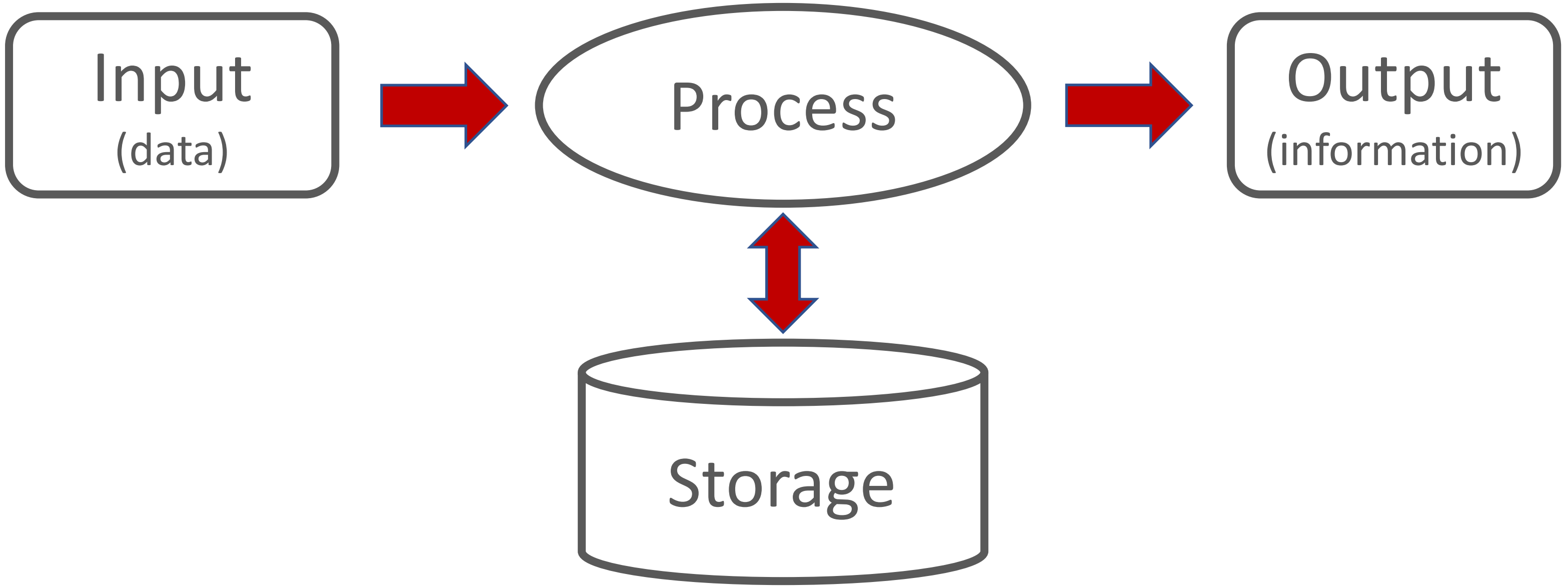
Data

- **Data processing**: Process of providing a context for data is a **fundamental activity** of an **information system**.
- Facts/Data (numbers, characters, words, images) alone mean nothing until they are combined with other data and thus provide a context for understanding.

- Data is raw material
- Processing data may lead to information

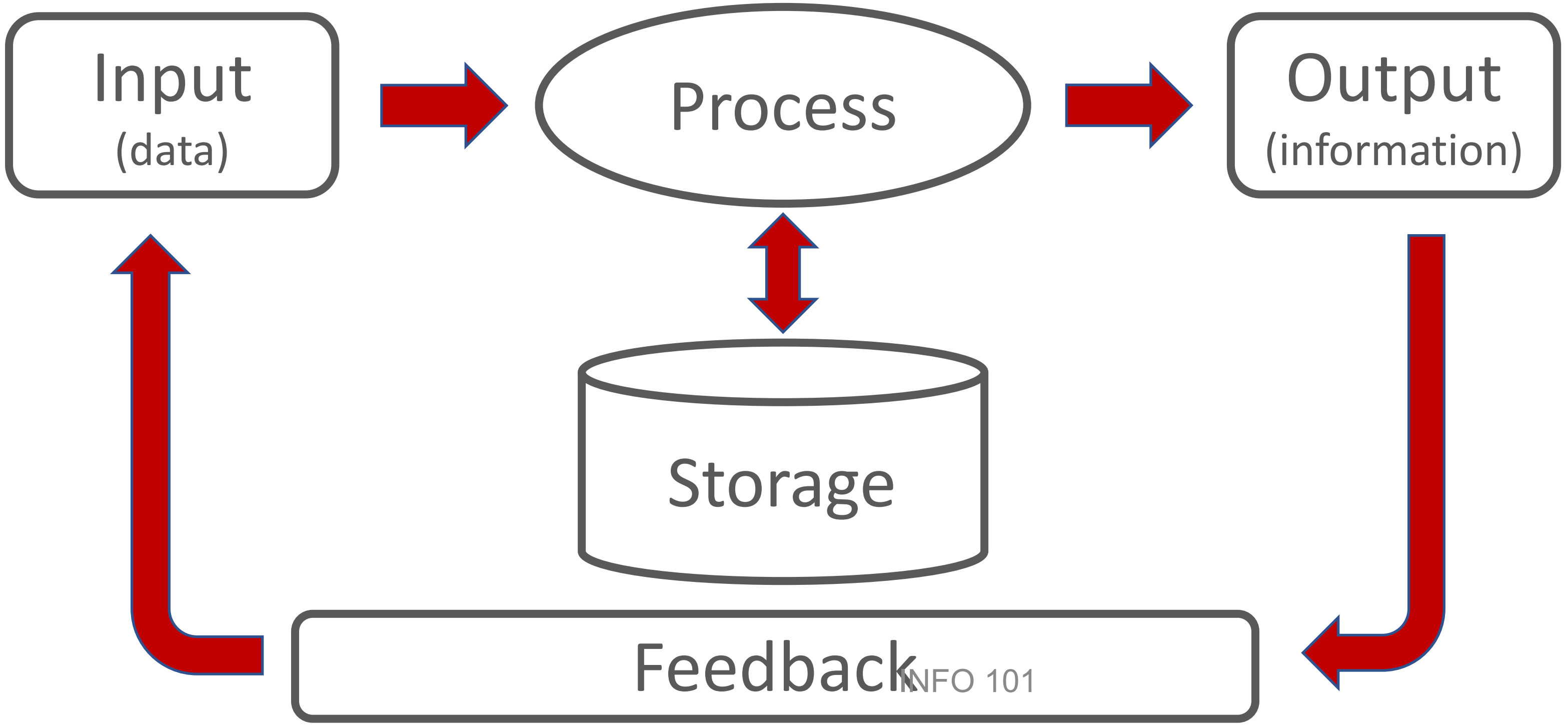
Information

- *„ ... is any entity or form that provides the answer to a question of some kind or resolves uncertainty."*



Feedback

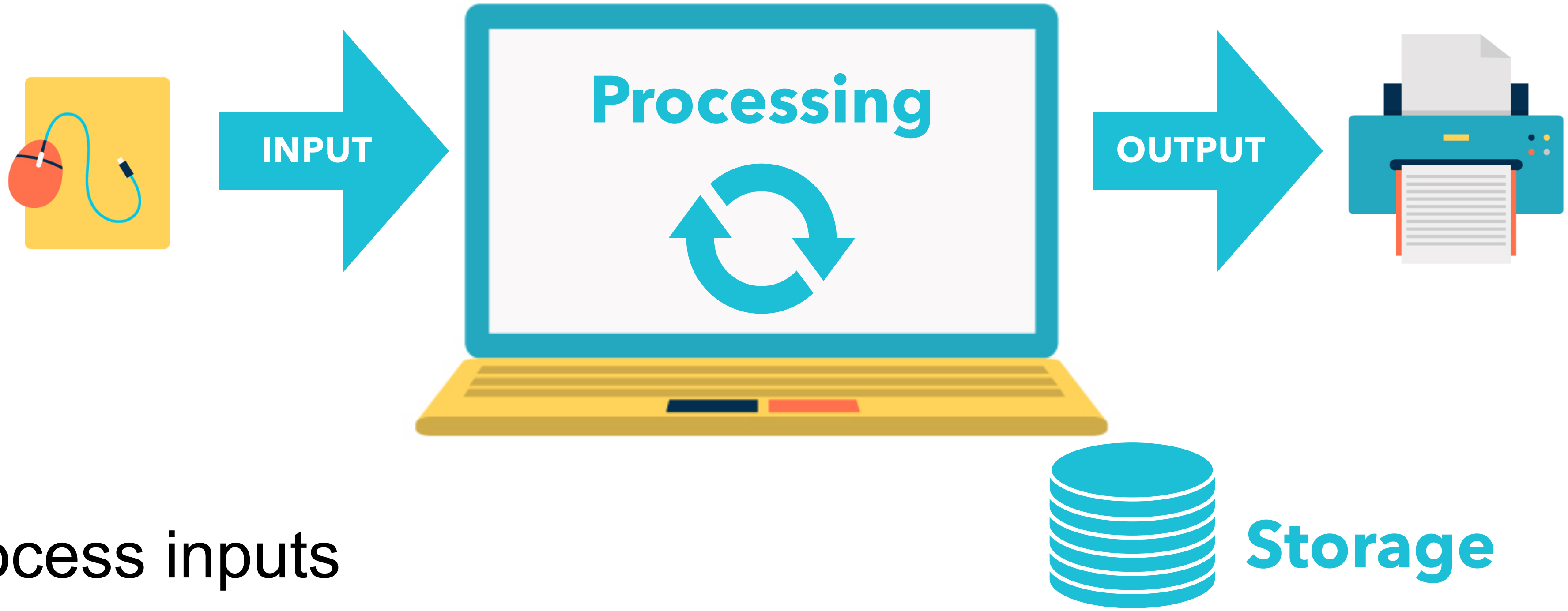
- Often necessary to refine questions in order to come up with a decision!
- Data processing is an iterative process



Example

- Want to withdraw money from your bank account at an ATM (automatic teller machine)
  - provide the computer with data (your account number) and instructions ("please report my balance")
  - computer processes your request and gives you information (your balance).
  - Based your balance, you decide whether to withdraw money or not (or the amount of money to withdraw)

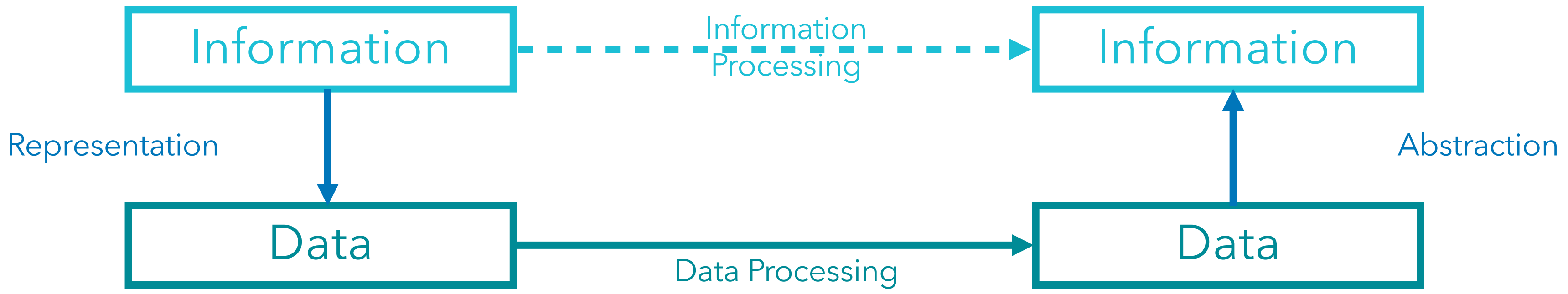
Task of a computer



- Process inputs
- Do calculations
  - Based on inputs and storage
- Generate output

Data in Computer Science

- A computer process information
- Information are stored in a computer as data
- Data are represented using 0 and 1
  - Binary system
- The representation has to assure that information can be gained back from processed data



Coding

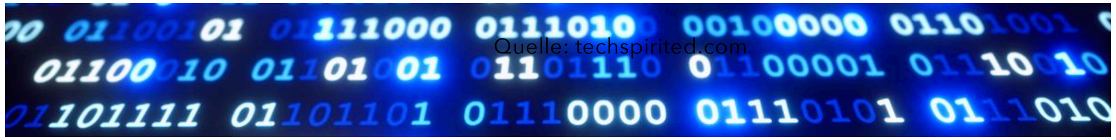
- Mapping of values from one domain (alphabet) into another
- Symbols are representations of values, concepts,...
  - Example: letters of an alphabet
- Alphabet is a set of characters
- Mapping has to be computable, reversible, and unique
- Coding is used for a particular purpose:
  - Storage, communication, compressing, cyphering,...

Binary numbers

Quelle: techspirited.com

- Smallest information unit = **bi**nary digi**t** (Bit)
  - Can be 1 or 0
  - Represents Yes/No, True/False,...
  - Number system of base 2
- This coding (binary code) represents information in a computer
- The coding itself has to be represented in the computer itself, e.g.:
  - Electrical charge(0 = not charged, 1 = charged)
  - Voltage (0 = 0V, 1 = 5V)
  - Magnetism (0 = not magnetized, 1 = magnetized)

Binary numbers

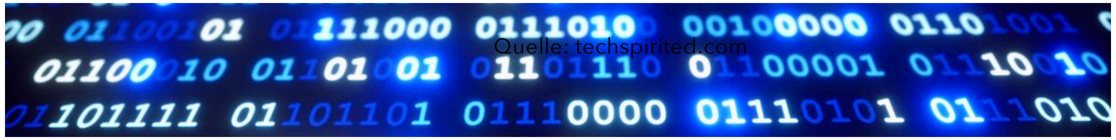


Quelle: techspirited.com

- In case of more than two states, one bit is not enough (e.g., geographics directions)
- Need a sequence of bits:
  - with n bits we are able to represent 2^n states

Number of bits	Number of states	Domain
1	2^1= 2	0 to 1
2	2^2= 4	0 to 3
3	2^3= 8	0 to 8
4	2^4= 16	0 to 15
5	2^5= 32	0 to 31
6	2^6= 64	0 to 65
7	2^7= 128	0 to 127
8	**2^8= 256**	**0 to 255**
16	2^{16}= 65 536	0 to 65 535
32	2^{32}= 4 294 967 296	0 to 4 294 967 295

Binary numbers



Quelle: techspirited.com

- In case of more than two states, one bit is not enough (e.g., geographics directions)
- Need a sequ
  - with n bits w

1 Byte = 8 Bit

Domain: 0 - 255

2 Bytes are also called Words

1 Kilobyte (KB) = 1000 Bytes

1 Megabyte (MB) = 10^6 Bytes

1 Gigabyte (GB) = 10^9 Bytes

1 Terabyte (TB) = 10^{12} Bytes

Numbe		
8	**2^8= 256**	**0 to 255**
16	2^{16}= 65 536	0 to 65 535
32	2^{32}= 4 294 967 296	0 to 4 294 967 295

Representing numbers

- Every number can be represented using:
  - A base (B), a digit (b), the digit's position (i)

$$n = \sum_{i=0}^{N-1} b_i \times B^i$$

DECIMAL

- ➤ Base: 10
- ➤ 10 digits: 0 to 9

Decimal number	2.position 100	1.position 10	0.position 1	Sum / number
208	2 * 10^2	0 * 10^1	8 * 10^0	200 + 0 + 8 = 208
59	0 * 10^2	5 * 10^1	9 * 10^0	0 + 50 + 9 = 59

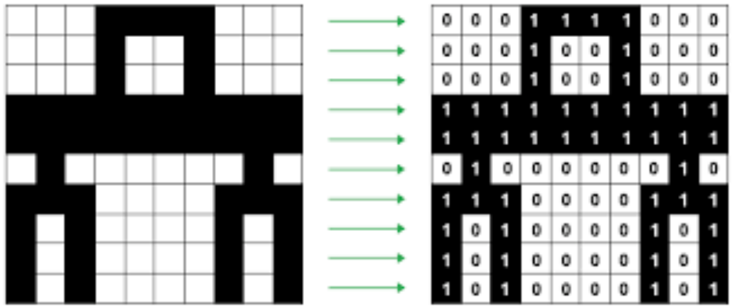
BINARY

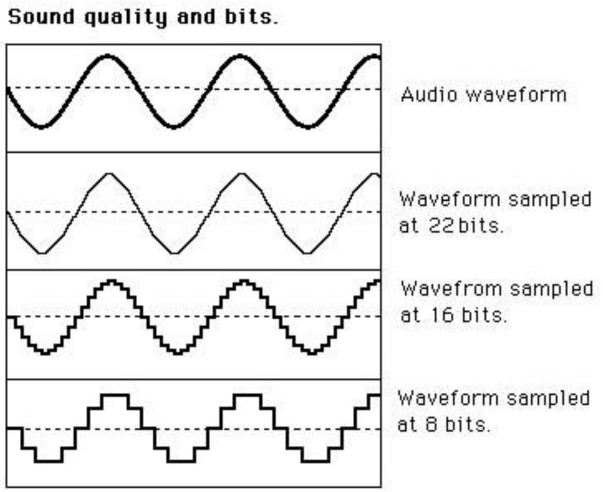
- ➤ Base: 2
- ➤ 2 digits: 0, 1

Binary number	2.position 4	1.position 2	0.position 1	Sum / number (decimal)
111	1 * 2^2	1 * 2^1	1 * 2^0	4 + 2 +1 = 7
10	0 * 2^2	1 * 2^1	0 * 2^0	0 + 2 + 0 = 2

Binary numbers

- With the binary system we can represent everything
  - text
  - images,
  - audio,…

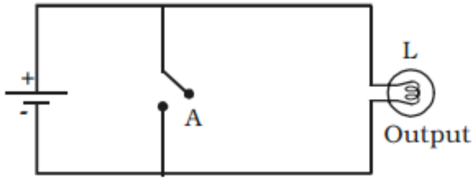


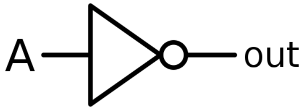


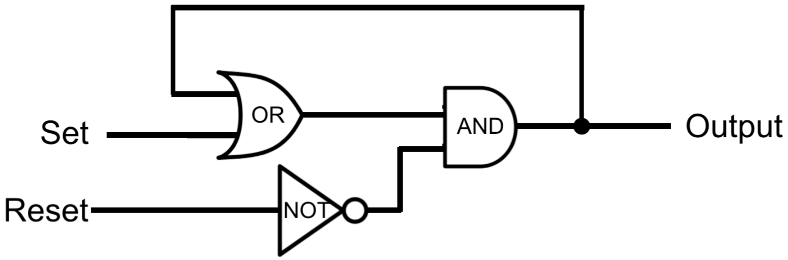
Quellen: www.learnitwithmrc.co.uk, stuffs4geek.blogspot.com/,www.sciencefriday.com

Binary numbers

- Binary coded data can be processed using arithmetic-logic unit in a computer
  - Examples: Add, Subtract, Increment, Decrement, ... Check for equivalence etc.

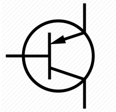






We will see more details soon!

Abstraction used in computing

Application programs	`Java, C`
Assembler programs	`add R1, R2`
Machine code	1010011_2
Register level	`Reg[2] := Reg[3]`
Gate level	$f = a \lor b$
Transistor level	

Information System Components

- Data
- Database
- Process
- Information
- System Life Cycle
- Environment
- Specifications

Information System Components

- **Data**
  - Data supports the **objectives of an organization** and is considered an **organizational asset**. Deciding what data is to be handled by the IS is perhaps the most significant aspect of system development. Since organizational goals change over time it is important that organizational data requirements be viewed as varying over time as well.
- **Database**
  - **Data must be stored** somewhere so that it is reliably available for future use. Databases which are commonly used for this purpose permit data storage to be transparent to the user and ensure **accuracy**, **integrity**, and **no data redundancy**.

Information System Components

- **Process**
  - Consideration must be given to what is done with the organization's data to convert it into information. It is essential to be aware of the organization's objectives to ensure what processing rules are appropriate for the desired result. Data processing follows rules as implemented in computer programs.
- **Information**
  - The main objective for an information system is to provide a fundamental base for decision making. People making decisions require information that is timely, integrated, accurate, and useful. The IS must be designed and constructed so as to ensure that these requirements are fulfilled. Information may be presented in several ways.

Information System Components

- **System Life Cycle**
  - Just like humans, each information system has a life cycle. An IS born as an initial concept is built and used until it is ultimately retired when no longer useful. The four phases of the Systems Life Cycle (SLC) are Conceptualization and Implementation, Growth, Maturity, and Decline.
- **Environment**
  - No information system acts alone. The people who depend upon its information output for decision making are part of a larger network of **stakeholders**. These questions must be asked and answered: How will the IS be used? Who will resist changes in technology? How will the IS change how work is done? What is to be done to protect privacy?

Stakeholders

- **Technical staff**
  - This group is responsible for the development of the new IS and is concerned with project schedules and resources available.
- **Clerical staff**
  - This group, usually the main users of the new IS, is often the most resistant to change. Typically a new system changes the way work is performed and change can cause anticipation and fear.
- **Managers**
  - These individuals receive the information typically generated by the system. Therefore, it is imperative to make sure that the reports are accurate and relevant.
- **Customers**
  - These stakeholders receive output from the IS and are quite concerned with its validity and efficiency. A bank customer, for example, receives a bank statement and expects that it is timely (once a month) and that all transactions are accurately reported.
- **Suppliers**
  - These stakeholders have many of the same concerns as customers. They conduct transactions with the organization and expect the transactions to be accurately recorded. A supplier expects to be paid correctly for products shipped to the business.
- **Investors**
  - This group has put up their money for the benefit of the business. They are entitled to be periodically appraised of the financial condition of the firm.
- **Regulators**
  - These stakeholders work in government agencies that have jurisdic-tion over business. Their need for accurate information should be obvious.

Information System Components

- **Specifications**
  - The specifications form a **contract** between the system developers and other stakeholders.

Classes of Information Systems

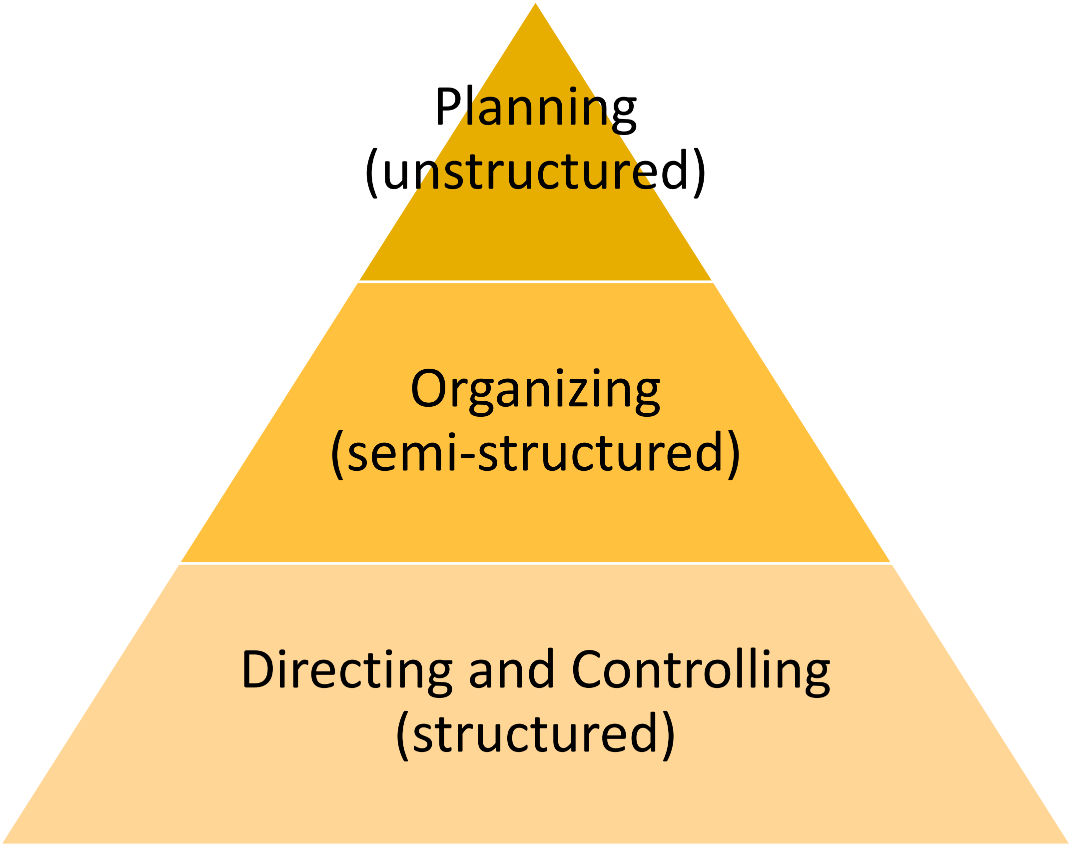
- **Electronic Data Processing** (EDP)
  - Computers are used to automate repetitive tasks
- **Management Information System** (MIS)
  - Prepare management control reports on a regularly scheduled basis.
- **Decision Support System (**DSS)
  - Supports higher level decision making. Often a DSS will integrate organizational data with models that are used to predict organizational outcomes.
- **Executive Information System (**EIS)
  - Extension of a DSS. Integration of external data (economic, industry specific, governmental) with organizational data. Decisions made with support of an EIS are often one time only decisions.

Classes of Decisions

- **Structured**
  - Well defined and often involves repetitive tasks; limited possible actions based on the output of such decision making.
- **Semi-structured**
  - May involve trend spotting and forecasting. Mathematical, statistical and other models are frequently used.
- **Unstructured**
  - More what-if oriented and deal mostly with the future. Human intuition is involved. Decisions are generally one time only.

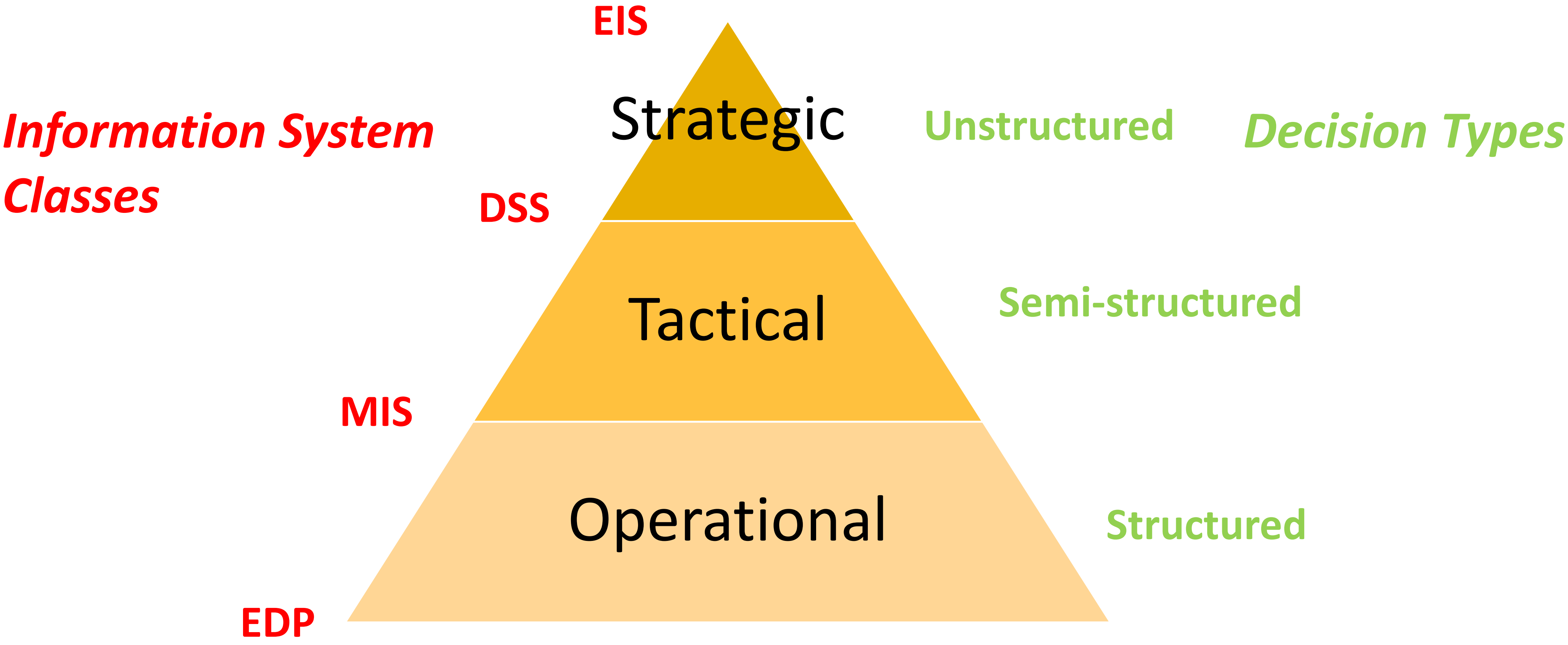
Management Levels and Decision Making

Types of Managers



Types of Decisions

Putting it all together



Computer Literacy

- Every worker handles computerized information!
- Computing devices are omnipresent (mobile phones!)
- Information technology is the main driver of change and also the main enabler
- Need to know how to work and interact with computers
  - Data gathering
  - Manipulation
  - Analysis
  - Presentation
- By **computer literacy**, we mean a broad understanding of the technology and its applications.

Security and Privacy

- Data / information is gathered and stored everywhere
- How to be sure that the stored data is accurate, not accessible from people without rights, and not altered in an unexpected way?
- How to be sure that communication is private?

- Assure that information cannot be accessed from someone else in an unwanted way!
  - Data used elsewhere
  - Data accessible from others

Information Systems cover a lot of topics!

- Internet and the World Wide Web (WWW)
- Hardware
- Software
- Data Communications and Networking
- System Analysis / Systems Engineering
- Computer Programming
- Data and Information, Database and SQL
- HTML, XHTML, and XML
- E-Commerce
- Security, Ethics, and Privacy
- Impact of Computers on Society
- Decision Support
- Future of Computing