

LESSON: HISTORY OF COMPUTERS

GRADE(S): 10-12 **TIME:** 1 class (90 min)

LESSON SUMMARY:

An introduction to the field of computer science meant to engage the student in the historical and economic components of the field with an emphasis on the hardware side. Computers are presented from their very beginning to date. The lesson ends with an overview of the creation of the Internet and WWW. Six fundamental computer science terms are discussed in/with the class.

LESSON OBJECTIVES:

Students will be able to:

- Understand 6 fundamental concepts of computer science in a historical context
- Understand the basic market mechanisms that put one computer company ahead of the others. (e.g IBM and Apple)

TOPIC(S):

STEM Careers
Technology & Education
Technology & Innovation

KEYWORDS:

Computer Science	OS (Operating
History	System
Internet	Algorithms &
WWW (World Wide Web)	Programming

LESSON MATERIALS:

- Power-point presentation
- During the discussions in class the students may benefit from:
- Internet connection and Search engine availability
- Quiz and key

COMPETENCIES:

- Problem Solving
- Cultural & Global Citizenship

LITERACY

LKU 2: Students use efficient and effective strategies to acquire, evaluate, and ethically use information.

NUMERACY

NKU 2: Students apply knowledge of spatial* information to make an informed decision.*Spatial information refers to the physical location of objects or people or the relationship between objects or people.

NKU 3: Students interpret, represent, and communicate in a variety of digital and non-digital formats to support decisions in situations involving numeracy.

LEARNING OUTCOMES

Unit/Topic: COURSE CSE1010: COMPUTER SCIENCE 1 Level: Introductory

General Learner Outcomes:

1. identify and describe the nature, approaches and areas of interest of computer science

Specific Learner Outcomes:

- 1.1 define and describe computer science with consideration of:
 - 1.1.1 the main goal of the discipline
 - 1.1.2 the use of algorithms
 - 1.1.3 computer systems used to test and/or implement algorithms
 - 1.1.4 the translation of algorithms through programming
- 1.2 describe the general areas of interest of computer science including:
 - 1.2.4 computer elements and architecture
 - 1.2.9 general development of information technology applications
- 1.3 compare and contrast computer science, computer engineering and information technology; e.g., theoretical versus applied, general versus specific, exploratory versus applicatory

1.4 describe some of the misconceptions associated with computer science; e.g., synonymous with programming, reliant on solitary individuals for the bulk of its advances, relatively little real-world contact, the learning of various computer applications

1.5 computer science's role in an information society

5 E's	Lesson Instructions & Times	Special Teacher Notes
<p>SUMMARY</p>	<p>85-90 minutes</p> <p>Engage your students by showing a 30 slides Power-Point presentation with 6 inquiry type questions and a 6 multiple choice questions quiz. The assessment can be more summative emphasizing the end of the lesson quiz or more formative checking for understanding using questions during the lesson.</p> <ol style="list-style-type: none"> 1. The history of computers lesson has embedded 6 questions strictly related to the curriculum. These questions are meant to be discussed, first without and then with technology, in groups, think/pair/share, or engaging the 	<p>We recognize the teacher might need time to present the course outline and other logistic issues. We estimate 5 minutes with some uncertainty.</p> <p>These questions related to the curriculum are critical. Make sure there is enough time allocated for their exploration, around 5 minutes each. Computer: a machine</p>

5 E's	Lesson Instructions & Times	Special Teacher Notes
	<p>entire class with the teacher as the facilitator. As a facilitator summarize the students' findings.</p>	<p>that can store, retrieve and process data and be instructed to carry out a sequence of arithmetic or logical operations automatically (based on a computer program). Actual standard computers include desktops, laptops and some advanced tablets. A web browser is an application, therefore it is a computer program and not a computer.</p>
<p>ENGAGE Hook Demonstration</p>	<p>5 min</p> <p>2. Begin the lesson by loading up the Powerpoint presentation. On the first slide the fundamental question shown is : What is a computer? Ask the following questions to prompt the students, including:</p> <ul style="list-style-type: none"> • Is the smart-phone a computer? • How about a fancy smart-watch? • What is the difference? <p>Extension questions to engage the students may include:</p> <ul style="list-style-type: none"> • How much you would pay for a computer? • How much would you pay for a word processor? • What are computers good for? <p>The students will answer in the context of 21st century. Controversy regarding what is a computer, what contains a computer and what can be programmed as a computer is expected. Most devices that contain a microprocessor are at least related to a computer.</p>	<p>Many devices are smart and can run programs without being standard computers, for example, a smartwatch or a smartphone. Looking up the question:"Is the smartphone a computer?" will reveal a yes answer. However, what is missing from these devices is the standalone programming capabilities. Finally, a lot of devices contain a computer but they are not a computer (e.g. an automobile or a dishwasher).</p>

5 E's	Lesson Instructions & Times	Special Teacher Notes
<p>EXPLAIN & ELABORATE</p> <p>Small group discussion Class discussion Content explanation Teacher presentation</p>	<p>5 min</p> <p>3. Continue the history lesson by taking the young minds back in 1940. Slides (Early Electronic Computers and ABC) will be presented. Mention there were times when building/owning a computer was an international achievement.</p>	<p>As this is an introductory class it will be somewhat less technical meant to engage the students in the subject. Suggested correct core answers are given as part of the lesson instructions.</p>
<p>EXPLORE</p> <p>Hands on activities Independent practice Group work</p>	<p>5 min</p> <p>4. The next critical question is: "What is a computer program?"</p> <p>5. Explore this question with the class in a think/pair/share and also use the Speaker's notes (PowerPoint Slides' Notes). It is expected the students will be allowed to search the concepts described in the questions using an Internet search engine as a way to elaborate and explain the questions, however ensure that students do not access this immediately when the question is posed. Offer time for students to inquire and come up with their own answers before doing a google search.</p>	<p>A computer program is a list of instructions that tell a computer what to do. Explore the curriculum related concepts in as much detail as desired. Historical material should be presented in an engaging fashion. The size of computers, the market mechanisms, the key chronological events are all necessary to set the stage for describing fundamental concepts in computer science. It is expected that the teacher might be familiar with some of the historical events while for the students these would be completely new.</p>

5 E's	Lesson Instructions & Times	Special Teacher Notes
		<p>In this lesson the content is not complex but a few fundamental ideas must be delivered to the students as per curriculum: computer, computer program, programming language, computer programmer, (encryption) algorithm, computer science.</p>
<p>EXPLAIN & ELABORATE</p> <p>Small group discussion Class discussion Content explanation Teacher presentation</p>	<p>2 min</p> <p>6. Present the ENIAC the world's first finished computer.</p>	<p>Use PowerPoint Speaker Notes.</p>
<p>EXPLORE</p> <p>Hands on activities Independent practice Group work</p>	<p>5 min</p> <p>7. What is a programming language? 8. Explore with the class, aware that a google search might clarify the question. Offer time for students to inquire and come up with their own answers before doing a google search and also use the Speaker's notes (PowerPoint Slides' Notes) for more specific facts regarding the question.</p>	<p>Explore the curriculum related concepts in as much detail as desired. Note that the way these questions are tied to the curriculum is not rigid. The teacher is free to address the questions in the PowerPoint in any way he/she thinks suited.</p> <p>Programming Language: a formal language, which comprises a set of instructions that produce various kinds of output. Most programming languages consist of instructions for computers.</p>

5 E's	Lesson Instructions & Times	Special Teacher Notes
<p>EXPLAIN & ELABORATE</p> <p>Small group discussion Class discussion Content explanation Teacher presentation</p>	<p>4 min</p> <p>9. Present the ENIAC as compared to ABC and the first women programmers. (5 min) What is a computer programmer?</p>	<p>As this is an introductory class it will be somewhat less technical meant to engage the students in the subject. Use PowerPoint Speaker Notes.</p>
<p>EXPLORE</p> <p>Hands on activities Independent practice Group work</p>	<p>5 min</p> <p>10. What is a computer programmer? 11. Explore with the class, aware that a google search might clarify the question. Offer time for students to inquire and come up with their own answers before doing a google search and also use the Speaker's notes (PowerPoint Slides' Notes) for more specific facts regarding the question.</p>	<p>Explore the curriculum related concepts in as much detail as desired. Here is an opportunity to connect to social sciences/ justice concepts.</p> <p>Computer Programmer: A person who writes programs for the operation of computers, especially as an occupation. It meant a lot more in the past in terms of hardware knowledge.</p>
<p>EXPLAIN & ELABORATE</p> <p>Small group discussion Class discussion Content explanation Teacher presentation</p>	<p>3 min</p> <p>12. Present World War II cryptography battle.</p>	<p>As this is an introductory class it will be somewhat less technical meant to engage the students in the subject. Use PowerPoint Speaker Notes.</p>

5 E's	Lesson Instructions & Times	Special Teacher Notes
<p>EXPLORE</p> <p>Hands on activities Independent practice Group work</p>	<p>5 min</p> <p>13. What is an encryption algorithm?</p> <p>14. Explore with the class, aware that a google search might clarify the question. Offer time for students to inquire and come up with their own answers before doing a google search and also use the Speaker's notes (PowerPoint Slides' Notes) for more specific facts regarding the question.</p>	<p>Explore the curriculum related concepts in as much detail as desired. Algorithm: A process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer.</p>
<p>EXPLAIN & ELABORATE</p> <p>Small group discussion Class discussion Content explanation Teacher presentation</p>	<p>15. Use the attached powerpoint to cover slides 13-30. Use teacher notes provided on slides for assistance. During this discussion, highlight market mechanism, innovation vs. successful business.</p>	<p>As this is an introductory class it will be somewhat less technical and meant to engage the students in the subject. Use PowerPoint Speaker Notes. Several historical events are presented. The teacher is expected to use inquiry and keep the connection with the students by asking questions periodically.</p>

5 E's	Lesson Instructions & Times	Special Teacher Notes
<p>EVALUATE</p> <p>Formative assessment</p>	<p>10 min</p> <p>16. This lesson comes with a 6 multiple choice question quiz for a quick assessment. The quiz might be delivered using Top Hat, Kahoot or a similar online test delivery system.</p>	<p>If possible, use a digital medium to provide the quiz on. (Top Hat or similar). If possible, use a digital medium to provide the quiz on. (Top Hat or similar).</p>
<p>CLOSURE</p> <p>*Connection to Phenomena/Guiding Question</p>	<p>End with the question: What is computer science?</p> <p>17. Explore with the class, aware that a google search might clarify the question. Offer time for students to inquire and come up with their own answers before doing a google search and also use the Speaker's notes (PowerPoint Slides' Notes) for more specific facts regarding the question..</p>	<p>Computer Science is the study of processes that interact with data and that can be represented as data in the form of programs. It enables the use of algorithms to manipulate, store, and communicate digital information</p> <p>This discussion will lead into the next lesson: Getting started with Python Programming</p>



History of Computers



What is a **computer**?



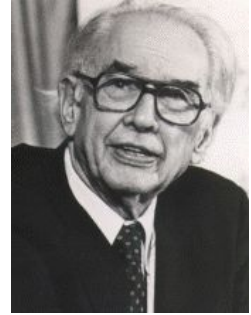
Early Electronic Computers

- The ABC
- The ENIAC
- The British code breaking computers
- Stored program computers



The ABC (**A**tanassoff **B**erry **C**omputer)

- John Atanasoff - A math/physics professor at Iowa State College (now Iowa State University)
- Clifford Berry –A graduate student studying under Atanasoff



What is a **computer program**?



The ENIAC - Electronic Numerical Integrator And Computer

- John William Mauchly -A Physics professor at Ursin College. Produced the top-level design of the ENIAC



- John Adam Presper "Pres" Eckert Jr. –A lab instructor at the Moore School -Designed the individual circuits of the ENIAC.



J. Presper Eckert

What is a **programming language**?



The ENIAC - Electronic Numerical Integrator And Computer

- Development costs in 1949 were \$500,000
- The machine:
 - Filled a room (x100 times bigger than comparable machines of the time)
 - Weighed 30 tons
 - Consumed 140,000 watts



The ABC And The ENIAC

- The ABC was the first prototype electronic computer (not quite completed): 1942.
- The ENIAC was the first fully, operational electronic computer (finished): 1949.
- Women primary computer programmers.



What is a **computer programmer**?



World War II Cryptography Battle



Alan Turing

The Allies

The Axis



Arthur Scherbius



Code Breaking British Bomb



Encoding/Encrypting German Enigma

What is an (encryption) algorithm?



Stored Program Computer (SPC)

- Relevance:

- It's a fundamental part of modern computers and many electronics
- Eliminated punch cards and punch tapes

- Origins?

- The answer is controversial

- The location where the idea was developed

- The Moore School (ENIAC)

- The person most commonly credited

- John Von Neumann




First SPC: The Manchester Machine

- People who worked at Bletchley Park during the war obtained jobs at Manchester University.
- In 1948 the Manchester machine was the first stored program computer
- The initial machine was limited in its capabilities:
 - The instruction set consisted of subtractions, conditional branches and a 'stop' instruction.

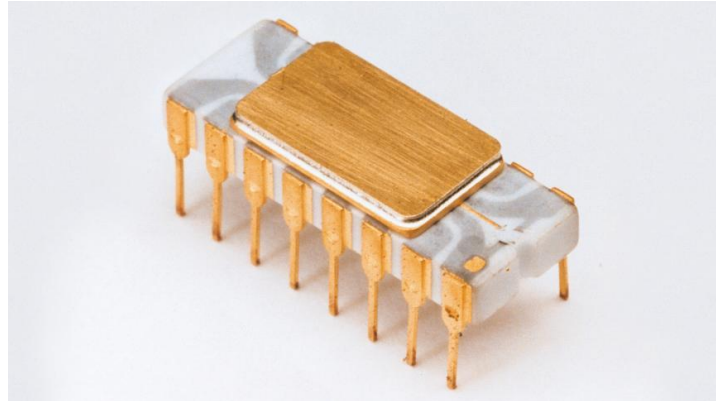


The Microcomputer

- The microprocessor breakthrough
 - The first microcomputer for home users: Altair
 - Microsoft and its influence on Microcomputers
 - The IBM PC (Personal Computer)
 - The Apple computers
 - The IBM PC clones and the rise of Microsoft as a software company
- 
- A decorative graphic in the bottom right corner consisting of a purple wavy line and a yellow four-pointed starburst.

The First Microprocessor

- Produced by Intel in the early 1970's
- Its development revolutionized computers by making them feasible for home-like environments.



The Altair Microcomputer

- The Altair is widely recognized as the spark that ignited the microcomputer revolution as the first commercially successful personal computer.
- Most computer users were very technical and programmed in assembly or binary codes.



Microsoft And The Microcomputer

- IBM approached two companies as possible vendors/developers of an operating system for their IBM PCs:
 - Digital Research
 - Microsoft
- Digital Research, uneasy about the conditions related to making such an agreement with IBM, initially refused.
- IBM and Microsoft worked out an arrangement to have a version of Microsoft's DOS (Disk Operating System) run IBM computers: PC-DOS

The IBM PC (Personal Computer: 1981)

- IBM was a large company but a late comer into the microcomputer market.
- The IBM PC used an operating system produced by Microsoft
- With the entry of IBM in the microcomputer market, many developers produced a plethora of software:
 - Word processing
 - Accounting software
 - Games
 - Spreadsheets



The IBM PC and Apple Computers

- Apple entered the microcomputer market sooner and already had an established market when IBM began to first market the PC. IBM
- Because of the prevalence of so much software the IBM PC soon overtook the Apple in sales.



Apple



Apple Computers

- Apple I Computer 1976
 - It was far from the standard of a modern computer
- Apple II Computer 1977
 - It was a simpler and more powerful design than the Altair
 - The color graphics were superior to larger and more expensive computers.
- Apple Lisa 1983
 - First Graphical Interface contrary to popular belief it was not invented by Apple. Xerox Star: pioneered the GUI in 1981
 - Like the Star, Lisa was expensive (\$10K) and sales were weak
- Apple Macintosh 1984
 - Similar to Lisa but was sold at a substantially lower price \$2.4K



The IBM PC Clones

- Although the IBM PC was marketed and sold under the IBM brand most of the parts were not manufactured in house.
- The parts manufacturers were free to sell their components to other companies.



The IBM PC Clones

- About the same time that the IBM PC was sold, three ex employees of Texas Instruments founded their own company: Compaq.
 - They conceived of the idea of producing their own copy of the IBM PC under their own brand name.
 - It would run under MS-DOS and be 100% compatible with applications software written for the PC.
 - The first IBM PC clone was delivered by Compaq in 1983.



IBM PC Clones

- The loser of the clone war was the hardware company IBM.
- The real winner of the clone war was the software company Microsoft.
- Challenges of running a hardware vs a software company must be noted
- By the 1990's Microsoft developed an interface for MS-DOS that incorporated some of the features of the MAC GUI.



ARPA and ARPANET- The Birth of Internet

- ARPA was a branch of the ministry of defense.
- The focus at ARPA was on getting different types of computers to communicate over a reasonable distance (km)
- The first computers were connected via ARPANET (Advanced Research Projects Agency Network).
- The initial ARPANET consisted of 2 host computers which were connected at the start of 1969 (birth of the early Internet!) from the following two locations:
 - UCLA
 - Stanford

ARPANET And The First Internet Message.

- Later additional hosts were added to the network (end of 1969) from:
 - The University of California (Santa Barbara)
 - The University of Utah
- Originally the message ‘login’ was to be transmitted.
- But the transmission stopped (i.e., it “died” after the first two characters) and thus ‘login’ the Internet was born!




Internet Technology Breakthroughs

- In 1972
 - The first e-mail application was developed by Ray Tomlinson.
- 1989:
 - In March 1989, Tim Berners-Lee laid out his vision for what would become the World Wide Web in a document called “Information Management: A Proposal”.
- 1990:
 - The ARPANET was shut down.
 - The first Internet search program Archie was developed at McGill university by Alan Emtage and Bill Heelan.
- 1991:
 - The World Wide Web was released to the public.


World Wide Web Milestones

- Recall the inception paper from 1989 by Tim Berners Lee
- Documents could be linked through a protocol called http(hyper text transfer protocol).
- Documents were made available for free browsing and downloading from the web (substantially easier than other alternatives).
- 1990:
 - The first web browser “WorldWideWeb” (later renamed ‘Nexus’) was written.
- 1993:
 - Mark Andreessen of NCSA (National Center for Super Computing) co-author of Mosaic, the first widely used Web browser; co-founder of Netscape

World Wide Web Impact

- Prior to the advent of the WWW the Internet was largely used by a highly specialized, technical group of users.
 - The advent of the WWW drastically changed that. People without strong technical backgrounds could and would use the WWW.
 - Now some people even equate the World Wide Web with the Internet itself!
- 
- A decorative graphic in the bottom right corner consisting of a yellow four-pointed starburst, a purple wavy line, and a yellow curved line.

Review

- Early Electronic Computers and their creators.
 - The microprocessor
 - What was the first computer targeting the home user
 - What was the influence of Microsoft on microcomputers
 - The history of the IBM PC
 - The foundation of Apple Computers
 - IBM architecture being taken over by the clones
 - Internet
 - WWW
- 
- A decorative graphic in the bottom right corner consisting of a purple wavy line and a yellow four-pointed starburst.

What is **computer science** ?

References

By All That's Interesting, A History Of The Internet And It's Invention, Available from <https://allthatsinteresting.com/internet-history>. Retrieved June 2019.

Tam J., Kremer R.,(2014), History of Computers, Department of Computer Science, University of Calgary. Available from: <http://kremer.cpsc.ucalgary.ca/courses/cpsc231/lectureNotes/history.pdf>, Retrieved June 2019.

Wikipedia: The Free Encyclopedia. Wikimedia Foundation Inc. Available from <https://en.wikipedia.org/> Retrieved June 2019.

A decorative graphic in the bottom right corner consisting of a yellow four-pointed starburst and a purple and yellow abstract shape.

QUIZ: HISTORY OF COMPUTERS KEY

1. Which of the following is true about an algorithm?
 - a) It is the same as a computer program.
 - b) It appeared after the first electronic computers.
 - c) Must be implemented using computer.
 - d) It is not a mathematical concept.
 - e) It is one of the fundamental ways of problem solving.**

2. Which of the following is true about a programming language?
 - a) One must be bilingual to learn a programming language.
 - b) A programming language is informal.
 - c) There are computer programmers who use more than 5 languages in a work day.**
 - d) The programming language such as C and Java were used with the early computers.
 - e) An object oriented language is not using specific data structures.

3. A computer programmer should not know which programming language:
 - a) JavaScript.
 - b) Python.
 - c) Turbo C##**
 - d) Java.
 - e) Rust.

4. The first stored program computer who could implement an algorithm is:
 - a) ABC
 - b) ENIAC
 - c) Manchester**
 - d) Apple
 - e) IBM

QUIZ: HISTORY OF COMPUTERS

5. Von Neumann computer architecture is characterized by:

- a) **The stored-program computer concept, where instruction data and program data are stored in the same memory.**
- b) Punch cards and later floppy-disks.
- c) Program data is stored outside the instruction data.
- d) A smaller memory than needed in other architectures.
- e) Too old to be applicable.

6. Some of the misconceptions about computer science are:

- a) it is synonymous with programming
- b) it is reliant on solitary individuals for the bulk of its advances
- c) it has relatively little real-world contact,
- d) it is synonymous with the learning of various computer applications
- e) **all of the above.**

QUIZ: HISTORY OF COMPUTERS KEY

1. Which of the following is true about an algorithm?
 - a) It is the same as a computer program.
 - b) It appeared after the first electronic computers.
 - c) Must be implemented using computer.
 - d) It is not a mathematical concept.
 - e) It is one of the fundamental ways of problem solving.
2. Which of the following is true about a programming language?
 - a) One must be bilingual to learn a programming language.
 - b) A programming language is informal.
 - c) There are computer programmers who use more than 5 languages in a work day.
 - d) The programming language such as C and Java were used with the early computers.
 - e) An object oriented language is not using specific data structures.
3. A computer programmer should not know which programming language:
 - a) JavaScript.
 - b) Python.
 - c) Turbo C##
 - d) Java.
 - e) Rust.
4. The first stored program computer who could implement an algorithm is:
 - a) ABC
 - b) ENIAC
 - c) Manchester
 - d) Apple
 - e) IBM

QUIZ: HISTORY OF COMPUTERS KEY

5. Von Neumann computer architecture is characterized by:
- a) The stored-program computer concept, where instruction data and program data are stored in the same memory.
 - b) Punch cards and later floppy-disks.
 - c) Program data is stored outside the instruction data.
 - d) A smaller memory than needed in other architectures.
 - e) Too old to be applicable.
6. Some of the misconceptions about computer science are:
- a) it is synonymous with programming
 - b) it is reliant on solitary individuals for the bulk of its advances
 - c) it has relatively little real-world contact,
 - d) it is synonymous with the learning of various computer applications
 - e) all of the above.

BACKGROUND: HISTORY OF COMPUTERS

DEFINITION

Algorithm: A process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer.

Computer: a machine that can be instructed to carry out sequences of arithmetic or logical operations automatically via computer programming.

Computer Science is the study of processes that interact with data and that can be represented as data in the form of programs. It enables the use of algorithms to manipulate, store, and communicate digital information.

Computer Program: a collection of instructions that performs a specific task when executed by a computer. Most computer devices require programs to function properly. A computer program is usually written by a computer programmer in a programming language.

Computer Programmer: A person who writes programs for the operation of computers, especially as an occupation.

Programming Language: a formal language, which comprises a set of instructions that produce various kinds of output. Programming languages are used in computer programming to implement algorithms. Most programming languages consist of instructions for computers.

LESSON STRATEGY

This lesson is suitable for a Grade 5-12 audience and requires no prerequisites. It is presenting milestones and details from the history of computers. It is important to note that this is not a comprehensive history of computer science lesson which would have to describe languages, operating systems, algorithms and computer architecture in details.

Starting with the primitive computers of the 1940s, the lesson progresses through the second world war computers with Alan Turing and the British Code Breaking Machines. The Stored Program Computer (SPC) is introduced as the last phase of pre-modern times.

The microprocessor inaugurates the modern era of computers. The first microprocessor was introduced by Intel in the 1970s. This led to the development of the personal computers. The influence of Microsoft is discussed in this context and the history of Apple Computers is mentioned in contrast. The effect of IBM PC clones on the market is remembered and it is explained how it benefited Microsoft. Some simple market mechanisms are described to captivate and inform the students.

The "birth" of Internet known in 1969 as the ARPANET is the next topic presented. The lesson on the history of the computers is ended with the emergence of the World Wide Web.

In summary, a computer history overview is given to the students starting from its humble beginnings to advanced networking.

Sources:

Tam, J. and Kremer, R. (2014). History of Computers. Retrieved from <http://kremer.cpsc.ucalgary.ca/courses/cpsc231/lectureNotes/history.pdf>

Wikipedia: The Free Encyclopedia. Wikimedia Foundation Inc. Available from <https://en.wikipedia.org/> Retrieved June 2019.