**Computing as science?**

**Warm-up!**

You will be listening to a short material (3'30'') revolving around the question:

"What is computer science?"

Select one perspective on Computer Science that you find relevant and share it with us.

Brainstorming

Think again about what you know/ what you have just heard.

How would you complete the following statement: "Computer Science is NOT..." Pin some answers on the discussion board (or Class Notebook)

Pre-reading

A. You will be reading a text on the evolution of Computing.   
Before tackling the text, think about an appropriate answer to the following questions :

1. Could you name a milestone in the evolution of computing?
2. In your view, is computer science predominantly a *mathematical, engineering* or *scientific discipline?*
3. Would you say that today computing is shaped by the interaction with or implementation in other fields?

B. Below you will find a few important events in the long history of computer science.

Try to guess in which order these events took place, then read the text to check your choices.

A) the term computing is taken as standard to refer to the core disciplines of computer science, information processing, software engineering, etc. ;

B)Turing and his contemporaries used a mathematical model to define computation;

C) new subfields of applied computing like computer architecture, cybersecurity, mobile technology or GPU emerge;

D) the US and commission projects to build the first digital computers;

F) computational science shifts the focus away from the computer as object of attention;

G) academia starts offering computer science programmes;

**Timeline here:**

Reading practice:

**A.** Computing is a relatively young discipline. It started as an academic field of study in the 1930s with a cluster of remarkable papers by Kurt Gödel, Alonzo Church, Emil Post and Alan Turing. The papers laid the mathematical foundations that would answer the question “what is computation?” and discussed schemes for its implementation. These men saw the importance of automatic computation and sought its precise mathematical foundation.

**B.** At the time that these papers were written, the terms “computation” and “computers” were already in common use, but with different connotations from today. Computation was taken to mean the mechanical steps followed to evaluate mathematical functions; computers were people who did computations. In recognition of the social changes they were ushering in, the designers of the first digital computer projects all named their systems with acronyms ending in “-AC”, meaning automatic computer—resulting in names such as ENIAC, UNIVAC and EDSAC.

**C.** At the start of the World War II, the militaries of the United States and the United Kingdom became interested in applying computation to the calculation of ballistic and navigation tables and to the cracking of ciphers and commissioned projects to build electronic digital computers.

**D.** During its youth, computing was an enigma to the established fields of science and engineering. At first, computing looked like only the applied technology of math, electrical engineering or science, depending on the observer. However, over the years, computing provided a seemingly unending stream of new insights, and it defied many early predictions by resisting absorption back into the fields of its roots. By 1980 computing had mastered algorithms, data structures, numerical methods, programming languages, operating systems, networks, databases, graphics, artificial intelligence and software engineering. Its great technological achievements—the chip, the personal computer and the Internet—brought it into many lives. These advances stimulated more new subfields, including network science, Web science, mobile computing, enterprise computing, cooperative work, cyberspace protection, user-interface design and information visualization. The resulting commercial applications have spawned new research challenges in social networks, endlessly evolving computation, music, video, digital photography, vision, massive multiplayer online games, user-generated content and much more.

**E.** The name of the field has changed several times to keep up with the flux. In the 1940s it was called *automatic computation* and in the 1950s, *information processing*. In the 1960s, as it moved into academia, it acquired the name *computer science* in the U.S. and *informatics* in Europe. By the 1980s computing comprised a complex of related fields, including computer science, informatics, computational science, computer engineering, software engineering, information systems and information technology. By 1990 the term *computing* had become the standard for referring to this core group of disciplines.

**F.** Traditional scientists frequently questioned the name *computer science*. They could easily see an engineering paradigm (design and implementation of systems) and a mathematics paradigm (proofs of theorems) but they could not see much of a science paradigm (experimental verification of hypotheses). Moreover, they understood science as a way of dealing with the natural world, and computers looked suspiciously artificial.

**G.** An important aspect of all definitions surround the field of computing was the positioning of the computer as the object of attention. The computational-science movement of the 1980s began to step away from that notion, adopting the view that computing is not only a tool for science, but also a new method of thought and discovery in science. The process of dissociating from the computer as the focal point came to completion in the late 1990s when leaders in the field of biology—epitomized by Nobel laureate David Baltimore and echoing cognitive scientist Douglas Hofstadter—said that biology had become an information science and DNA translation is a natural information process.

**H.** Scientists in other fields have come to similar conclusions. They include physicists working with quantum computation and quantum cryptography, economists working with economic systems, and social scientists working with networks. They have all said that they have discovered information processes in their disciplines’ deep structures. Computing as a field has come to exemplify good science as well as engineering. It is now seen as a broad field that studies information processes, natural and artificial.

Adapted from Peter J. Denning, The great principles of computing, *American Scientist*, Issue Sept-Oct., 2010, p. 369.

For the original version, see <https://www.americanscientist.org/article/the-great-principles-of-computing>.

1. **Look at the following statements and decide which is true (T) or false (F), based on information from the text.**
2. The computational science movement shifted the focus away from the computer as object of attention.
3. Turing and his contemporaries used a mathematical model to define computation.
4. For nearly four decades, despite its astounding progress, computing remained an enigma to the outsiders of the scientific fields of engineering and the general public.
5. The term informatics was questioned by traditional scientists as it didn’t echo a scientific paradigm.
6. The forerunners of today’s digital computer were automatic computers.
7. By the 1980s, computing still overlapped greatly with mathematics and electrical engineering.
8. The interest in the commercial applications of technology hampered research progress.
9. Scientists from various disciplines came to acknowledge the importance and usefulness of information processes in their own fields.
10. Starting from the 60s, academic departments were formed to gather faculty and offer new programmes of study in the field of computing.

**2. In your opinion, which of the following statements summarizes the text? Give an argument for your choice.**

1. The pervasiveness of computing in all fields of science is unquestionable.
2. Computing is no more about computers than astronomy is about telescopes.
3. Computing is the new great domain of science.

SPEAKING

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| You are a designated speaker on behalf of your University at the IBM i Community Summit. You are attending the Young Programmers Roundtable and you were invited to give a short talk about a powerful event/ learning experience which has shaped your understanding of the area of Computer Science.    You may consider the following protocol for your storyboard:  Background information - Event- Reflection on event (possible change in worldview) - Conclusion    Make sure to answer the question” What made this event different from others and how it shaped my understanding of the field?” |

**Language work**

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| **Useful vocabulary and Collocations (words that go together of form fixed relationships)** |
| Cluster (of papers)  Lay foundations (for) / Seek a foundation for  To usher (a change)  Acronym  Insights (to provide)  To spawn (research challenges)  To keep up with the flux  Core (group of)  To hamper  Pervasive(ness) |

**1. Review the vocabulary items above and fill in the blanks with the most appropriate term. Some vocabulary items may be used in two separate contexts.**

1. The CineForm codec has been in development for a long time, overseeing many innovations in the video production market as it ......... transition from standard definition to HD.

2. They planned to enter the overseas business market of telecom service providers after ..... in the domestic home market.

3. Qualitative coding data makes your analysis more systematic and rigorous and enables you to find ........ that are truly representative of your data.

4. Social network analysis is applied to determine ........ of similar venues, interdisciplinary venues and high prestige venues.

5. It has been suggested that traditional methods using individual comparisons cannot ....... of specimens and data needed for data mining approaches to materials optimization.

6. A ....... is a group of inter-connected computers that work together to perform computationally intensive tasks

7. Since the establishment of information architecture as an area of expertise and research, its community of practitioners has been .......... to establish concepts, scope, relations with other disciplines.

8. To make communication more streamlined, the field of computer science has become an ...... -laden jargon which may seem incomprehensible if you are a beginner.

9. The ....... of social media negatively affected the study abroad experience transforming it into a mobile phenomenon.

10. The advent of cheap 3D printers has encouraged a culture of shared design and open innovation and ......... a movement towards open-source hardware.

11. The chip shortage is ....... Microsoft Surface and Microsoft OEM revenue, reflecting a significant 20% drop compared to this time in 2020.

12. Process ...... is a technique in which OS creates a child process by the request of another process.

13. In addition to its ...... areas, the curriculum also includes focus areas of cybersecurity, search and retrieval and more active, practical learning such as Capstones, internships, service learning and independent study.

14. Hyperthreading makes a single processor ...... work like two CPUs by providing two data and instruction streams.

15. ...... computing, also called ubiquitous computing, is the growing trend of embedding computational capability (generally in the form of microprocessors) into everyday objects to make them effectively communicate and perform useful tasks.

**Academic Skills - Accountable talk**

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| Maximising the benefits of classroom talk goes beyond just organising for talk opportunities. The quality of the talk is important. Accountable talk refers to the type of talk that moves learning forward.  There are three aspects of accountable talk that you may need to remember:   * Accountability to knowledge * Accountability to the (learning) community * Accountability to rigorous thinking.   A focus on accountability to accurate knowledge highlights the importance of including correct information in a discussion.  A focus on accountability to the learning community ensures that talk participants make efforts to help others in the group understand. Helping others to understand involves paraphrasing, re-phrasing, using examples, active listening and building upon the contributions of others.  Finally, a focus on the accountability to rigorous thinking promotes logical thinking, reasoning and the ability to explain thinking. |

**Organising information - the *Argument – Counterargument* structure**

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| When you speak/write in academic contexts you make an **argument:** you propose a thesis and offer some reasoning, using evidence, that suggests why the thesis is true. When you **counter-argue**, you consider a possible argument *against* your thesis or some aspect of your reasoning.  Using the **argument-counterargument structure** can be a persuasive tactic. It allows you to anticipate doubts and pre-empt objections that a skeptical reader might have; it presents you as the kind of person who weighs alternatives before arguing for one, who confronts difficulties instead of sweeping them under the rug, who is more interested in discovering the truth than winning a point.  This is a good way to test your ideas when drafting, while you still have time to revise them.  Not every objection is worth entertaining, of course, and you shouldn't include one just to include one. |