مفهوم التفكير الحاسوبي ومهاراته

Computational Thinking and its Skills

تقديم

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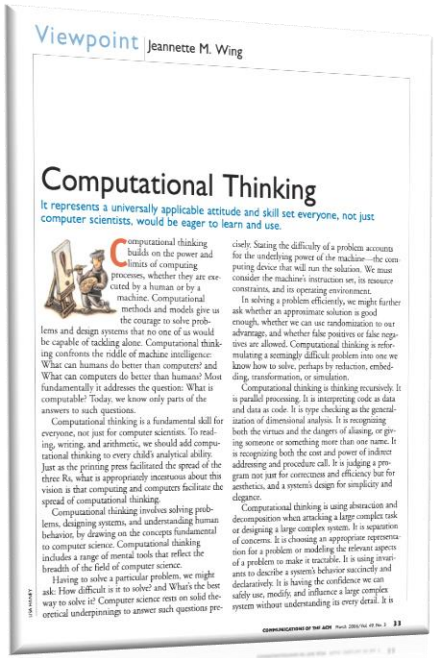
ظهور مصطلح: (التفكير الحاسوبي)



Viewpoint | Jeannette M. Wing

Computational Thinking

It represents a universally applicable attitude and skill set everyone, not just computer scientists, would be eager to learn and use.

Computational thinking builds on the power and limits of computing processes, whether they are executed by a human or by a machine. Computational methods and models give us the courage to solve problems and design systems that no one of us would be capable of tackling alone. Computational thinking confronts the riddle of machine intelligence: What can humans do better than computers? and What can computers do better than humans? Most fundamentally it addresses the question: What is computable? Today, we know only parts of the answers to such questions.

Computational thinking is a fundamental skill for everyone, not just for computer scientists. To reading, writing, and arithmetic, we should add computational thinking to every child's analytical ability. Just as the printing press facilitated the spread of the three Rs, what is appropriately incentuous about this vision is that computing and computers facilitate the spread of computational thinking.

Computational thinking involves solving problems, designing systems, and understanding human behavior, by drawing on the concepts fundamental to computer science. Computational thinking includes a range of mental tools that reflect the breadth of the field of computer science.

Having to solve a particular problem, we might ask: How difficult is it to solve? and What's the best way to solve it? Computer science rests on solid theoretical underpinnings to answer such questions precisely. Stating the difficulty of a problem accounts for the underlying power of the machine—the computing device that will run the solution. We must consider the machine's instruction set, its resource constraints, and its operating environment.

In solving a problem efficiently, we might further ask whether an approximate solution is good enough, whether we can use randomization to our advantage, and whether false positives or false negatives are allowed. Computational thinking is reformulating a seemingly difficult problem into one we know how to solve, perhaps by reduction, embedding, transformation, or simulation.

Computational thinking is thinking recursively. It is parallel processing. It is interpreting code as data and data as code. It is type checking as the generalization of dimensional analysis. It is recognizing both the virtues and the dangers of aliasing, or giving someone or something more than one name. It is recognizing both the cost and power of indirect addressing and procedure call. It is judging a program not just for correctness and efficiency but for aesthetics, and a system's design for simplicity and elegance.

Computational thinking is using abstraction and decomposition when attacking a large complex task or designing a large complex system. It is separation of concerns. It is choosing an appropriate representation for a problem or modeling the relevant aspects of a problem to make it tractable. It is using invariants to describe a system's behavior succinctly and declaratively. It is having the confidence we can safely use, modify, and influence a large complex system without understanding its every detail. It is

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Wing's Vision

"Computational thinking will be a fundamental skill used by everyone in the world by the middle of the 21st century."

ما هو التفكير الحاسوبي

- وسيلة لصياغة الأفكار واستخدام أجهزة الكمبيوتر لحل المشاكل (Papert، 1996).
- "حل المشكلات وتصميم النظم وفهم السلوك الإنساني، من خلال الاعتماد على المفاهيم الأساسية لعلوم الحاسب الآلي" (Wing، 2006، 33.p).
- "... إعادة صياغة مشكلة تبدو صعبة إلى مشكلة نعرف كيف نحلها..." (Wing، 2006، 33.p).
- كطريقة "لمعالجة المعلومات بشكل منهجي وصحيح بكفاءة" لحل المشكلات المعقدة (Lu & Fletcher، 2009، 261.p).

ما هو التفكير الحاسوبي

- **CT is a problem-solving process that includes (but is not limited to) the following characteristics:**
  - Formulating problems in a way that enables us to use a computer and other tools to help solve them
  - Logically organizing and analyzing data
  - Representing data through abstractions, such as models and simulations
  - Automating solutions through algorithmic thinking (a series of ordered steps)
  - Identifying, analyzing, and implementing possible solutions with the goal of achieving the most efficient and effective combination of steps and resources
  - Generalizing and transferring this problem-solving process to a wide variety of problems." (CSTA & ISTE, 2011, p. 7)

مهارات التفكير الحاسوبي ومفاهيمها

نظرة العلماء و المتخصصين
حول التفكير الحاسوبي

مهارات حياتية

عدد من المهارات والممارسات والأساليب الفكرية الأساسية -قابل للتطبيق على جميع التخصصات- التي تساعد على حل المشكلات المعقدة

(Barr & Stephenson, 2011; Conery et al., 2011; Furber, 2012; Lu & Fletcher, 2009; Wing, 2008; Wing, 2006).

مهارات التفكير الحاسوبي ومفاهيمها

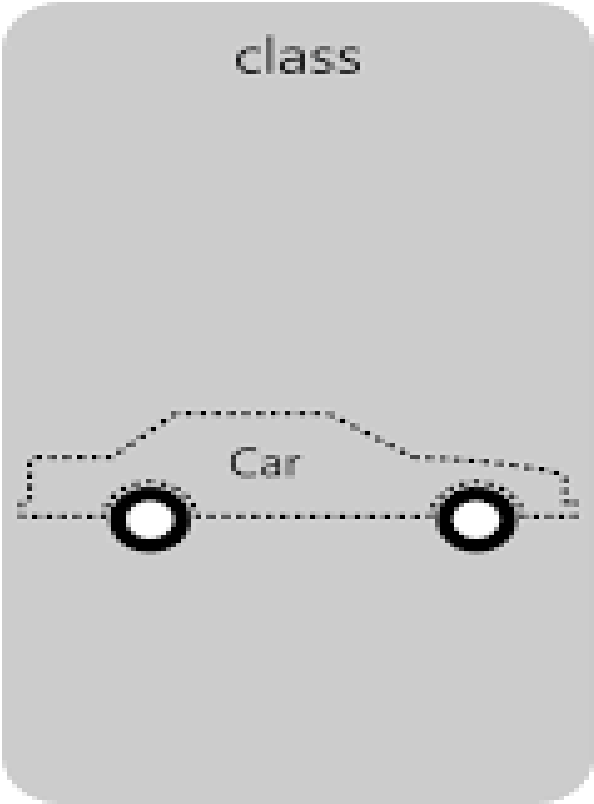
- التقسيم او التفكيك (Decomposition)
- التجريد (Abstraction)
- تصميم الخوارزميات (Algorithms Design)
- الاتمتة (Automation)

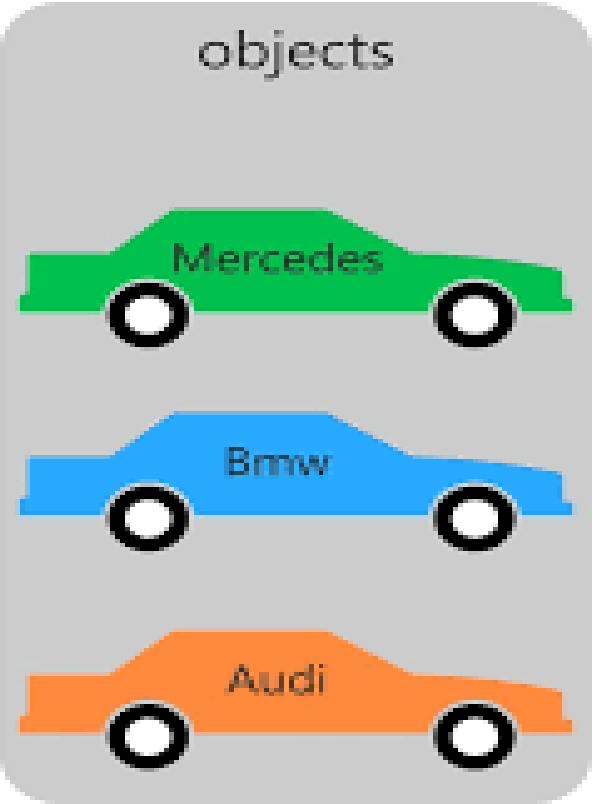
- جمع البيانات (Data Collection)
- تحليل البيانات (Data Analysis)
- تمثيل البيانات (Data Representation)

- المحاكاة (Simulation)
- التوازي (Parallelization)
- التعميم (Generalization)

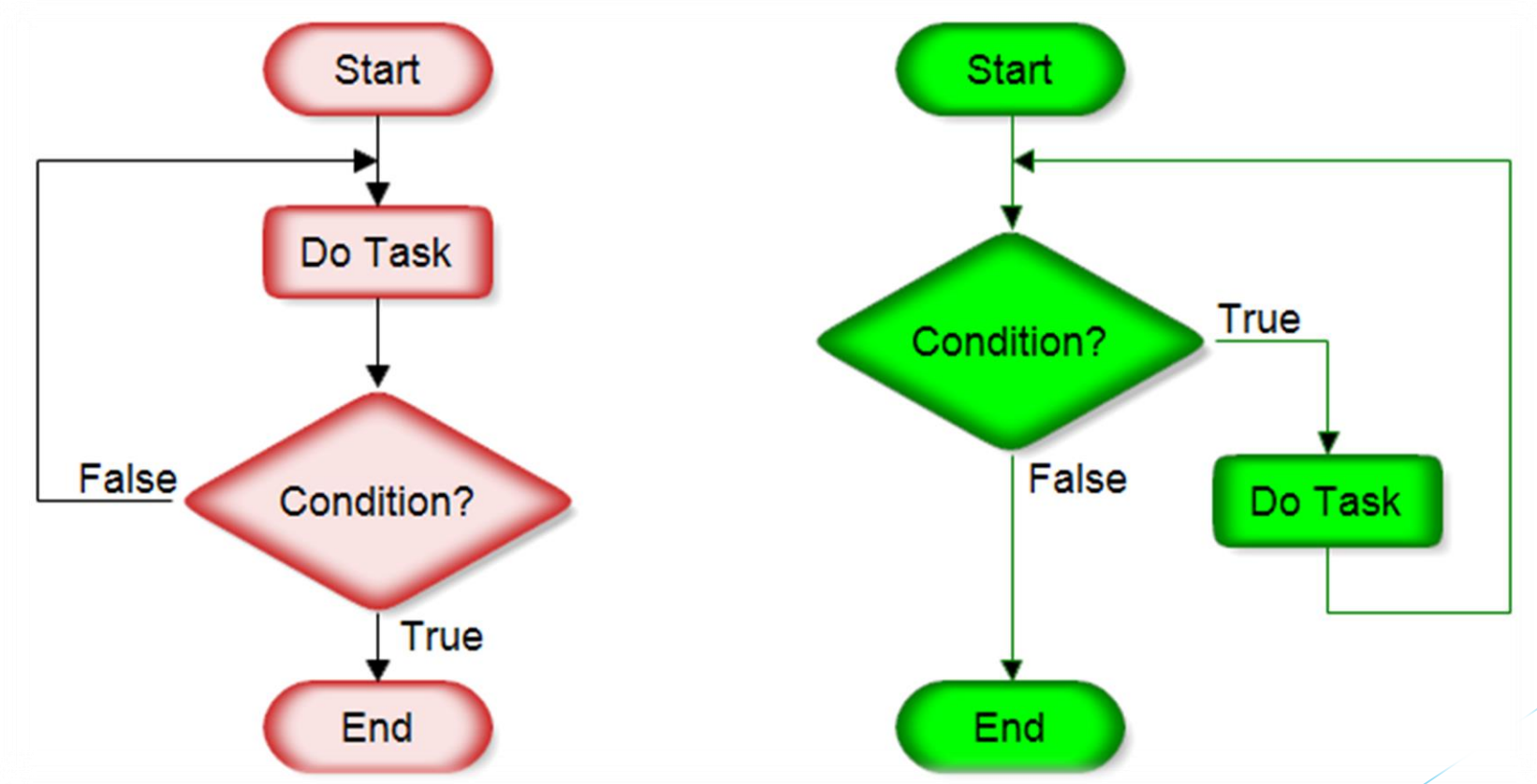
التقسيم او التفكيك (Decomposition)

التجريد (Abstraction)

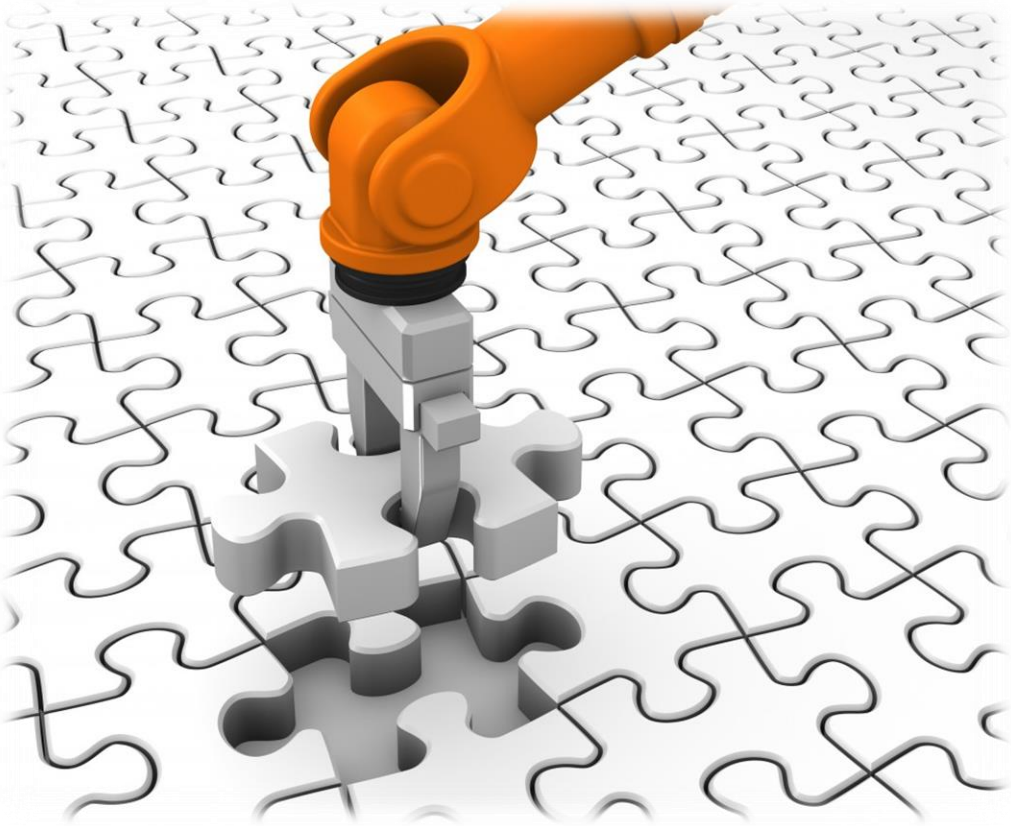




تصميم الخوارزميات (Algorithms Design)



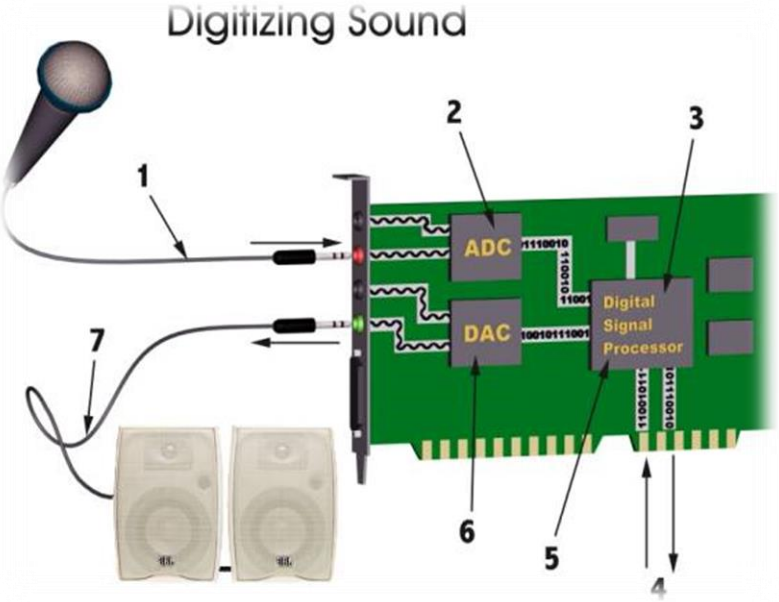
الأتمتة (Automation)



جمع البيانات (Data Collection)

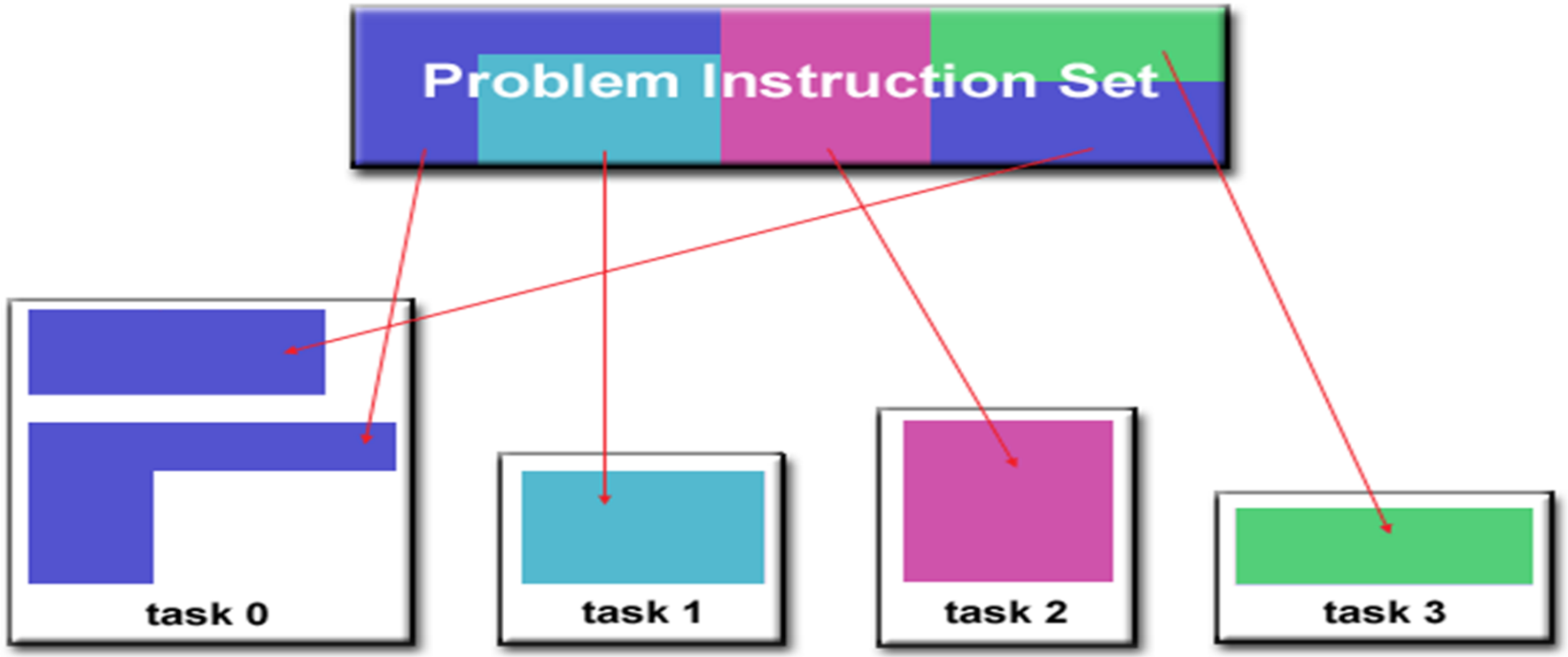
تحليل البيانات (Data Analysis)

تمثيل البيانات (Data Representation)



المحاكاة (Simulation)

التوازي (Parallelization)



التعميم (Generalization)

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Thank You

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