What is computer science?

Is it the study of computers ?

- This leaves aside the theoretical work in CS, which does not make use of real computers, but of formal models of computers

- A lot of work in CS is done with pen and paper

- Actually, the early work in CS took place before the development of the first computer

- *Computer Science is no more about computers than astronomy is about telescopes, biology is about microscopes, or chemistry is about test tubes. Science is not about tools; it is about how we use them*

What is computer science?

Is it the study of how to write computer programs (programming) ?

- Programming is a big part of CS
  - but it is not the most important part

Is it the study of the uses and applications of computers and software ?

- Learning to use software packages is no more a part of CS than driver's education is part of automotive engineering
- CS is responsible for building and designing software

What is computer science?

- The study of principles, applications, and technologies of computing and computers

- It involves the study of:

    - data and data structures and the algorithms to process these structures

    - principles of computer architecture-both hardware and software

    - problem-solving and design methodologies

    - computer-related topics such as numerical analysis, operations research, AI, language design and translation techniques

What is **computer science**?

- The study of *algorithms*:
  - their formal properties
    - correctness, limits
    - efficiency/cost
  - their hardware realizations
    - computer design
  - their linguistic realizations
    - programming languages
  - their applications
    - network design, ocean modeling, bioinformatics, ...

What is **computer science**?

- A discipline that spans theory and practice

- It requires thinking both in abstract terms and in concrete terms

- Getting computers to do what you want them to do requires intensive hands-on experience

- But computer science can be seen on a higher level, as a science of problem solving

What is **computer science**?

- Computer scientists must be adept at modeling and analyzing problems
- They must also be able to design solutions and verify that they are correct
- Problem solving requires precision, creativity, and careful reasoning
- Computer science also has strong connections to other disciplines

What is an algorithm?

- A well-defined procedure that allows to solve a problem
- A finite set of instructions (steps) for solving a problem
  - must terminate
  - must be deterministic (unambiguous)
  - must be precise (solve the problem)
  - must be complete
  - must terminate
  - be executable (understandable)

Examples

- Cooking a dish
- Making a sandwich
- Shampooing hair
- Programming a VCR
- Making a pie
- Count number of students

Examples

Is this an algorithm?

- Step 1: Wet hair
- Step 2: Lather
- Step 3: Rinse
- Step 4: Repeat

Writing an algorithm

- May be in a number of different formats
  - natural language (such as English)
  - a specific programming language
  - a diagram, such as a flow chart
  - pseudocode - a mix of natural and programming languages

Example

- Problem: Adding two n-digit numbers

  7597831 +
  1287525

     8885356

  Write an algorithm to solve this problem
  Assume the basic operation is adding one-digit numbers

Types of Operations

- Basic operations
  - Wet hair
  - Rinse
  - Turn on VCR

- Conditional operations
  - If batter is too dry add water

- Repeat/looping operations
  - Repeat step 1 and 2 three times
  - Repeat steps 2,3,4,…10 until batter becomes soft