Computer Science Guidance

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About the course

- Assessment mode:

  Attendance+ Seminar + Exercise

  30%+ 50% + 20%
- Others:

  1. Keep silent in class

  2. Not be later.

About the course

- Division

You are divided into five groups and given problems to discuss twice. Each group selects out a leader responding to contact to me. My email: jh_zhang@hdu.edu.cn.

I will give you questions. Each group discusses the questions and gives the answers to the questions after class. You will be request to show the answers in next class.

About the course

Computer Science Guidance

Instead of

Introduction to Computer Science or

Computer Science: An Overview.

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Guidance: Know what you will study in the coming four years.

The First Group of Questions

- What is your future study direction in college?
- What courses do you suppose to learn?
- How to schedule the time to learn the courses well?
- What are computer, algorithm, programming and software?

The answers of each group are requested to shown in class on 17th, Oct., and then send them to my email.

Chapter 0: Introduction

Reference: J. Glenn Brookshear, Dennis Brylow. Computer Science: An Overview (Eleventh Edition). Pearson Education Inc., 2013.

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Chapter 0: Introduction

- 0.1 The Role of Algorithms
- 0.2 The Origins of Computing Machines
- 0.3 The Science of Algorithms
- 0.4 Abstraction
- 0.5 An Outline of Our Study
- 0.6 Social Repercussions

Terminology

- **Algorithm:** A set of steps that defines how a task is performed
- **Program:** A representation of an algorithm
- **Programming:** The process of developing a program
- **Software:** Programs and algorithms
- **Hardware:** Equipment

Figure 0.1 An algorithm for a magic trick

Effect: The performer places some cards from a normal deck of playing cards face down on a table and mixes them thoroughly while spreading them out on the table. Then, as the audience requests either red or black cards, the performer turns over cards of the requested color.

Secret and Patter:

Step 1. From a normal deck of cards, select ten red cards and ten black cards. Deal these cards face up in two piles on the table according to color.

Step 2. Announce that you have selected some red cards and some black cards.

Step 3. Pick up the red cards. Under the pretense of aligning them into a small deck, hold them face down in your left hand and, with the thumb and first finger of your right hand, pull back on each end of the deck so that each card is given a slightly *backward* curve. Then place the deck of red cards face down on the table as you say, "Here are the red cards in this stack."

Step 4. Pick up the black cards. In a manner similar to that in step 3, give these cards a slight *forward* curve. Then return these cards to the table in a face-down deck as you say, "And here are the black cards in this stack."

Step 5. Immediately after returning the black cards to the table, use both hands to mix the red and black cards (still face down) as you spread them out on the tabletop. Explain that you are thoroughy mixing the cards.

Step 6. As long as there are face-down cards on the table, repeatedly execute the following steps:

6.1. Ask the audience to request either a red or a black card.

6.2. If the color requested is red and there is a face-down card with a concave appearance, turn over such a card while saying, "Here is a red card."

6.3. If the color requested is black and there is a face-down card with a convex appearance, turn over such a card while saying, "Here is a black card."

6.4. Otherwise, state that there are no more cards of the requested color and turn over the remaining cards to prove your claim.

History of Algorithms

- The study of algorithms was originally a subject in mathematics.
- Early examples of algorithms
  - Long division algorithm
  - Euclidean Algorithm
- **Gödel's Incompleteness Theorem**: Some problems cannot be solved by algorithms.

Figure 0.2 The Euclidean algorithm

Description: This algorithm assumes that its input consists of two positive integers and proceeds to compute the greatest common divisor of these two values.

Procedure:

Step 1. Assign M and N the value of the larger and smaller of the two input values, respectively.

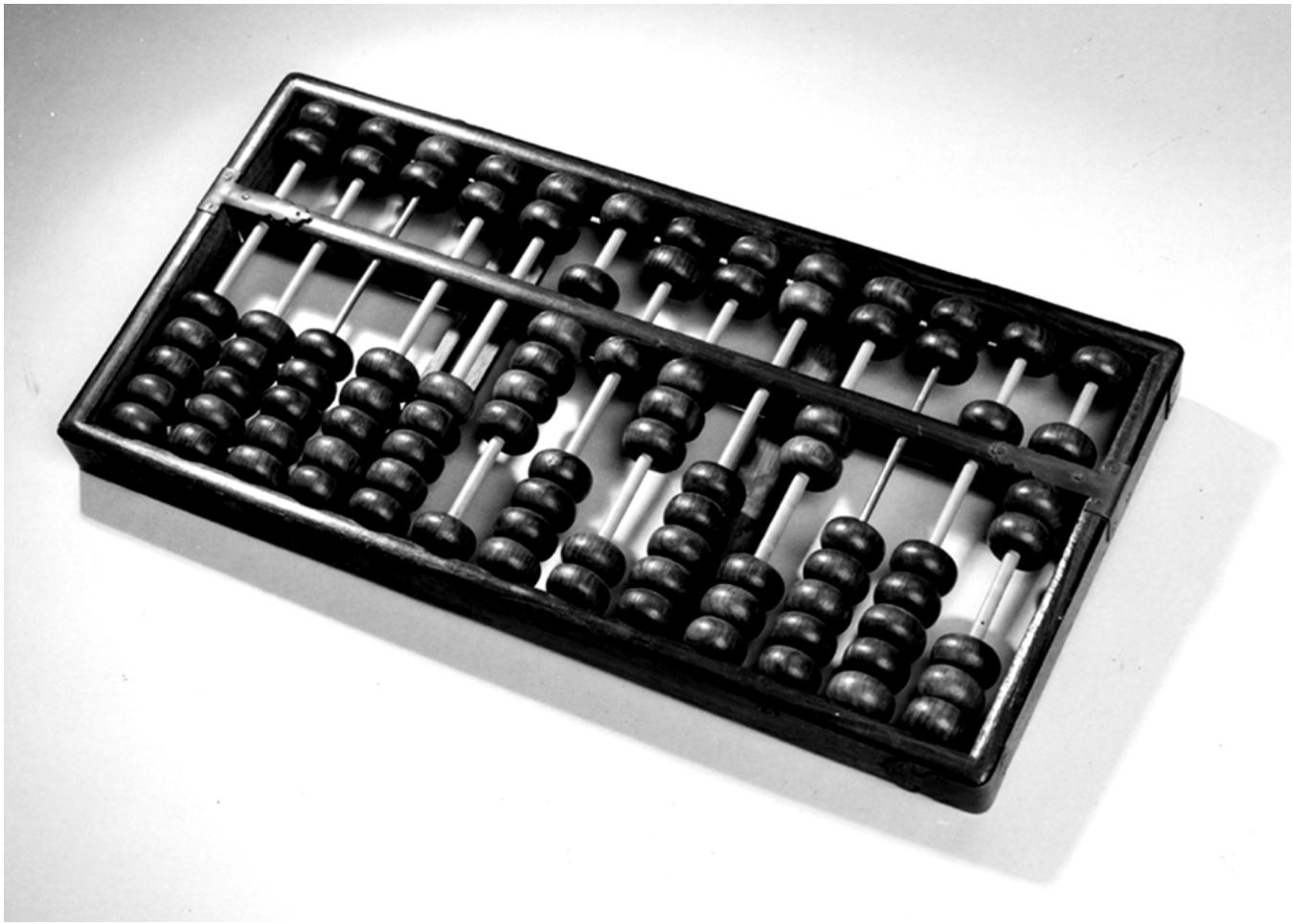
Step 2. Divide M by N, and call the remainder R.

Step 3. If R is not 0, then assign M the value of N, assign N the value of R, and return to step 2; otherwise, the greatest common divisor is the value currently assigned to N.

Origins of Computing Machines

- Early computing devices
  - Abacus: positions of beads represent numbers
  - Gear-based machines (1600s-1800s)
    - Positions of gears represent numbers
    - Blaise Pascal, Wilhelm Leibniz, Charles Babbage

Figure 0.3 **An Abacus**



Early Data Storage

- Punched cards
  - First used in Jacquard Loom (1801) to store patterns for weaving cloth
  - Storage of programs in Babbage's Analytical Engine
  - Popular through the 1970's
- Gear positions

Early Computers

- Based on mechanical relays
  - 1940: Stibitz at Bell Laboratories
  - 1944: Mark I: Howard Aiken and IBM at Harvard
- Based on vacuum tubes
  - 1937-1941: Atanasoff-Berry at Iowa State
  - 1940s: Colossus: secret German code-breaker
  - 1940s: ENIAC: Mauchly & Eckert at U. of Penn.

Figure 0.4 **The Mark I computer**

Personal Computers

- First used by hobbyists
- IBM introduced the PC in 1981.
  - Accepted by business
  - Became the standard hardware design for most desktop computers
  - Most PCs use software from Microsoft

Into the Millennia

- Internet revolutionized communications
  - World Wide Web
  - Search Engines (Google, Yahoo, and Microsoft)
- Miniaturization of computing machines
  - Embedded (GPS, in automobile engines)
  - Smartphone

Computer Science

- The science of algorithms
- Draws from other subjects, including
  - Mathematics
  - Engineering
  - Psychology
  - Business Administration
  - Psychology

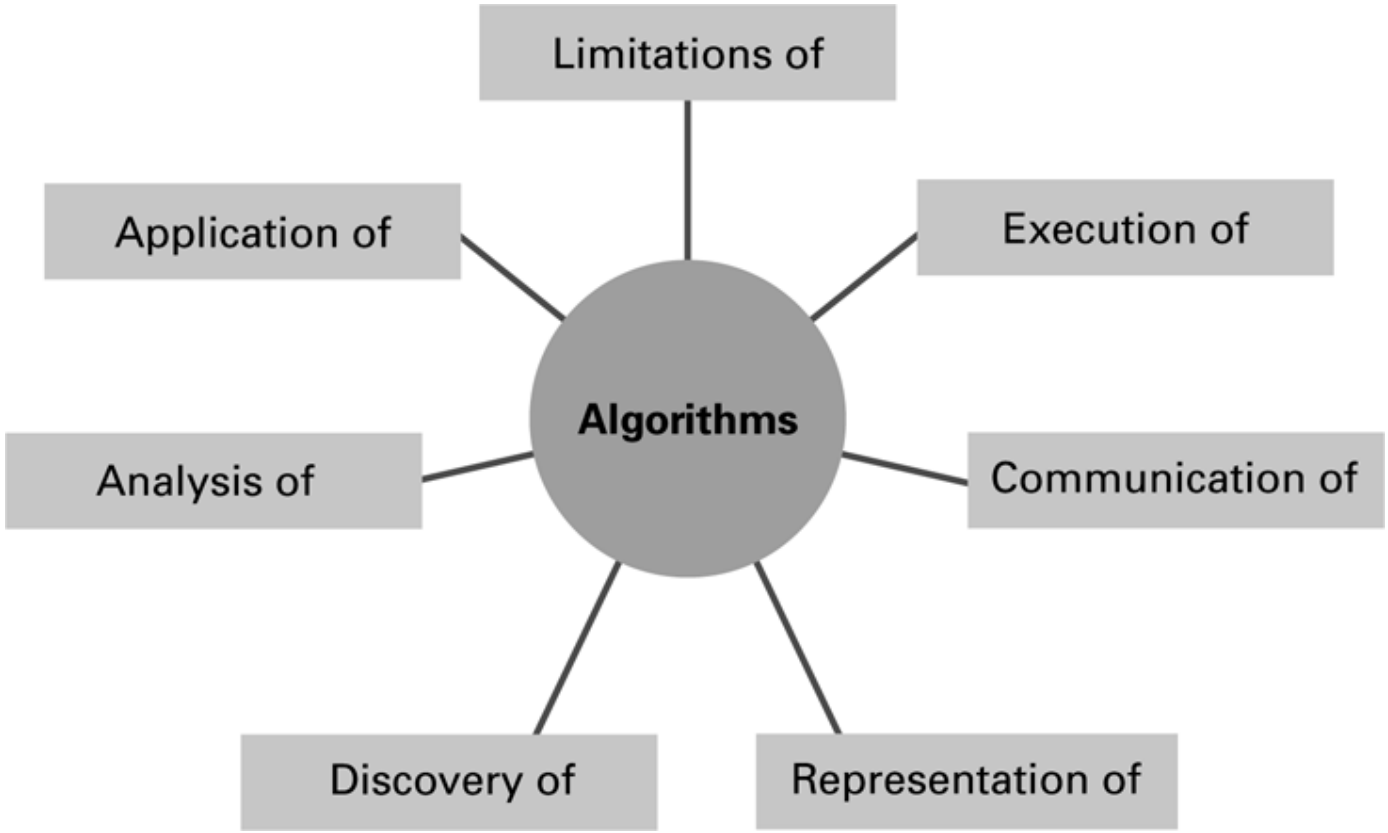
Central Questions of Computer Science

- Which problems can be solved by algorithmic processes?
- How can algorithm discovery be made easier?
- How can techniques of representing and communicating algorithms be improved?
- How can characteristics of different algorithms be analyzed and compared?

Central Questions of Computer Science (continued)

- How can algorithms be used to manipulate information?
- How can algorithms be applied to produce intelligent behavior?
- How does the application of algorithms affect society?

Figure 0.5 The central role of algorithms in computer science



Abstraction

- **Abstraction:** The distinction between the external properties of an entity and the details of the entity's internal composition
- **Abstract tool:** A "component" that can be used without concern for the component's internal properties

Outline of Our Study

- Chapter 1: Data Storage
- Chapter 2: Data Manipulation
- Chapter 3: Operating Systems
- Chapter 4: Networks and the Internet
- Chapter 5: Algorithms
- Chapter 6: Programming Languages

Outline of Our Study (continued)

- Chapter 7: Software Engineering
- Chapter 8: Data Abstractions
- Chapter 9: Database Systems
- Chapter 10: Computer Graphics
- Chapter 11: Artificial Intelligence
- Chapter 12: Theory of Computation

Social Repercussions

- Advances in computer science raise new questions.
  - In law: Questions of rights and liabilities
  - In government: Questions of regulation
  - In the work place: Questions of professionalism
  - In society: Questions of social behavior

Ethical Theories

- Consequence based:

  What leads to the greatest benefit?
- Duty based:

  What are my intrinsic obligations?
- Contract based:

  What contracts must I honor?
- Character based:

  Who do I want to be?

Q&A