Data Structures and Algorithms (1)

Instructor: Ming Zhang

Textbook Authors: Ming Zhang, Tengjiao Wang and Haiyan Zhao

Higher Education Press, 2008.6 (the "Eleventh Five-Year" national planning textbook)

https://courses.edx.org/courses/PekingX/04830050x/2T2014/
Chapter 1 Overview

- Problem solving
- Data structures and abstract data types
- The properties and categories of algorithms
- Evaluating the efficiency of the algorithms
1.1 Problem solving

- Goal of writing computer programs?
  - To solve practical problems
- Problem Abstraction
  - Analyze requirements and build a problem model
- Data Abstraction
  - Determine an appropriate data structure to represent a certain mathematical model
- Algorithm Abstraction
  - Design suitable algorithms for the data model
- Data structures + Algorithms \( \Rightarrow \) Programs
  - Simulate and solve practical problems
Farmer Crosses River Puzzle

cabbage

sheep

wolf

Chapter 1
Overview

1.1 Problem solving
1.1 Problem solving

- **Problem abstraction**: FSWC crossing over the river
  - Only the farmer can row the boat
  - There are only two seats on the boat including the farmer
  - “Wolf and sheep”, “sheep and cabbages” can not stay along without the accompany of the farmer

- **Data abstraction**: graph model
  - Unreasonable state: WS, FC, SC, FW, WSC, F
  - The vertex represents the “original bank status” (10 states, including “empty”)
  - edge: state transition as the result of a reasonable operation (cross over the river)
Farmer Crosses River Puzzle

- Data structure
  - Adjacency matrix
- Algorithm abstraction:
  - The shortest path

Farmer is abbreviated as F
Sheep is abbreviated as S
Wolf is abbreviated as W
Cabbage is abbreviated as C
Questions: process of problem solving

- Farmer Crosses River Puzzle —— The shortest path model
  - Problem abstraction?
  - Data abstraction?
  - Algorithm abstraction?
  - You may write programs to achieve it.

- Any other model?
Data Structures and Algorithms

Thanks

the National Elaborate Course (Only available for IPs in China)
http://www.jpk.pku.edu.cn/pkujpk/course/sjjg/

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