Experiments for Data Structures, Algorithms and Strategies Solving Problems based on Programming Contests

Yonghui Wu

Fudan University

Stony Brook - SUNY

Asia Council Member, ICPC Asia Programming Contest 1st Training Committee – Chair

yhwu@fudan.edu.cn

Outline

* Background (Why to Do?)
* My Idea (What to Do?)
* Experiments and My books (How to Do?)
* Results of my works
* Future Works

Background (Why to Do?)

* Programming contests since 1980s.
  * ACM-ICPC, Google Code Jam, TopCoder, Codeforces …
  * The Goal of Programming Contests: Solving Problems by programming
* Programming contests' problems from all over the world can be gotten, analyzed and solved by us.
  * A large problems' library
  * Polish students' programming skill

Experiments Based on Programming Contests' Problems

* Programming contests' problems can be used not only for programming contests' training, but also for education.
  * Using Programming Contests' Problems in Experiments
    * Combine programming contests' training and education
    * Polish students' programming skill better

My Idea (What to Do?)

* Team
  * Team work
  * Contestants' Personal ability
* A programming contestant's ability
  * programming knowledge system
  * mode of thinking (programming strategies solving problems)

General Books for Experiments

* Experiment books using programming contests' problems
  * programming contest training
  * experiments & education

knowledge system and strategies

* A programming contestant's knowledge system
  * "Algorithms + Data Structures = Programs".
* Strategies solving problems
  * strategies for data modeling and algorithm design
  * problems are not problems of standard modes

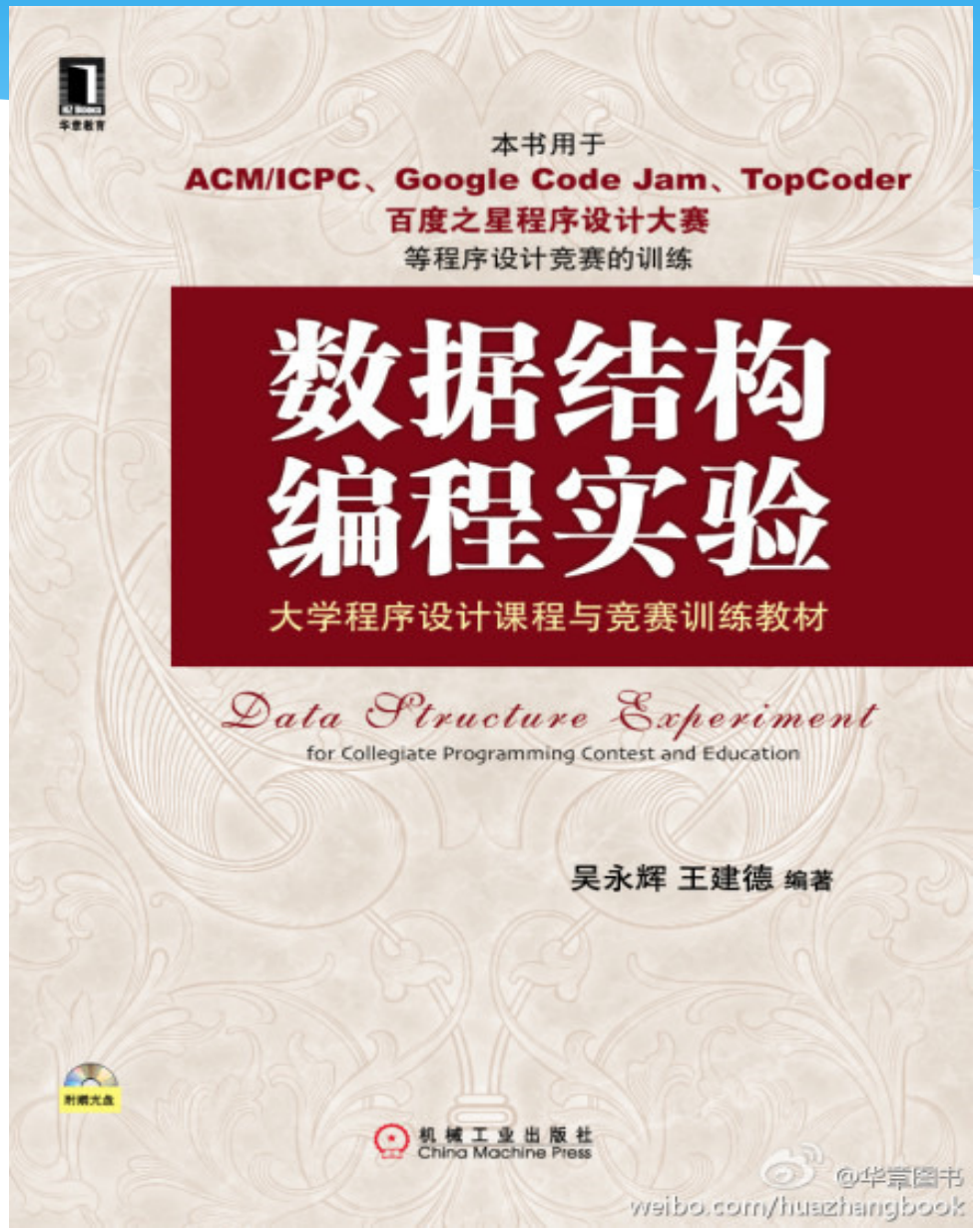
Experiments and My books (How to Do?)

* Data structure Experiment: for Collegiate Programming Contest and Education
* Algorithm Design Experiment: for Collegiate Programming Contest and Education
* Programming Strategies Solving Problems: for Collegiate Programming Contest and Education
  * Trilogy

Data structure Experiment: for Collegiate Programming Contest and Education

* Data structure Experiment: for Collegiate Programming Contest and Education
  * Chinese Version:
    * Published in Mainland China and Taiwan
  * English Version:
    * Manuscript is being improved at SBU
    * Will be published by CRC Press

Published in Mainland China



Published in Taiwan

Introdution

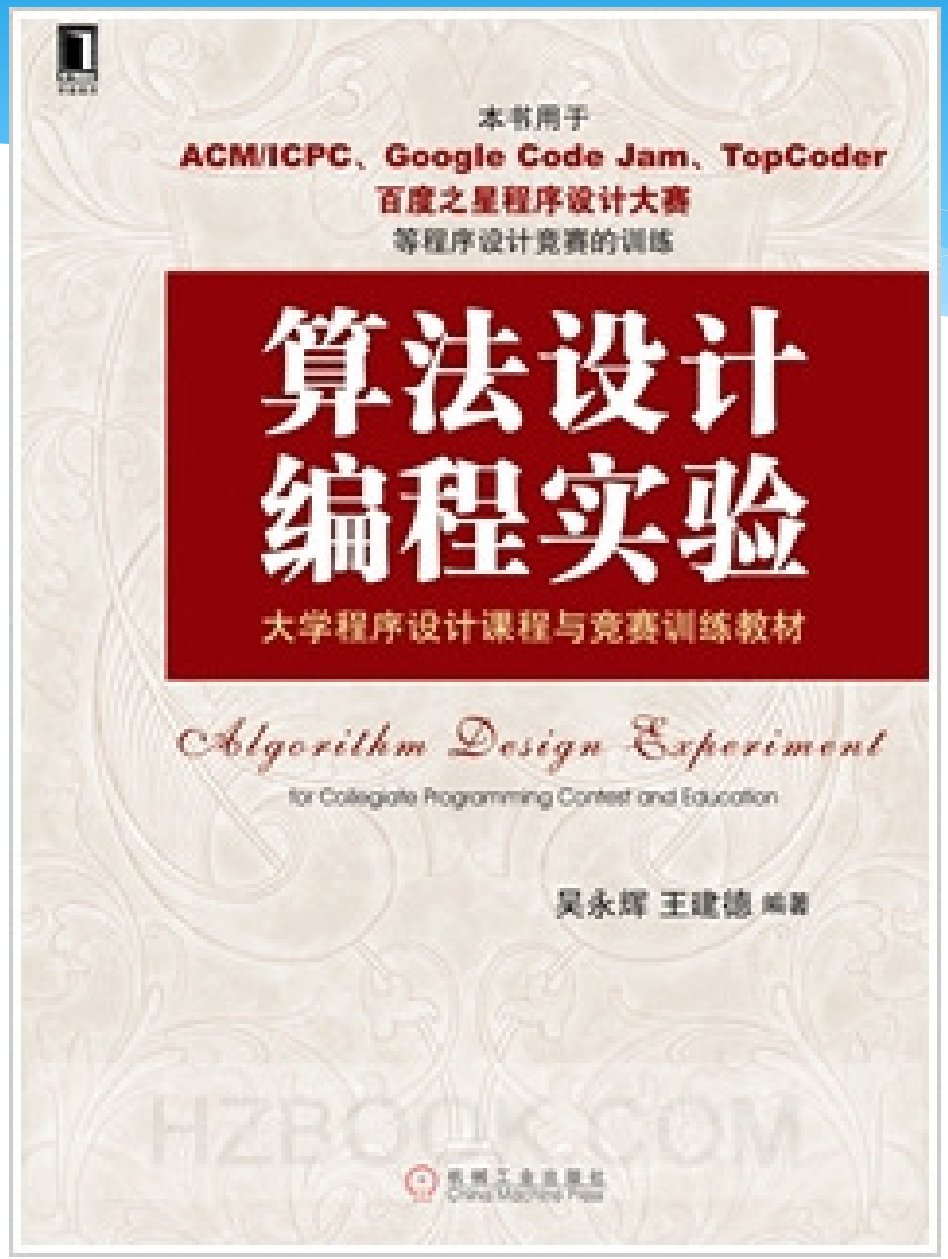
* 204 Programming Contest Problems
* 4 parts, 14 chapters

CONTENTS

* 4 Parts:
  * Fundamental Programming Skills
  * Experiments for Linear Lists
  * Experiments for Trees
  * Experiments for Graphs
* Detailed Contents

Algorithm Design Experiment: for Collegiate Programming Contest and Education

* Algorithm Design Experiment: for Collegiate Programming Contest and Education
  * Chinese Version:
    * Published in Mainland China
    * Will be published in Taiwan (Gotop)
  * English Version will be written at SBU in Fall


本书用于
ACM/ICPC、Google Code Jam、TopCoder
百度之星程序设计大赛
等程序设计竞赛的训练
算法设计
编程实验
大学程序设计课程与竞赛训练教材
Algorithm Design Experiment
for Collegiate Programming Contest and Education
吴永辉 王建德 编著
HZBOOK.COM

Introduction

* 234 Programming Contests' Problems
* 8 Chapters

CONTENTS

* Ad Hoc
* Simulation
* Number Theory
* Combinatorics
* Greedy
* Dynamic Programming
* Advanced Data Structures
* Computation Geometry
* Detailed Contests

Characters of the books

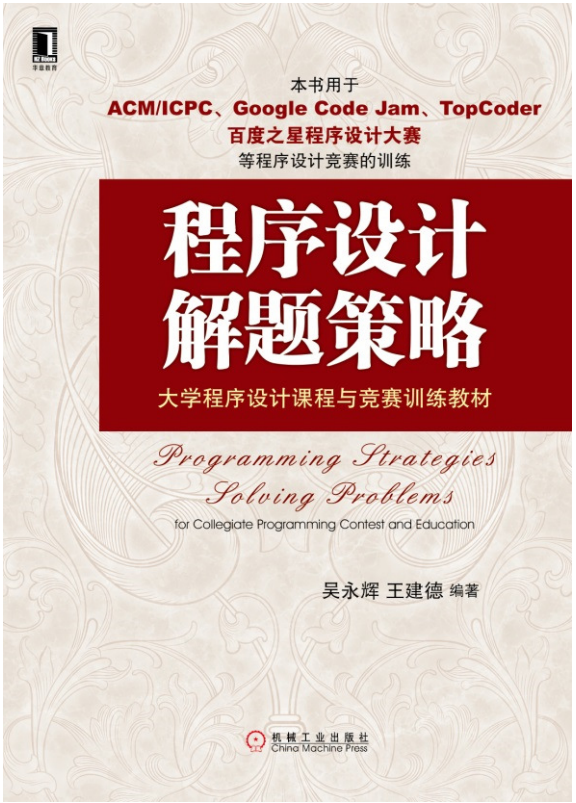
* (1) The books' outlines are based on the outlines of data structure and algorithm.
  * Programming contest problems and their analyses and solutions are used as experiments.
  * For each chapter, there is a section "Problems" to let students solve programming contests' problems.
    * Such a layout lets the books be used not only for education, but also for programming contests' training.

* (2) Problems in my books are all selected from ACM-ICPC regional and world finals programming contests, universities' local contests and on-line contests, and from 1990 to now.
  * The essence of programming contests' problems is tried to select and show in the books.

* (3) Not only analyses and solutions to problems are showed, but also test data for problems are provided.
  * It can make readers can polish their programming skill easily and better, even without teachers, classmates, and internet.

Strategies Solving Problems: for Collegiate Programming Contest and Education

* Strategies Solving Problems: for Collegiate Programming Contest and Education
  * Chinese version will be published this year in Mainland China in February


本书用于
ACM/ICPC、Google Code Jam、TopCoder
百度之星程序设计大赛
等程序设计竞赛的训练
程序设计
解题策略
大学程序设计课程与竞赛训练教材
Programming Strategies
Solving Problems
for Collegiate Programming Contest and Education
吴永辉 王建德 编著
机械工业出版社
China Machine Press

Introduction

* About 100 programming contests' problems
* 7 Chapters
* Problems are not problems of standard modes

Contents

* Strategies Solving Problems based on Tree Structures
* Strategies Solving Problems based on Graph (Network) Structures
* Strategies Constructing Data Relationships
* Dichotomy in Data Statistics
* Optimization Strategies for Dynamic Programming
* Strategies in Computation Geometry
* Games

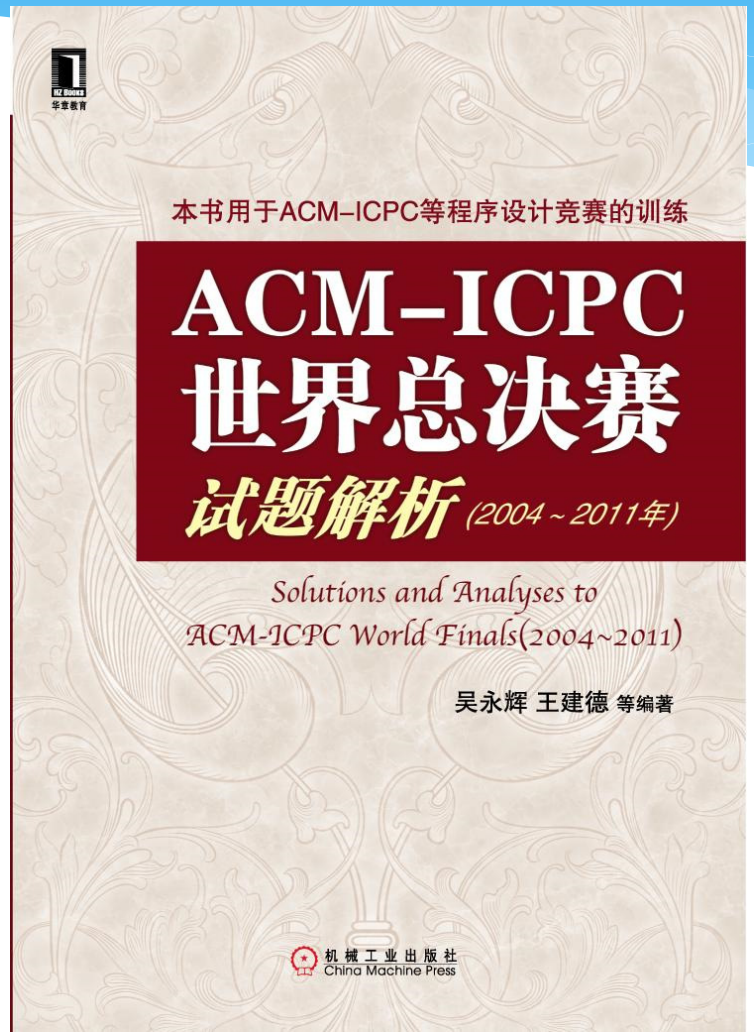
* Strategies Solving Problems based on Tree Structures
  * Partition Trees;
  * Minimum Spanning Trees and their extended forms;
  * Segment Trees;
  * Improved BST: Red-Black Trees, Splay Trees;
  * Leftist Trees;
  * Skip Lists

* Strategies Solving Problems based on Graph (Network) Structures

Results of my works

* History
* Welcomed and widely used in Mainland China, HongKong and Taiwan
* Manuscripts of English versions are being used in some American universities

Solutions and Analyses to ACM-ICPC World Finals (2004-2011)



Future works

* English versions
  * Trying to finish these books' English versions in Stony Brook – SUNY as a visiting scholar, supported by China Scholarship Council
* Trying to use and improve my books in Asia, America, ……

Online Judge System	Web Site
POJ	http://poj.org/
ZOJ	http://acm.zju.edu.cn/onlinejudge/
UVA	http://uva.onlinejudge.org/ http://livearchive.onlinejudge.org/
Ural	http://acm.timus.ru/
SGU	http://acm.sgu.ru/
HDOJ	http://acm.hdu.edu.cn/