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

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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
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
Introduction

* 234 Programming Contests’ Problems
* 8 Chapters
CONTENTS

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