



# X033533 -- Algorithm: Analysis and Theory

## Course Syllabus -- Spring 2016

### COURSE INFORMATION:

**Time:** 12:55pm--3:40pm, Thursday

**Location:** Chen Rui Qiu Building 219 (陈瑞球楼 219)

#### February 2016

| week | S  | M  | T  | W  | T  | F  | S  |
|------|----|----|----|----|----|----|----|
|      |    | 1  | 2  | 3  | 4  | 5  | 6  |
|      | 7  | 8  | 9  | 10 | 11 | 12 | 13 |
|      | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| (1)  | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| (2)  | 28 | 29 |    |    |    |    |    |

#### March 2016

| week | S  | M  | T  | W  | T  | F  | S  |
|------|----|----|----|----|----|----|----|
| (2)  |    |    | 1  | 2  | 3  | 4  | 5  |
| (3)  | 6  | 7  | 8  | 9  | 10 | 11 | 12 |
| (4)  | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| (5)  | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| (6)  | 27 | 28 | 29 | 30 | 31 |    |    |

#### April 2016

| week | S  | M  | T  | W  | T  | F  | S  |
|------|----|----|----|----|----|----|----|
| (6)  |    |    |    |    |    | 1  | 2  |
| (7)  | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
| (8)  | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| (9)  | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| (10) | 24 | 25 | 26 | 27 | 28 | 29 | 30 |

#### May 2016

| week | S  | M  | T  | W  | T  | F  | S  |
|------|----|----|----|----|----|----|----|
| (11) | 1  | 2  | 3  | 4  | 5  | 6  | 7  |
| (12) | 8  | 9  | 10 | 11 | 12 | 13 | 14 |
| (13) | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| (14) | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| (15) | 29 | 30 | 31 |    |    |    |    |

#### June 2016

| week | S  | M  | T  | W  | T  | F  | S  |
|------|----|----|----|----|----|----|----|
| (15) |    |    |    | 1  | 2  | 3  | 4  |
| (16) | 5  | 6  | 7  | 8  | 9  | 10 | 11 |
| (17) | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| (18) | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
|      | 26 | 27 | 28 | 29 | 30 |    |    |

**Total: 18 weeks, 16 classes**

- Class Day
- Holiday
- Final Exam Week

### INSTRUCTOR INFORMATION:

**Name:** Xiaofeng Gao (高晓枫)

**Office:** Telecom Building 3-543

**Phone:** 021-34207407

**Email:** [gao-xf@cs.sjtu.edu.cn](mailto:gao-xf@cs.sjtu.edu.cn) (best way to contact with me)

**Office Hour:** By appointment (Please mention your class ID and purpose in email beforehand)

**Teaching Assistant:** Zhiyin Chen (陈智殷), Email: [cknight\(at\)foxmail.com](mailto:cknight(at)foxmail.com)

### COURSE PREREQUISITES:

Discrete Mathematics, Data Structure, Programming Language



## REFERENCE:

- **Algorithm:**
  - T. Cormen, C. Leiserson, R. Rivest, C. Stein, Introduction to Algorithms, MIT Press, 2009
  - M. H. Alsuwaiyel, Algorithm Design Technique and Analysis, World Scientific, 1999.
  - S. Dasgupta, C. Papadimitriou, U. Vazirani, Algorithm, McGraw-Hill, 2007.
  - J. Kleinberg, and E. Tardos, Algorithm Design, Pearson-Addison Wesley, 2005.
  - Alfred V. Aho, John E Hopcroft, Jeffery D. Ullman, The Design and Analysis of Computer Algorithms, Addison-Wesley, 1974.
  - Udi Manber, Introduction to Algorithms: A Creative Approach, Addison-Wesley, 1989.
  - Henming Zou, The Way of Algorithms, China Machine Press, 2010.
- **Computational Complexity:**
  - Christos Papadimitriou, Computational Complexity, Addison Wesley, 1994.
  - Theory of Computational Complexity, by Ding-Zhu Du, and Ker-I Ko, published by John Wiley & Sons, Inc., 2000.
  - Computational Complexity: A Modern Approach, by Sanjeev Arora and Boaz Barak, Cambridge University Press, 2006.
- **Approximation:**
  - Vijay V. Vazirani, Approximation Algorithms, Springer-Verlag, 2001.
  - D.P. Williamson and D.B. Shmoys, The Design of Approximation Algorithms, 2011.
  - D.Z Du, K-I. Ko, and X.D. Hu, Design and Analysis of Approximation Algorithms, 2012.

## EVENTS AND GRADING:

The final grade will be derived from your performance on the tests, and assignments. The class participation is shown as follows:

| <u>Events:</u>      |     | <u>Grading Policy:</u> |          |
|---------------------|-----|------------------------|----------|
| Midterm Exam        | 25% | 90-100%                | <b>A</b> |
| Final Exam          | 25% | 80-89%                 | <b>B</b> |
| Assignments         | 30% | 70-79%                 | <b>C</b> |
| Projects            | 10% | 60-69%                 | <b>D</b> |
| Class Participation | 10% | 59% and below          | <b>F</b> |
| <b>Total</b> 100%   |     |                        |          |

## WEBPAGE AND MATERIALS:

- All the class materials (slides, references), homework assignments, announcements, and other information can be seen from <http://cs.sjtu.edu.cn/~gao-xf/algorithm/>
- Please check the webpage often to get the up-to-date information.



## INSTRUCTOR/COURSE POLICIES

### Common Sense Notices

- Please attend every class and do not be late. **15-minute** late attendance is considered absent.
- Please turn off all cell phones, buzzers, and other noisy electronic devices during class time.
- Please show common courtesy to your fellow classmates and professor.

### Homework

- **English only.** Each takes 5%, Bonus for Electronic Submission.
- **Late assignments.** Every effort should be made to hand assignments by the due date and time. NO late submission is accepted. Missed work will result in a grade of ZERO.
- **Academic dishonesty.** Your work must be your own. Cheating will result in a grade of 0 for the applicable assignment; further disciplinary action, including assigning a failing grade for the entire course and reporting your name to the department may also be taken.

### Email Netiquette

- My response will be irregular on the weekend or when I am away from campus.
- When you email me you should consider the email as official correspondence. As such, the email should not appear as a text message but should have proper grammar and punctuation. The email title should include: **Class ID/Your Purpose.** An example is below.

(Email Title: [X033533]Want a material for midterm)

Dear Dr. Gao,

My name is John Smith. I'm from your class X033533-Algorithm. I will not attend tomorrow's class due to sickness. Can you send me a copy of the midterm review so I may use it as a study tool? Thanks a lot.

Sincerely Yours,

John Smith

SID: 509030XXXX

Department of Computer Science and Engineering  
Shanghai Jiao Tong University

Email: [JohnASmith@gmail.com](mailto:JohnASmith@gmail.com)



**TENTATIVE SCHEDULE:** (These dates could be changed depending upon the pace of the course)

| Week  | Date   | Lecture Topic   | HW     | Event          |
|-------|--------|---|--------|----------------|
| 1     | Tue.25 | <b><u>Syllabus, Preliminary, Introduction to Algorithm</u></b><br>Schedule, Grading Policy, Preliminary, Basic Introduction, etc. | Lab-01 |                |
| 2     | Mar.03 | <b><u>Data Structure, Math Functions</u></b><br>Data Structure, Graph, Disjoint Set, Mathematical Fundamentals, etc.              | Lab-02 |                |
| 3     | Mar.10 | <b><u>Divide-and-Conquer</u></b><br>Mergesort, Selection, Sorting Network, etc.   | Lab-03 |                |
| 4     | Mar.17 | <b><u>Greedy Approach (1)</u></b><br>Activity Selection, Minimum Spanning Tree, Huffman Code, etc.                                | Lab-04 |                |
| 5     | Mar.24 | <b><u>Greedy Approach (2)</u></b><br>Interval Partitioning, Task Scheduling, Shortest Path, Cache, Matroid, etc.                  | Lab-05 |                |
| 6     | Mar.31 | <b><u>Dynamic Programming (1)</u></b><br>Matrix-Chain, Longest Common Subsequence, 0-1 Knapsack, etc.                             | Lab-06 |                |
| 7     | Apr.07 | <b><u>Dynamic Programming (2)</u></b><br>Optimal Substructure, Weighted Interval Scheduling, Sequence Alignment                   |        |                |
| 8     | Apr.14 | Application. Exercises. Midterm.  |        | <b>Midterm</b> |
| 9     | Apr.21 | <b><u>Graph Algorithms (1)</u></b><br>Single Source Shortest Paths, All-Pairs Shortest Paths, etc.                                | Lab-07 | Project-01     |
| 10    | Apr.28 | <b><u>Graph Algorithms (2)</u></b><br>Maximum Flow, Minimum Cut, etc.   | Lab-08 |                |
| 11    | May 07 | <b><u>Graph Algorithms (3)</u></b><br>Computational Geometry, Real-World Applications   | Lab-09 |                |
| 12    | May 14 | <b><u>Amortized Analysis</u></b><br>Aggregate Analysis, Accounting Method, Potential Method                                       | Lab-10 |                |
| 13    | May 21 | <b><u>NP-Completeness (1)</u></b><br>NP class, Polynomial time, etc.  | Lab-11 |                |
| 14    | May 28 | <b><u>NP-Completeness (2)</u></b><br>Reducibility, Proofs, etc.   | Lab-12 |                |
| 15    | Jun.04 | <b><u>Approximation Design (1)</u></b><br>Approximation Ratio, Approximation Class, Examples                                      | Lab-13 |                |
| 16    | Jun.11 | <b><u>Approximation Design (2)</u></b><br>Sequential Algorithm, Local-Search, LP, Primal-Dual Technique, etc.                     |        |                |
| 17-18 | TBD    | <b>Review. Exercises. Tutoring. Final Exam</b>  |        | <b>Final</b>   |