Tamkang University Academic Year 110, 2nd Semester Course Syllabus

Course Title	RANDOMIZED ALGORITHMS	Instructor	CHUANG-CHIEH LIN
Course Class	TEIBM1A MASTER'S PROGRAM, DEPARTMENT OF COMPUTER SCIENCE AND INFORMATION ENGINEERING (ENGLISH-TAUGHT PROGRAM),	Details	◆ General Course ◆ Selective ◆ One Semester

Relevance to SDGs	1A SDG4 Quality education

Departmental Aim of Education

Ⅰ. Cultivate the ability to conduct independent research and problem solving.

Ⅱ. Strengthen creativity and research capacity.

Ⅲ. Build profound professional knowledge in computer science and information engineering.

Ⅳ. Engage in self-directed lifelong learning.

Subject Departmental core competences

A. Independent problem solving ability.(ratio:10.00)

B. Independent innovative thinking ability.(ratio:10.00)

D. Research & development (R&D) ability in information engineering.(ratio:80.00)

Subject Schoolwide essential virtues

2. Information literacy. (ratio:90.00)

5. Independent thinking. (ratio:10.00)

Course Introduction	This course focuses on theoretical aspects and applications of randomized algorithms. Compared to heuristic algorithms which do not have accuracy or time complexity guarantee, randomized algorithms have rigorous guarantees so that the outputs turn out to be convincing. We will also cover the topics of randomized algorithms in machine learning and expect the students to learn solid theoretical foundation and also be capable of implementing several projects on applying randomized algorithms or study on the state-of-the-art papers on algorithm design or machine learning.

The correspondences between the course's instructional objectives and the cognitive, affective, and psychomotor objectives.

Differentiate the various objective methods among the cognitive, affective and psychomotor domains of the course's instructional objectives.

I. Cognitive : Emphasis upon the study of various kinds of knowledge in the cognition of the course's veracity, conception, procedures, outcomes, etc.

II.Affective : Emphasis upon the study of various kinds of knowledge in the course's appeal, morals, attitude, conviction, values, etc.

III.Psychomotor: Emphasis upon the study of the course's physical activity and technical manipulation.

No.	Teaching Objectives	objective methods
1	Introduction to Randomized Algorithms	Cognitive
2	Las Vegas and Monte Carlo	Cognitive
3	Chernoff Bounds	Cognitive
4	The Secretary Problem	Cognitive
5	The Coupon Collector's Problem	Cognitive
6	Randomized Quicksort	Cognitive
7	Random Treaps	Cognitive
8	Markov Chains and Random Walks	Cognitive
9	Multi-armed Bandit Problems	Cognitive

The correspondences of teaching objectives : core competences, essential virtues, teaching methods, and assessment

No.	Core Competences	Essential Virtues	Teaching Methods	Assessment
1	ABD	25	Lecture, Discussion	Study Assignments, Discussion(including classroom and online)
2	ABD	25	Lecture, Discussion	Study Assignments, Discussion(including classroom and online)
3	ABD	25	Lecture, Discussion	Study Assignments, Discussion(including classroom and online)
4	ABD	25	Lecture, Discussion	Study Assignments, Discussion(including classroom and online)
5	ABD	25	Lecture, Discussion	Study Assignments, Discussion(including classroom and online)
6	ABD	25	Lecture, Discussion	Study Assignments, Discussion(including classroom and online)

7	ABD	25	Lecture, Discussion	Study Assignments, Discussion(including classroom and online), Practicum
8	ABD	25	Lecture, Discussion	Study Assignments, Discussion(including classroom and online)
9	ABD	25	Lecture, Discussion	Study Assignments, Discussion(including classroom and online), Report(including oral and written)

Course Schedule

Week	Date	Course Contents	Note
1	111/02/21～111/02/25	Introduction	
2	111/02/28～111/03/04	Examples of Probability Paradoxes	
3	111/03/07～111/03/11	Probability Prerequisites	
4	111/03/14～111/03/18	The Coupon Collector's Problem	
5	111/03/21～111/03/25	The Secretary Problem	
6	111/03/28～111/04/01	Randomized Quicksort	
7	111/04/04～111/04/08	- Teaching Observation Week - (Moments and Deviations)	
8	111/04/11～111/04/15	Midterm Paper Presentations	
9	111/04/18～111/04/22	Chernoff and Hoeffding Bounds	
10	111/04/25～111/04/29	Balls and Bins	
11	111/05/02～111/05/06	Markov Chains and Random Walks	
12	111/05/09～111/05/13	Continuous Distributions and the Poisson Process	
13	111/05/16～111/05/20	Random Treaps	
14	111/05/23～111/05/27	Multi-Armed Bandit Problems	
15	111/05/30～111/06/03	Coupling of Markov Chains	
16	111/06/06～111/06/10	Markov Chains Monte Carlo	
17	111/06/13～111/06/17	Final Paper Presentation	
18	111/06/20～111/06/24	Make-up or concluding	

Requirement	Prerequisites on Probability Theory and programming.
Teaching Facility	Computer, Projector
Textbooks and Teaching Materials	Randomized Algorithms. Motwani, R. and Raghavan, P., 1995.Cambridge University Press. Probability and Computing: Randomized Algorithms and Probabilistic Analysis. M. Mitzenmacher and E. Upfal, 2005.
References	The Probabilistic Method. 3rd Edition. N. Alon and J. H. Spencer, 2008.
Number of Assignment(s)	**5** (Filled in by assignment instructor only)
Grading Policy	◆ Attendance： ％ ◆ Mark of Usual：30.0 ％ ◆ Midterm Exam： 30.0 ％ ◆ Final Exam： 40.0 ％ ◆ Other〈 〉： ％
Note	This syllabus may be uploaded at the website of Course Syllabus Management System at http://info.ais.tku.edu.tw/csp or through the link of Course Syllabus Upload posted on the home page of TKU Office of Academic Affairs at http://www.acad.tku.edu.tw/CS/main.php . **※ Unauthorized photocopying is illegal. Using original textbooks is advised. It is a crime to improperly photocopy others' publications.**