Course Specification

Name of Institution Mahidol University

Campus/faculty/department Salaya campus

Mahidol University International College

Science Division

Section 1 General Information

1. Course code and course title

Thai ICCS 313 การวิเคราะห์ขั้นตอนวิธี

English ICCS 313 Algorithm Analysis

2. Number of credit 4 (4-0-8)

(lecture 4 hours – self study 8 hours/ week)

3. Curriculum and type of subject

3.1 Curriculum Offered in international curriculum

3.2 Type of subject Major Required course, Computer Science

4. Responsible faculty member Full-time faculty members, Mahidol University International College, Mahidol University

5. Trimester / year of study

5.1 Trimester 1/ 2015-2016

5.2 Number of students _____ students

6. Pre-requisites ICCS200 Data Structures and Algorithms

7. Co-requisites -

8. Venue of study Mahidol University, Salaya campus

Section 2 Goals and Objectives

1. Goals

Asymptotic algorithm analysis; algorithm selection strategies; algorithms of well-defined problems in computer science; recognizing strength and weakness of algorithms; practical solutions to NP-complete problems

2. Objectives of development/revision

By the end of the course students should be able to

- Analyze the asymptotic performance of algorithms.
- Demonstrate a familiarity with major algorithms and algorithmic techniques.
- Decide which algorithm among a set of possible choices is best for a given application.
- Design efficient algorithms for new situations, using as building blocks the techniques learned.

Section 3 Course Management

1. Course descriptions

ศึกษาการวิเคราะห์และออกแบบอัลกอริทึมโดยเน้นการนำไปใช้ได้จริง หลักการเลือกขั้นตอนวิธี ขั้นตอนวิธีสำหรับปัญหาพื้นฐานในวิทยาการคอมพิวเตอร์ การจำแนกข้อเด่นและข้อด้อยของขั้นตอนวิธี ความซับซ้อนแบบอะซิมพ์ทอติก ขั้นตอนวิธีแบ่งแยกและเอาชนะ กำหนดการพลวัต ทฤษฎีกราฟ ปัญหาวิถีสั้นสุด การไหลในเครือข่าย และ อัลกอริทึมการประมาณ

Study of techniques for analyzing and designing efficient algorithms, emphasizing methods useful in practice. Topics covered includes: asymptotic analysis; number-theoretic algorithms; graph algorithms; shortest paths; network flow; divide-and-conquer; dynamic programming; approximation algorithms; and randomized algorithms.

2. Credit hours / trimester

Lecture	Additional class	Laboratory / field trip/ internship	Self study
48 hours (4 hour x 12 weeks)	-	-	96 hours (8 hours x 12 weeks)

3. Number of hours that the lecture provides individual counseling and guidance

1 hour / week

Section 4 Development of Students' Learning Outcome

1. Expected outcome on students' skill and knowledge

Students will be able to apply the knowledge from lectures and with the ideas received from analysis and synthesis to set up solutions/ precautions to benefit individuals;

2. Teaching methods

Course organized using lecture and assignments.

3. Evaluation methods

1. Morality and Ethics

1.1 Expected outcome on morality and ethics

- (1) To posses morality and ethics
- (2) To have self-discipline, honesty, kindness, self- responsible and social responsibility
- (3) To demonstrate academic ethical behavior
- (4) To respect others' rights and be a good listener
- (5) To respect rules and regulations
- (6) To have good attitude toward professors/career
- (7) To demonstrate Leadership, team player

1.2 Teaching methods

Learning Centered Education : Emphasis on knowledge development, important skills in career development and living, encourage students to use their full potentials

(1) Lecture

(2) Assignments

1.3 Evaluation methods

(1) Written examination

(2) Class attendance

(3) On-time submission of assignments and their quality

2. Knowledge development

2.1 Expected outcome on knowledge development

- (1) To posses basic knowledge, theories and concepts towards the understanding of self, society, surrounding in order to be well-rounded person
- (2) To process the knowledge related to principles, theories and practice in the course
- (3) To integrate the knowledge to other related subjects
- (4) To remain current in research and new knowledge

2.2 Teaching methods

Learning Centered Education : Emphasis on knowledge development, important skills in career development and living, encourage students to use their full potentials

(1) Lecture

(2) Assignments

2.3 Evaluation methods

(1) Written examination

(2) Class attendance

(3) On-time submission of assignments and their quality

3. Intellectual development

3.1 Expected outcome on intellectual development

- (1) To have systematic and analytical thinking
- (2) To be able to search, consolidate and evaluate ideas and evidence for problem solving

- (3) To be able to apply knowledge and experience to analyze and creatively solve problems both in general and academic

3.2 Teaching methods

(1) Lecture

(2) Assignments

3.3 Evaluation methods

(1) Written examination

(2) Class attendance

(3) On-time submission of assignments and their quality

4. Interpersonal relationship and responsibility

4.1 Expected outcome on Interpersonal relationship and responsibility

- (1) To posses good interpersonal relationship skills (self esteem and dignity) and have respect for the rights and value of others

(2) To possess leadership and initiative in problem solving

(3) To be constructive team member (in various roles) and be responsible for assignment tasks, professional and society

4.2 Teaching methods

(1) Lecture

(2) Assignments

4.3 Evaluation methods

(1) Written examination

(2) Class attendance

(3) On-time submission of assignments and their quality

5. Mathematical analytical thinking, communication skills, and information technology skills

5.1 Expected outcome on mathematical analytical thinking, communication skills, and information technology skills

- (1) To be able to select and apply appropriate statistical and mathematical methods to research problems
- (2) To be able to apply information technology for data gathering, processing, interpreting and presenting information/results
- (3) To have the ability to communicate effectively and select appropriate methods of presentation

5.2 Teaching methods

(1) Lecture

(2) Assignments

5.3 Evaluation methods

(1) Written examination

(2) Class attendance

(3) On-time submission of assignments and their quality

Section 5 Teaching and Evaluation Plans

1. Teaching plan

Week	Topic	Hours	Teaching methods/ multimedia	Instructor
1	- Introduction - Analysis framework: Big-O notation	4	Lecture	
2	- Algorithms with numbers: Modular arithmetic, Primality testing, Cryptography, Universal hashing	4	Lecture	
3	- Divide-and-conquer: Multiplication, Recurrence relations, Mergesort, Quicksort	4	Lecture	
4	- Graph Algorithm I: Depth-first search, Strongly connected components	4	Lecture	
5	- Graph Algorithm II: Breadth-first search, Dijkstra's algorithm, Shortest paths in DAGs	4	Lecture	
6	Mid-Term Exam	4	Lecture	

7	- Greedy Algorithms: Prim's and Kruskal's Algorithms, Huffman encoding, Horn formulas, Set cover	4	Lecture	
8	- Dynamic Programming I: Shortest paths in DAGs, Longest increasing subsequences, Edit distance	4	Lecture	
9	- Dynamic Programming II: Knapsack, Chain matrix multiplication, Shortest paths, Independent sets in trees	4	Lecture	
10	- Network flow problems	4	Lecture	
11	- Introduction to NP-complete problems - Search algorithms - Approximation algorithms	4	Lecture	
12	- Randomized algorithms	4	Lecture	

13	Final Examination	4	Lecture	

2. Evaluation plan

Expected outcomes	Methods / activities	Week	Percentage

Section 6 Teaching Materials and Resources

1. **Texts and main documents**

   Vazirani, U. and Papadimitriou, C. and Dasgupta, S. Algorithms. McGraw-Hill Education, 2006. ISBN 9780073523408.

2. **Documents and important information**

3. **Documents and recommended information**

Section 7 Evaluation and Improvement of Course Management

1. **Strategies for effective course evaluation by students**
    - 1.1 Evaluation of peers by students
    - 1.2 Student evaluation
        - 1.2.1 Course content
        - 1.2.2 Course management
        - 1.2.3 Suggestions
        - 1.2.4 Overall opinion
2. **Evaluation strategies in teaching methods**
    - 2.1 Student evaluation
    - 2.2 Presentation
3. **Improvement of teaching methods**

    3.1 Workshop on course improvement with the participation of all lecturers in this course

    3.2 Meeting with all other science lecturers to share experiences and practices for improvement
4. **Evaluation of students' learning outcome**

    Analysis of students' learning outcomes using scores from class attendance, group activity and presentation of project and poster presentation
5. **Review and improvement for better outcome**

    Meeting of lecturers to review the course before semester starts and before each period of teaching