

**University of Macau**  
**Department of Computer and Information Science**  
**CISB353 Formal Languages and Automata**  
**Course Syllabus**  
**1<sup>st</sup> Semester 2014/2015**

**Course Description**

(2-2) 3 credits. This course introduces the fundamental concepts of formal languages and automata. It emphasizes the general principles of formal languages, grammars, and automata theory. Topics include finite automata, regular expressions, regular languages and their properties, context-free grammars, languages and their properties, pushdown automata, Turing machines, and undecidability.

**Course Time and Location:**

Lecture	Monday 9:00 - 10:50	E4-3054
Tutorial	Friday 16:00 - 17:50	E6-2095

**Course Type:**

Theoretical with substantial practice content

**Prerequisites:**

- CISB111

**Reference Textbooks:**

- John E. Hopcroft, Rajeev Motwani, and Jeffrey D. Ullman, *Introduction to Automata Theory, Languages and Computation*, 3<sup>rd</sup> edition, Addison Wesley, 2007.
  - John E. Hopcroft, Rajeev Motwani, and Jeffrey D. Ullman, *Introduction to Automata Theory, Languages and Computation*, 2<sup>nd</sup> edition, Addison Wesley, 2001, 2003.
- (All 3 books are available from the UM Library.)

**Major Prerequisites by Topic:**

1. Basic knowledge of Mathematical Reasoning.
2. Basic knowledge of Set Theory.
3. Basic knowledge of Relations.
4. Basic knowledge of Graphs.
5. Basic knowledge of Trees.

**Course Objectives:**

1. Learn the fundamental concepts of formal languages and automata. [a,c]
2. Be able to construct regular expressions, grammars, and automata for different levels of formal languages. [a,c]
3. Understand the relationship between Turing machines and modern computers. [a,c]
4. Understand the limitations and undecidable problems of modern computers. [a,c]

**Course Outline:**

Week(s)	Topics	Assessment(s)
1	<b>Introduction</b>	
2	<b>Finite Automata</b> - Study the deterministic finite automata, non-deterministic finite automata, Finite Automata with $\epsilon$ -transitions, and their relationships.	Assignment 1
3	<b>Regular Expressions</b> - Study the definitions and manipulations of regular expression, and its equivalence to finite automata; Define regular languages.	Assignment 2

4	<b>Regular Languages and Their Properties</b> - Study the limitations of finite automata and the pumping lemma; Study closure properties of regular languages; Study minimization of the finite automata.	
5 and 6	<b>Context-Free Grammars</b> - Define context-free grammars and context-free languages; Study derivations, parse trees, and ambiguity of context-free grammars; Study simplification and normal forms of context-free grammars.	Assignment 3
7 and 9	<b>Pushdown Automata</b> - Define pushdown automata and study its relationship to context-free grammars; Study acceptance by empty stack and final states.	Midterm Exam and Assignment 4
10	<b>Context-Free Languages and Their Properties</b> - Study the limitations of context-free grammars and the pumping lemma; Study closure properties of context-free languages.	
12	<b>Turing Machines</b> - Define Turing machines and universal Turing machines; Study extensions and restrictions of Turing machines.	Assignment 5
13 and 14	<b>Undecidability</b> - Define recursively enumerable, recursive, and non-recursively enumerable languages, and their relationships with Turing machines; Define decidable and undecidable problems; Study universal language problems and modified post correspondence problems.	
14	<b>Review</b>	
15 onwards		Final Exam

#### Assessment:

Homework	20% (Average of the 5 assignments)
Midterm Exam	30% (1 hr 50 mins in class exam on Oct. 6 <sup>th</sup> , 2014)
Final Exam	50% (3 hours exam; date and time TBA)

#### Course Instructor:

Name: Dr. ZHANG Yibo, Bob - Assistant Professor, Computer and Information Science

Office: E11-4093

Office Hours: Tuesday 14:00 - 15:00 or by appointment

Tel.: 8822-4425

E-mail: [bobzhang@umac.mo](mailto:bobzhang@umac.mo)

#### Notes

- Attendance is strongly recommended.
- Check the course webpage for announcements, assignments, and lectures.
- No makeup exam is given except for medical proof.
- Cheating is absolutely prohibited by the university.