University of the Philippines Diliman
College of Engineering
Department of Computer Science

Course Information

Number:	CS 133.
Schedule:	Wednesdays and Fridays, 10:00h to 11:30h (**WFU**) and 13:00h to 14:30h (**WFW**).
Title:	Automata Theory and Computability.
Description:	Finite automata, formal languages, and regular expressions. Context free grammars and pushdown automata. Turing machines, Church's thesis, complexity classes and (un)decidability.
Credit:	3 units.
Term:	Semester 1, AY 2017–2018.
Prerequisite:	CS 30 (Discrete mathematics for computer science).
Methodology:	Class lectures, exercises, readings, exams.
Instructor:	Francis George C. Cabarle.
Email Address:	fccabarle@up.edu.ph.
Consultation hours:	The next hour immediately after the end of the lecture, or by appointment (email me please!).

Course Outline

- Introduction

  Introduction to automata theory
  Some concepts of discrete mathematics
  Formal languages

- Regular languages and finite automata

  (Non)deterministic finite automata
  NFA and DFA equivalence
  (Non)Regular languages
  Regular expressions
  Properties of regular languages
  Pumping lemma for regular languages

- **EXAM 1**

- Context-free languages and pushdown automata

  (Non)context-free languages
  (Non)deterministic pushdown automata
  Pumping lemma for CFLs

- **EXAM 2**

- Turing machines

  Church-Turing thesis
  Language of a Turing machine
  Turing machine variants

- **EXAM 3**

- Decidability and undecidability

  Decidable and undecidable problems
  Intractability
  Complexity classes

- **EXAM 4**

- **REMOVAL EXAM**

Class Policies

University and college policies are presumed to be in effect, e.g. on student demeanour, cheating.

Exams. No make-up exam will be given unless the student has a valid excuse. Missed exams receive zero credits or points. Complaints regarding exam results will be entertained only up to a week after exam bluebooks are returned. After such a week has expired, no further complaints regarding the exam will be accepted.

Cheating. Cheating in any form will be subjected to proper disciplinary action and will incur a final grade of 5.0.

Grading System

Students will be graded according to the following scale:

General Average	**Final Grade**
[92, 100]	1.0
[88, 92)	1.25
[84, 88)	1.50
[80, 84)	1.75
[76, 80)	2.00
[72, 76)	2.25
[68, 72)	2.50
[64, 68)	2.75
[60, 64)	3.00
[0, 60)	5.00

- Breakdown of final grade: each exam is 25%, i.e. $25\% * 4 = 100\%$.
- If general average (i.e. sum of your exam scores divided by the perfect scores for all exams) of the student is below 60% after the fourth exam, the student must take the FINAL (chance to pass) or REMOVAL EXAM *provided that* the student has:
  1. taken ALL four previous exams, *AND*
  2. at least two of the four exams are above 50%.
- The student will receive a grade of either a 3.0 or 5.0 corresponding to a passing or failing grade in the REMOVAL EXAM, respectively.

Suggested References

There is no required textbook, but the first two references are very much encouraged (newer editions are welcome):

1. M. Sipser. *Introduction to the Theory of Computation*: 2ed. PWS Publishing Company, 2005.
2. J. Hopcroft, R. Motwani, J. Ullman. *Introduction to Automata Theory, Languages and Computation*: 2ed. Addison-Wesley, 2001.
3. Other (non)electronic references on automata and computability theory, e.g. MIT OCW course 6.045J/18.400J on automata, computability, and complexity,[1] and *Machines, Languages, and Computation* by P.J. Denning, J.B. Dennis, J.E. Qualitz, Prentice-Hall, 1978 (also available at the engineering library).

"The best theory is inspired by practice. The best practice is inspired by theory."
– Donald E. Knuth,
(computer scientist, mathematician, and professor emeritus at Stanford University, recipient of the Turing Award and the von Neumann Medal)

[1] http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-045j-automata-computability-and-complexity-spring-2011/index.htm