# COMP 7612: Fundations of Computer Science

## Why a course on Foundations

This course is a self-contained presentation of the principles of the *science* that govern symbolic information processing. They provide a high and wide vantage point, indispensible to grasp the nature, scope and limitations of computing machinery.

Computer models form the backbone of the understanding of computers in a *principled* and *systematic* manner. Computer models and their properties are to computer science what physical laws are to natural science, or what wind-tunnels are to flight engineering. They provide the tools and intuition required for a critical assessment of computer capabilities, and (more importantly) their ultimate limitations and meaning in the context of human endeavors.

## Course Description

**7612. Foundations of Computing. (3).**
Review of basic models of computation and complexity; measures and modes of complexity analyses, both logical and experimental; deterministic and stochastic methods for program analysis and data compaction. PREREQUISITE: COMP 6030, or permission of instructor.

## **Syllabus** (Module/week)

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|---|---|
| 1/ Week 1 | Big Picture: What is Information Processing? Recognition, Generation, Compaction |
| 1/Week 2 | Finite Memory Models |
| 2/Week 3-5 | Language and Computation; Grammars |
| 3/ Week 6 | Algorithmic and Cryptographic Problems **.** [Midterm Break] |
| 3/Week 7-9 | Unlimited Memory: Turing Machines. Equivalent models. The Church-Turing thesis |
| 4/Week 10-11 | Unsolvability and Reducibility |
| 5/Week 12-13 | Computational Complexity |
| 5/Week 14 | Infeasible problems and NP-completenss |
| 1-5/Week 15 | **Term project presentations** |

## Evaluation*

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| **10%** | Class Participation (2) | Based on attendance and pro-active class interaction |
| **40%** | Quizzes | Quizzes (8) will be given at random times once every two weeks on the average |
| **15%** | **Proposal/Progress report** | due by the deadline posted in the "Assignments" on Canvas |
| **35%** | **Term Project** | *Written report 1*: 10%;<br>*Written report 2*: 15%;<br>*Oral report*: 10% |

***** All assignments are posted and due as shown on Canvas under the "Assignments" link.

## Textbook(s)

[**G**] Max H. Garzon, **A primer on the Science of Computing.** Classnotes.
[Copyrighted material available in chapter units under "Modules".
They are made available to you for personal use only, not for dissemination.]

Supplementary reference:
+ [**L**] P. Linz (2016) An Introduction to Formal Languages and Automata. Jones & Bartlett Learning, ISBN-13: 978-1-284-07724-7.
[This textbook may be freely available online and provide alternative views and examples on the major concepts in this class.]

**Notes on Collaboration Policy**

**Plagiarism** (cheating behavior) in any form is unethical and detrimental to proper education and **will not be tolerated**. All work submitted by you the student (projects, programming assignments, lab assignments, quizzes, tests, etc.) **is expected to be the student's** own ork. *Plagiarism is incurred when any part of anybody else's work is passed as your own (no proper credit is listed to the sources,* ***including use of any generative AI like chatGPT*** *in doing your assignment) so the reader is led to believe it is therefore your own production.* Students are allowed and encouraged to discuss with each other and look up resources in the literature (including the internet) on their assignments, but appropriate references must be included for the materials consulted, and appropriate citations made when the material is taken verbatim. By taking this course, you agree that any assignment turned in is your personal responsibility and may undergo a review process and that the assignment may be included as a source document in Turnitin.com's restricted access database solely for the purpose of detecting plagiarism in such documents. Any assignment not submitted according to the procedures given by the instructor may be penalized or may not be accepted at all.

If plagiarism or cheating occurs, the students involved will receive a failing grade (0) on the assignment and (at the instructor's discretion, especially on second occurrences) a failing grade in the course. The course instructor may also decide to forward the incident to the University Judicial Affairs Office for further disciplinary action. For further information on the U of M code of student conduct and academic disciplinary procedures, please refer to https://www.memphis.edu/osa/students/academic-misconduct.php.