

Module 6 Overview

Complexity Theory & NP (Chapter 7)



Module Intro

Even when a problem is decidable and thus computationally solvable in principle, it may not be solvable in practice if the solution requires an inordinate amount of time or memory. In this final part of the book, we introduce computational complexity theory—an investigation of the time, memory, or other resources required for solving computational problems. We begin with time. Our objective in this chapter is to present the basics of time complexity theory. First we introduce a way of measuring the time used to solve a problem. Then we show how to classify problems according to the amount of time required. After that we discuss the possibility that certain decidable problems require enormous amounts of time, and how to determine when you are faced with such a problem.



Objectives

Upon completion of this module, students will be able to:

1. Explain what it means for a Turing Machine to run in polynomial time
2. Explain what it means for a language to be in P or in NP
3. Determine the worst case run time for a Turing Machine and a polynomial function using big-O notation
4. Explain what it means to be NP Hard
5. Explain what it means to be NP Complete
6. Explain how to show a problem is in NP
7. Design a verifier for a NP problem
8. Design a nondeterministic TM for a NP problem
9. Discuss if P = NP

10. Explain how polynomial-time reductions work and the purpose of these reductions
11. Explain how each language in a polynomial-time reduction is related to the other language



Readings and Resources

You can explore this module's information in multiple ways:

- View slides
- Access this information from the textbook (**Chapter 7**) [**Course Textbook**](#)
(<https://virginiacommonwealth.instructure.com/courses/119232/pages/course-textbook>)
- Solve practice activities



Module at a Glance

Below is an overview of this module. Pay particular attention to items with **points**, **values** and **due dates**, as these are graded assignments. (Note: module overview will not display if you are accessing Canvas on a mobile device.)

Module 6: Complexity Theory & NP Problems (Chapter 7)

[**Module 6 Overview: Complexity Theory & NP \(Chapter 7\)**](#)

[**M6 Chapter 7.1: Notes - Complexity Theory & Complexity Classes**](#)

[**M6: 7.1 Practice**](#)
0 pts

[**M6 Chapter 7.2: Notes - NP Problems and Verifiers of Them**](#)

[**M6: 7.2 Practice**](#)
0 pts

[**M6 Chapter 7.3: Notes - Polynomial-Time Reductions and NP Completeness**](#)



M6: Challenge Problem Set

0 pts