Learning Objectives

After completing this unit, you should be able to:

- Explain how computer science is the study of algorithms.
- Describe the weekly schedule and the flipped classroom.
- Summarize the "seven big ideas" of computer science.
- Install VirtualBox and import the virtual machine image.
- Interpret Lightbot programs (predict position and direction).
- Explain the study cycle and the importance of metacognition.
- Name three major developments in the history of computing.

Textbook Sections

0.0 Preface, Table of Contents
0.1 The Role of Algorithms
0.2 The History of Computing
0.3 An Outline of Our Study
0.4 Themes of Computer Science

Video Lectures

- Metacognition: Learning about Learning
- Charles Babbage and His Difference Engine

Assignments

Act01 Search Algorithms; Chapter 0 Problems
Lab01 Virtual Machine; Lightbot Puzzle Solving

Unit 1 Checklist: Aug 26 – Sep 01

Before Wednesday	**Date Completed**
FINISH model 1 of the Algorithms activity	
READ textbook 0.1 The Role of Algorithms (take notes)	
READ textbook 0.4 Themes of Computer Science (take notes)	
Complete steps 1-2 of Virtual Machine Installation (see course website: https://w3.cs.jmu.edu/cs101/virtual)	
START Lab01: Lightbot puzzle solving	(10 pts)
Before Friday	**Date Completed**
Complete steps 3-6 of Virtual Machine Installation	
READ textbook 0.2 The History of Computing (take notes)	
READ textbook 0.3 An Outline of Our Study (take notes)	
WATCH video: Metacognition (Paul Anderson) (take notes)	
WATCH video: Babbage's Difference Engine (take notes)	
START Act01 exercises (complete at least 75%)	(15 pts)
Before Monday	**Date Completed**
COMPARE your Lab01 and Act01 with the solutions in Canvas	
SUBMIT Quiz01 – 1st attempt closed: see what you don't know	
STUDY your notes, ask questions on Piazza, meet with the TAs	
SUBMIT Quiz01 – 2nd attempt open: try to get the full 10 points	(10 pts)

TAKE Exam01	(40 pts)

Activity 1: Algorithms

Each week, you will work in teams of 3–4 students to learn new concepts. This activity will introduce you to the process. We'll use a simple game to explore basic searching algorithms.

Model 1 Hi-Lo Game

Hi-Lo is a number guessing game with simple rules, played by school children.

a) There are two players – *A* and *B*.
b) Player *A* thinks of a number from 1 to 100.
c) Player *B* guesses a number.
d) Player *A* responds with "too high", "too low", or "you win".
e) Players *B* and *A* continue to guess and respond until *B* wins (or gives up).

Questions (20 min)

Start time: ________

1. How many different answers can player *A* give?

2. When does the game end?

3. Play the game a few times to ensure that everyone understands the rules.

4. Identify 4–5 different guessing strategies that Player *B* could use. Each strategy should describe a **different approach** to the game. For example: *Start at 1, and count up until the correct answer is found.* In computer science, we call such strategies **algorithms**. Try to have a mixture of simple and clever algorithms, including ones that young children could use.

a)

b)

c)

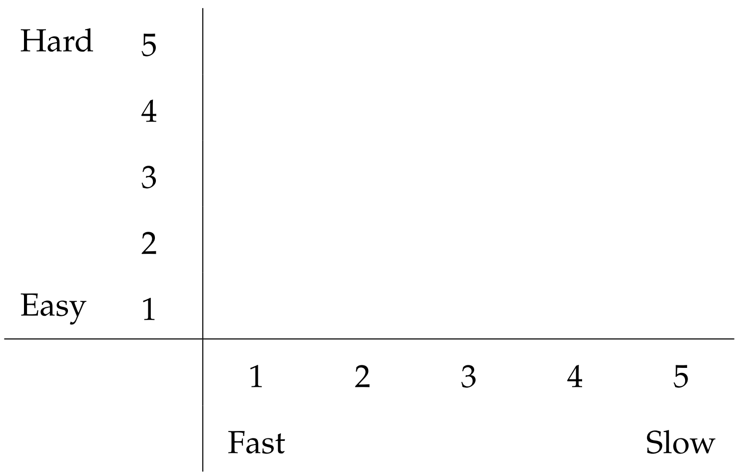
d)

e)

5. Rank order the algorithms with regard to how **fast** they will find the right answer. Write 1 for the fastest algorithm (fewest guesses) and 5 for the slowest one (most guesses).

6. Rank order the algorithms with regard to how **easy** they are to describe or specify. (Suppose you had to explain them to a first-grader so that he/she could play the game.) Write 1 for the algorithm that is easiest to describe and 5 for the one that is hardest.

7. For each algorithm (*a* to *e*), plot its fast and easy values on the graph:



8. In complete sentences, describe the relationship between the fast and easy rankings, including what you see from the graph.

In computing, we often must search for a particular item in a set. Computer scientists are particularly interested in searching very large sets, with thousands or millions of values. For example, the Harvard University Library has roughly 16,000,000 volumes, and the US Library of Congress has roughly 22 million cataloged books and over 100,000,000 total items.

Chapter 0: Introduction

Complete the following Chapter Review Problems (not in the textbook).

1. Euclidean algorithm. Euclid wrote one of the first known algorithms around 300 BC, and it's still in use today! Refer to Figure 0.2 (on Page 3) of the textbook to find the GCD of the following numbers. Use the provided tables to show the values of M, N, and R after each step. There may be more rows than needed. **Circle the final answer in each table.**

12 and 18		
M	**N**	**R**

21 and 34		
M	**N**	**R**

34 and 55		
M	**N**	**R**

1000 and 5040		
M	**N**	**R**

2. Play the professor. Each group will be assigned one of the "7 Big Ideas" from Section 0.4 of the textbook. Your task is to write a free response question suitable for Monday's exam. As a group, identify what's important about your topic and discuss how you can design a thought provoking question about it.

3. Play the student. Answer your question. Write 2–3 complete sentences with correct spelling and grammar, using language that a non-technical person would understand. Provide sufficient detail, and make good use of examples.

4. Name that chapter. Use the Table of Contents and Section 0.3 to match the topics on the right with their corresponding chapters on the left. Each chapter is referenced only one time.

1. Data Storage	______	how algorithms are represented and discovered
2. Data Manipulation	______	what problems can/cannot be solved, and why
3. Operating Systems	______	how data is organized on disk; relational model
4. The Internet	______	the layer between hardware and applications
5. Algorithms	______	the mathematics of modeling and rendering
6. Programming Languages	______	how data is organized in computer memory
7. Software Engineering	______	CS meets psychology, biology, and linguistics
8. Data Abstractions	______	different paradigms; compilers vs interpreters
9. Database Systems	______	1's and 0's, logic gates, and digital circuits
10. Computer Graphics	______	software life cycle, large software projects
11. Artificial Intelligence	______	how computers are connected to each other
12. Theory of Computation	______	machine language and program execution

5. Ethical reasoning. Which of JMU's "Eight Key Questions" is discussed at the very end of Chapter 0, and why?

6. Social issues. Pick one of the social issues at the end of the chapter, and discuss it as a group. Write a brief summary of your group's response to the questions. Use complete sentences.