

REVIEW LESSON

MTA Course: Software Development Fundamentals

Lesson name: Software Development Fundamentals 3.3

Topic: Understand algorithms and data structures (One 50-minute class period)

File name: SoftDevFund_RL_3.3

Lesson Objective:

3.3: Understand algorithms and data structures. *This objective may include but is not limited to:* arrays, stacks, queues, linked lists, and sorting algorithms; performance implications of various data structures; choosing the right data structure

Preparation Details**Prerequisite student experiences and knowledge**

Students should have had experience with various data structures and sorting algorithms. The lesson activity assesses student understanding of only three popular sorting algorithms: bubble sort, selection sort, and insertion sort. This MTA Certification Exam Review lesson is written for students who have learned about programming. Students who do not have the prerequisite knowledge and experiences cited in the objective will find additional learning opportunities using resources such as those listed in the Microsoft® resources and Web links at the end of this review lesson.

Instructor preparation activities

None

Resources, software, and additional files needed for this lesson:

- SoftDevFund_PPT_3.3
- SoftDevFund_SA_3.3
- SoftDevFund_SA_3.3_key

Teaching Guide

Essential vocabulary:

array—a list of data values or objects, all of the same type, any element of which can be referenced by an expression consisting of the array name followed by an indexing expression. Arrays are part of the fundamentals of data structures, which in turn are a major fundamental element of computer programming.

data structure—an organizational scheme, such as a record or array, that can be applied to data to facilitate interpreting the data or performing operations on it.

linked list—a list of nodes or elements of a data structure connected by pointers. A singly linked list has one pointer in each node pointing to the next node in the list; a doubly linked list has two pointers in each node that point to the next and previous nodes. In a circular list, the first and last nodes of the list are linked.

queue—a multielement data structure from which (by strict definition) elements can be removed only in the same order in which they were inserted; that is, it follows a first-in-first-out (FIFO) constraint.

sort algorithm—an algorithm that puts a collection of data elements into a sequenced order, sometimes based on one or more key values in each element.

stack—represents a variable-sized last-in-first-out (LIFO) collection of instances of the same arbitrary type.

Lesson Sequence

Activating prior knowledge/lesson staging (5 minutes)

1. Show the Activator slide in the PowerPoint® presentation for this lesson.
 - a. *Ask:* In what ways are data structures similar?
 - i. All data structures have methods for accessing and setting data. Some data structures store data in a certain order.
 - b. *Ask:* In what ways are data structures different?
 - ii. Data is input and accessed in different ways. Some data structures are more appropriate in a situation than others; they affect performance differently in different situations.

Lesson activity (30 minutes)

1. Review the concepts using the presentation.
 - a. Review the definitions.
 - b. Define data structures and give an example of how the choice of a data structure depends on the context.
 - c. Describe arrays and explain the example of array code.
 - d. Describe stacks and queues, show an animation of their action, and explain the example code.
 - e. Describe linked lists and explain the example code.
 - f. Review the various sorting algorithms by explaining how they work and showing a trace of their action on a sample data set.
 - Bubble Sort
 - Selection Sort
 - Insertion Sort

You may want to include Merge Sort and Quick Sort if you have the time. They are not reviewed in this lesson.

Assessment/lesson reflection (15 minutes)

1. Show the Lesson Review slide in the presentation.
 - a. Students will describe situations that call for the different types of data structures.
 - b. Students will describe how to sort a set of numbers using the various sorts reviewed in the lesson.
2. Students complete Student Activity Worksheet 3.3.

Microsoft resources and Web links**Arrays Tutorial (MSDN)**

<http://msdn.microsoft.com/en-us/library/aa288453%28VS.71%29.aspx>

An Extensive Examination of Data Structures Using C# 2.0 (MSDN)

<http://msdn.microsoft.com/en-us/library/ms379570%28VS.80%29.aspx>

Suggested best practices:

- This lesson briefly covers a number of topics. Ask the students what data structures require the most review and provide more information about those.