

GUIDED PRACTICE

Class: *Tree representation and the relationship between number of nodes and height of a tree*

Date assigned: *08/27/2018*

Date due: *08/29/2018*

Time estimate to complete this assignment: *190 mins*

Overview/Introduction

What is this lesson about?

This lesson is the second lecture of CS2400 course, which introduce tree representation and mathematical analysis to tree structure.

Learning Objectives

Basic objectives

1. List 3-5 learning objectives that you expect students to be able to master on their own before class
 - *Review height and depth of a node in a tree*
 - *Define a full binary tree and a complete binary tree*
 - *Calculate number of nodes in a full binary tree of height 4 and the possible numbers of nodes in a complete binary tree*
 - *Identify height of a complete binary tree with 10 nodes*

Advanced objectives

1. List 3-4 learning objectives that you expect students to need help mastering in class and after class
 - *Apply array structure to represent some given tree examples*
 - *Apply linked list structure to represent some given tree examples*
 - *Determine mathematical function between number of nodes and height of a full binary tree*
 - *Determine mathematical function between number of nodes and height of a complete tree*

Preparatory Activities and Resources:

1. Give detailed, action-oriented instructions for completing the Guided Practice assignment
 - a. Keep in mind that the activities should be minimal, simple, engaging, productive, and failure tolerant (see Talbert, 2017, pg. 135)
 - *Review the lecture slides of Lesson 1 to define height and depth of a node in a tree*
 - *Study the lecture slides of Lesson 2 to define a full binary tree and a complete binary tree*

2. Give a “playlist” of resources such as readings, videos, audio, or other content delivery methods that provide students the content to work with

Some useful materials:

- *Slides of Lesson 1 and Lesson 2*
- *The warm-up quizzes*
- *Online YouTube videos*

Exercises: Please complete by _____.

- Give a method for students to submit their work online BEFORE the face to face class meeting. Google forms, SurveyMonkey, and tools in your LMS will all work.
- The submitted work should demonstrate students’ mastery of the basic learning objectives.

- *Follow the videos provided to calculate number of nodes in a full binary tree of height 4, as presented in the warm-up quizzes*
- *Follow the videos provided to calculate the possible numbers of nodes in a complete binary tree, as presented in the warm-up quizzes*
- *Identify height of a complete binary tree with 10 nodes, as presented in the warm-up quizzes*

Questions?

Give a way for students to get help.

If any questions or concerns, please stop by my office during office hours or email me to make an appointment.

Lesson Plan

Lesson: _Tree representation and the relationship between number of nodes and height of a tree_

Timeframe: Note how long will it take the learner to complete all of the activities from pre-class to post-class activities.

___190 minutes in total (75 minutes + 110 minutes + 5 minutes)_____

Materials needed: Describe what items will be needed to complete the in-class activities.

1. Introductory video
2. Interactive tools (to show the steps of using array or linked list to represent a tree structure)
3. Lecture slides with exercises
4. Survey (to collect students' feedback on the materials they learned in class)

Objectives: List out the basic objectives tied to pre-class activities and the advanced objectives tied to in-class and post-class activities.

Basic: Review

1. Review height and depth of a node in a tree
2. Define a full binary tree and a complete binary tree
3. Calculate number of nodes in a full binary tree of height 4 and the possible numbers of nodes in a complete binary tree
4. Identify height of a complete binary tree with 10 nodes

Advanced:

1. Apply array structure to represent some given tree examples
2. Apply linked list structure to represent some given tree examples
3. Determine mathematical function between number of nodes and height of a full binary tree
4. Determine mathematical function between number of nodes and height of a complete tree

Background to the Lesson: Note the typical composition of learners in the class, how this lesson fits into the course design/schedule, prerequisite knowledge required, and typical challenges that learners face with this content area.

1. Most students in the class are sophomore or junior. This lesson is the second lecture of this course.

2. Prerequisite courses: CS1300 Discrete Structures, CS1400 Introduction to Programming and Problem Solving, and MAT 1140 with grades of C or better.
3. Typical challenges: mathematical analysis to tree structures.

Introduction to Lesson: Describe the purpose of this content area for learners and an overview of the activities and resources for the flipped lesson.

The purpose of this content area is to help students comprehend relationship between number of nodes and height of a complete binary tree.

The activities of this flipped lesson can be roughly grouped into three parts: prep work before the lesson, teaching activities in class, and survey after the lesson:

- Teaching materials including short videos, lecture slides, links to interactive tools, and warm-up quizzes will be posted, so that the students can learn the materials on their own and build their first-impression understanding of the materials.
- Teaching materials will be lectured by the instructor in class. Here the lecture slides and in-class exercises will be primary tools. Please note that the activities have two sessions: 1) let students find possible solutions individually; and 2) let students form groups to discuss their solutions and finalize the solution for each group to submit.
- Students' feedback will be collected via survey, which will help instructors learn the weaknesses in this flipped process.

Procedure [Time needed, include additional steps if needed].

Pre-Class Individual Space Activities and Resources: Outline the major steps for the preparatory activities and be sure to tie the steps to the basic learning objectives you have noted above. Note resources required for learner preparation.

Steps	Purpose	Estimated Time	Learning Objective
Step 1: Ask students to review the topics learned in the previous lectures	Refresh students' memory on relevant information	20 mins	Basic objective 1
Step 2: Ask students to watch the videos and go over the lecture slides to learn the materials that will be lectured in this lesson	pre-view the topics	40 mins	Basic objective 2
Step 3: Ask students to take a warm-up quiz	Identify the relationship between height and number of nodes of a complete tree	15 mins	Basic objectives 3 and 4
Step 4:			
Step 5:			

In-Class Group Space Activities and Resources. Outline the major steps for the in-class activities and be sure to tie the steps to the advanced learning objectives you have noted above. Also note any resources needed/developed to provide effective active learning activities within class.

Steps	Purpose	Estimated Time	Learning Objective
<p>Step 1:</p> <p>Lecture on tree representations (array structure and linked list structure).</p>	help students understand tree representation	15 mins	Advanced objectives 1 and 2
<p>Step 2:</p> <p>Ask students to do in-class exercises on tree representation (individually).</p>	hands-on practice on tree representation	5 mins	Advanced objectives 1 and 2
<p>Step 3:</p> <p>Lecture on a full binary tree and a complete binary tree. Review the warm-up quiz took by students In prep-work.</p>	help students understand a full binary tree vs a complete binary tree	30 mins	Advanced objectives 3 and 4
<p>Step 4:</p> <p>Ask students to do in-class exercises on deriving mathematical function between number of nodes and height of a complete binary tree.</p>	Build students' independent thinking	20 mins	Advanced objectives 3 and 4
<p>Step 5:</p> <p>Ask students to form groups to discuss the solution. The instructor will conclude this step by asking students to hand in each group's solution.</p>	Build students' collaborative thinking	40 mins	Advanced objectives 4

Post-Class Individual Space Activities and Resources. Outline the major steps for the post-class activities and be sure to tie the steps to the advanced learning objectives you have noted above. Also note any resources learners will need to complete any post-class activities assigned after the group space activities.

Steps	Purpose	Estimated Time	Learning Objective
Step 1: Ask students to finish a survey	Collect students' feedback on the flipped lesson	5 mins	Basic objectives 1 to 4 Advanced objectives 1 to 4
Step 2:			

Evaluation:

Analysis. In this section, note what you think will work, and what challenges you think you may face in implementation.

The proposed in-class activities such as think individually and group work will work. Also post-class survey will work. I think the main challenge is how to motivate student to accomplish prep work before the lesson. One more challenge is how to deal with the situation where some students complete prep work and some others are not.

Connections to Future Lessons. In this section, note how you think this lesson plan connects to your next topics in the course.

This lesson is the foundation to building strong understanding of the next topics in this course. In addition, as the second lesson of this course, this lesson plays an important role in helping student get familiar with the flipped format.