**Definition of ‘Binary Tree’**

**Assignment 1:3**

**Introduction**

Unit 1:3 assigns students to present the definition of a relatively complex term in three ways—parenthetical, sentence and expanded forms—within their chosen discipline or profession. The ability to effectively write definitions is an important component of technical writing. Written communication will differ between colleagues, friends, family, and unknown audiences. The usage of colloquial, jargon and slang terminologies may limit our ability to cross-communicate between different groups. Thus, it is important that we are able to accommodate different audiences within the context of the information that is being communicated.

In this assignment, I have chosen to present the definition of ‘binary tree’ towards novice Computer Science students in the aforementioned three forms.

**Parenthetical Definition**

Binary trees (trees that only divide into one or two branches at each joint) are examples of common data structures found in the field of Computer Science1.

**Sentence Definition**

A binary tree is a type of data that is structured into a tree-like form. An example of a binary tree would include simple family trees that only have up to two children per parent-pair. In Computer Science, it is usually portrayed as an inverted tree. It is important to note that this type of data structure can only expand in up to two branches at each joint2.

**Extended Definition**

*History of Binary Trees*

In 1951, David Huffman was writing a term paper that was presented with a problem of finding the most efficient way of expressing binary code3. Huffman was able to solve this problem by forming a binary tree that only contained values of ‘1’ and ‘0’. From this success, he published a paper called “A Method for the Construction of Minimum-Redundancy Codes” which became led into the principles of a binary tree4.

*What are Binary Trees?*



Figure 1. Binary Search Tree7.

In Computer Science, binary trees are used to store data in a hierarchal structure that usually portrayed as an inverted tree, as seen in ‘Figure 1’. It is built by connecting adjacent joints which are commonly called ‘nodes’. The ‘root’ is the node that acts as the origin or the beginning of a binary tree, which is denoted by number ‘8’ in Figure 1. Furthermore, each node is restricted to have up to two ‘children’ nodes. A node that has no additional nodes connected to it is called a ‘leaf’. It is important to note that the information contained within a node will generally be relevant to data found in adjacent nodes.

The most common type of binary tree is called the ‘Binary Search Tree’ – which is commonly abbreviated as ‘BST’5. A BST usually has limitations on what can be included in its child nodes. We refer to this as an invariant – or a criteria that must hold true. For example, Figure 1 shows a BST with nodes that have larger or smaller values than the parent node. In this example, the invariant requires nodes with smaller numbers expand to the right of the parent node. On the other hand, nodes with larger values expand to the left of the parent node.

*What examples of non-Binary Trees?*

It is important to distinguish a binary tree from a *multi-ary* tree. By definition, a binary tree will have nodes that can only expand with up to two ‘children’ nodes. On the other hand, a *multi-ary* tree can have infinite nodes upon expansion. Most binary trees also have invariant criteria that is similar to the aforementioned BST example. However, most *multi-ary* trees do not have very specific invariant criteria. Thus, we can distinguish a binary tree from a *multi-ary* tree with these properties6.

*What are the applications?*

An example of its application is observed in folder and file systems in computers. The main folder can be seen as the ‘root’. Any subfolders that are present in the main folder are called ‘nodes’. This pattern may continue until actual files are present. These files would be considered as the ‘leaves’, since they represent the tip of a tree. It is important to note that we are using this example within the context of a binary tree. Thus, each subfolder would either contain two subfolders, two files, or have one of each.

*Why is this important to you?*

Knowing the principles of a binary tree will allow better understanding in data structures. This is especially important in the field of Computer Science. It is seen in programming languages such as Racket and Java5. However, there are limitations of a binary tree in actual practice. In fact, *multi-ary* trees are more commonly used in data storage in servers or computers6. Ultimately, it is important to acquire this understanding of binary trees, along with knowledge of other principles in Computer Science, in order to create better programs.

**Works Cited:**

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