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Securing Data by Using Tree Traversal Techniques

Girija Rani Suthoju
Assistant Professor,
Department of CSE,
Koneru Lakshamaiah Education Foundation, Hyderabad, TS.

S. Swapna
Associate Professor,
Department of CSE,
Pallavi Engineering College, Hyderabad, TS.

Farhana Begum Sattar
Assistant Professor,
Department of CSE,
Vardhaman College of Engineering, Hyderabad, TS.

Abstract: Now-a-days, securing data is a typical scenario and secure world is inviting hackers proportional to the technology. Thus, Security must be provided to data in all sides by encoding data at sender and releasing in to network, on other side at receiver, the data must be decoded with the provided credentials. In the proposed system of this paper, we are introducing binary tree traversals to secure data as a ciphering technique. The data may be extracted from a tree through numerous traversal algorithms.
Keywords: ciphers, traversals, security, trees and encoding

1. INTRODUCTION

A tree is a non-linear data structure for instant storing and retrieval of statistics in number one memory. It represents records in the form of hierarchical shape. Statistics are saved in a tree i.e., referred to as a node, in which topmost node is known as root and every node has one or extra nodes lying at the left or proper facet of a tree. Except for root node each node has a parent node. The data may be extracted from a tree through numerous traversal algorithms. Tree traversal means journeying the nodes of a tree right now. On this paper, we are reading one of a kind algorithms for tree traversal.

A tree is one of the most critical elements of computer sciences. A tree is a non-linear data structure (such as graphs and trees), wherein facts is represented in a hierarchal way. Every element in a tree is called node. It is a collection of various nodes. When we want to symbolize a hierarchical courting represented among own family participants, personnel in organization and many others, the trees are very bendy, powerful and flexible records shape. In a tree, statistics is organized in random order. The statistics of unique elements are stored in a node of the tree and related to subsequent element inside the tree shape. The topmost element in a tree is referred to as root. In a tree, except for the basis node, every detail has a figure node. Each discern node has 0 or extra children. It's miles called a left child or a proper child**.**

2. MAIN CONTRIBUTIONS

While we are acting an operation on a tree for retrieval of an data, we're traveling or walk the tree i.e., called tree traversal. Different kinds of algorithms are used for traversal of a tree. Preorder traversal, in order traversal, submit order traversal or stage order traversal. Dfs or bfs set of rules is likewise used for a tree traversal. Both are used as a specific method to traverse a tree

Here are numerous applications of non-linear data structures, tree: i.e,. Clinical statistics, coverage proposal, a non-clinical information, underwriter information resources, 3D video games, record garage, space partition, specialization of image signature. Also, have the assets of picture filtering. Min tree and max tree phrases are used for image filtering.

3. OUR SYSTEM AND ASSUMPTIONS

No.	Types of Algorithms	Time complexity	Space complexity	Data Structure
1.	BFS	O(|n|): where n is the number of nodes	O(|n|)	Queue
2.	DFS	O(|n|)	Depends on implementation	Stack
3.	DFS(recursive implementation)	O(|n|)	O(|h|): h is the maximal depth of tree	
4.	DFS(with iterative solution)	O(|n|)	O(|n|)	Stack
5.	Recursive algorithm (Fibonacci sequence)	O(2^n)	O(nm): n is the maximum depth of recursion tree	
6.	Component tree computation algorithm (memory access with minimum degree b)	$O(b+\log_b v)$(as per memory access)	$O(b+\log_b v)$	Stack
7.	RHS algorithm for improvement in DFS algorithm[7]	O(N)	O(N)	Stack
8.	RHS (in case of complete Binary tree)[7]	$O(2^n-1)$	-	Stack
9.	Iterative deepening depth-first search (IDDFS) algorithm(for well-balanced tree)	$O(b^d)$: where b is the branching factor and d is the shallowest solution	O(d)	Stack
10.	Martin & Ness's Balancing Algorithm	O(N)	The stack is used to carrying out the traversal	Stack
11.	A Colin day	O(N)	Little space is required	Contiguous memory
12.	Change & Ayengar	O(N)	Additional workspace required = size of tree	Not used Stack
13.	Stout & Warren	O(N)	Only fixed amount of space is required	-
14.	In order traversal without recursion	O(N)	-	Stack
15.	Inorder traversal using recursion & iterative algorithm	O(n)	O(n)	Stack
	Preorder traversal (iterative and non-recursive)	O(n)	O(n)	Stack
	New modified non-recursive algorithm[14]	O(N)	O(NlogN)	-
	Max-tree algorithms.[13]	Shows in table No. 2(n is the number of pixels and k the number of gray levels)		

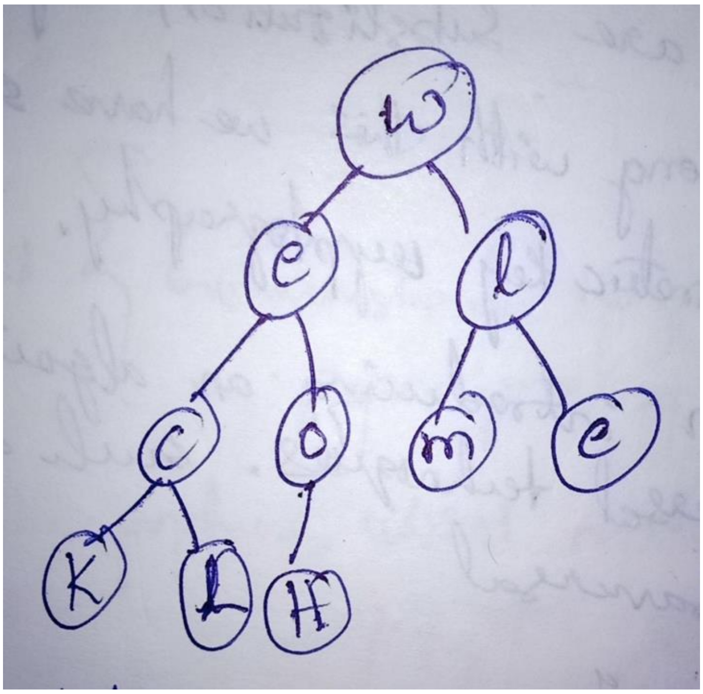
Fig .1: Complexities of Tree

Algorithm	Time complexity			Auxiliary space requirement		
	Small int	Large int	Generic int	Small int	Large int	Generic int
Berger	O(n log n)	O(n log n)	O(n log n)	n+k+O(n)	2n+O(n)	n+O(n)
Berger+rank	O(n α(n))	O(n log log n)	O(n log n)	3n+k+O(n)	4n+O(n)	3n+O(n)
Naiman and couprie	O(n α(n))	O(n log log n)	O(n log n)	5n+k+O(n)	6n+O(n)	5n+O(n)
Salembier et al.	O(nk)	$O(nk) \simeq (n^2)$	N/A	3k+n+O(n)	2k+n+O(n)	N/A
Nister and stewenius	O(nk)	$O(nk) \simeq (n^2)$	N/A	2k+2n	2k+2n	N/A
Wilkinson	O(n log n)	O(n log n)	O(n log n)	N+k+O(n)	3n	3n
Salembier non-recursive	O(nk)	O(n log log n)	O(n log n)	N+k+O(n)	3n	3n

Fig .2: Continuation of time and space complexities

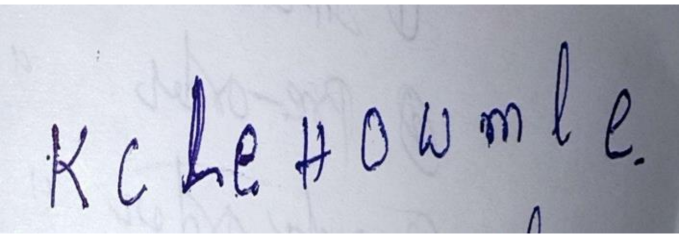
4. IMPLEMENTATION AND EXPERIMENTAL EVALUATION

Consider the tree as follows:

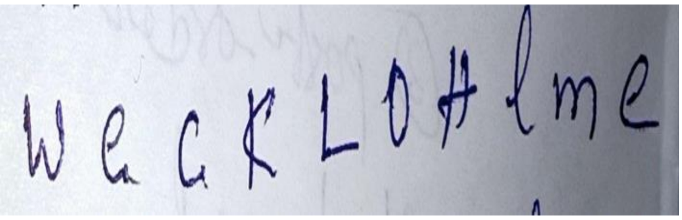


Then the tree traversals may be as follow:

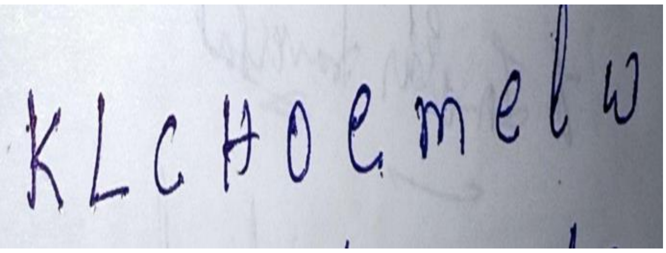
Inorder :



Preorder:



Postorder:



The related code in python can be given as:

```
class Node:
    def __init__(self, item):
        self.left = None
        self.right = None
        self.val = item

def inorder(root):
    if root:
        # Traverse left
        inorder(root.left)
        # Traverse root
        print(str(root.val) + "->", end='')
        # Traverse right
        inorder(root.right)

def postorder(root):
    if root:
        # Traverse left
        postorder(root.left)
        # Traverse right
        postorder(root.right)
        # Traverse root
        print(str(root.val) + "->", end='')

def preorder(root):
    if root:
        # Traverse root
        print(str(root.val) + "->", end='')
        # Traverse left
        preorder(root.left)
        # Traverse right
        preorder(root.right)
root = Node(1)
root.left = Node(2)
root.right = Node(3)
root.left.left = Node(4)
root.left.right = Node(5)
print("Inorder traversal ")
inorder(root)
print("\nPreorder traversal ")
preorder(root)
print("\nPostorder traversal ")
postorder(root)
```

5. CONCLUSIONS

Traversing a tree approach travelling every node within the tree. You might, as an instance, want to add all of the values within the tree or locate the largest one. For a lot of these operations, you'll need to visit each node of the tree. In this assessment paper mentioned various non-linear facts shape tree, and also mentioned exclusive forms of tree traversing strategies. In present tree traversing algorithms an trouble occurs about time complexity, space complexity and top stability of a tree. The writer modified the prevailing algorithm day by day for higher overall performance, according to a need of time in the facts shape. The algorithm that can balance a tree in much less time due to the fact that has not been evolved. In destiny, quality scope in the improvement in existing methods. Linear data structures like arrays, stacks, queues, and linked listing have most effective one manner to study the facts. However a hierarchical data structure like a tree may be traversed in distinct approaches will be helpful to cryptographic concepts.

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8. AUTHOR

[1] Ms. GIRIJA RANI SUTHOJU pursuing Ph.D in CSE department at JNTU Hyderabad. She received Masters degree (M.Tech) in the Department of Computer Science and Engineering at Aurora's Technological and Research Institute belongs to Jawaharlal Nehru Technological University, Hyderabad in 2014 and Bachelors degree (B.Tech) in the Department of Computer Science and Engineering from the same University in 2012.
She worked as an Assistant Professor for 5years in Aurora's Technological and Research Institute affiliated to Jawaharlal Nehru Technological University, Hyderabad. At present she is working in Koneru Lakshmaiah Educational Foundation (K L deemed to be University) Hyderabad.
Ms. Girija Suthoju received Merit Certificate in her Masters from ATRI, JNT University Hyderabad for her best performance in Academics. She also received Teaching Excellence award for best teaching thrice from 2016 to 2018. At present she is working in her area of research i.e., Cryptography and network security.

[2] Ms. S. Swapna pursuing her Ph. D in GITAM University Vizag. She has received her Masters degree (M.Tech) in the Department of Computer Science and Engineering at Aurora's Technological and Research Institute belongs to Jawaharlal Nehru Technological University, Hyderabad. She worked as an Assistant Professor for 5years in Aurora's Technological and Research Institute affiliated to Jawaharlal Nehru Technological University, Hyderabad. At present she is working in her area of research i.e., Cyber security.

She also received Teaching Excellence award for best teaching thrice from 2016 to 2018.

[3] Ms. Farhana Begum Sattar, working as an Assistant professor in CSE department at Vardhaman College of Engineering, Hyderabad. She worked as an Assistant Professor for 4years in Aurora's Technological and Research Institute affiliated to Jawaharlal Nehru Technological University, Hyderabad. At present she is working in her area of research i.e., Cryptography and network security and also in Cyber security.

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Stabilization of Clayey Soils by Using the Organic Waste-Material

Necmi Yarbaşı
Department of Civil Engineering
Engineering Faculty
Ataturk University
Erzurum, Turkey

Ekrem Kalkan
Department of Civil Engineering
Engineering Faculty
Ataturk University
Erzurum, Turkey

Abstract: Soil stabilization known as the process of improving the engineering properties of soils is a method applied when the engineering properties of soil are not suitable for purpose. There are several methods of soil stabilization that could be implemented to improve the physical characteristics of the soil. In this study, the pine tree sawdust as an organic material wase used as additive material for stabilization of clayey soils and the influence of pine tree sawdust on the geotechnical properties of clayey soil was investigated in terms of strength behaviors. The pine tree sawdust is an organic waste resulting from the mechanical milling or processing of timber (wood) into various standard shapes and useable sizes. The strength properties of the clayey soil when blended with pine tree sawdust indicates that the pine tree sawdust is a good stabilization material for this problematic soil. As a result, it is concluded that the pine tree sawdust material as an organic material can be successfully used for the reinforce of clayey soils in the geotechnical applications.

Keywords: Soil; clayey soil; pine tree sawdust; soil stabilization; strength behavior

1. INTRODUCTION

The soil is one of the oldest and perhaps most complex geological materials that humanity has been working on. Various problems have begun to be encountered by using the expansive soil as foundation or material. The expansive soil changes in volume in relation to changes in water content. This occurs as swelling upon wetting, and shrinkage upon drying. These soils have poor volume stability in the presence of water (Jones and Jefferson, 2012; Li et al., 2014). These soils have a problem worldwide undergoing considerable volume changes such as swelling on absorbing water and shrinking on evaporation.

Moreover, moisture fluctuations of them cause distinct changes in soil strength (Fredlund and Rahardjo, 1993; Sheng et al., 2008; Phanikumar, 2009; Lin, and Cerato, 2012; Pooni et al., 2019). Such soils should generally be avoided for the purpose of construction. Because, the structural damages of constructures built on expansive soils is well documented in literature (Petry and Little, 2002; Fall and Sarr, 2007; Kalkan and Bayraktutan, 2008; Ozer et al., 2011; Jones and Jefferson, 2012; Tiwari et al., 2012; Kalkan et al., 2019; James, 2020; Yarbaşı and Kalkan, 2020). Also, the damage to lightly loaded structures founded on expansive soils has been widely reported (Cameron et al., 1987; Walsh and Cameron, 1997; Fityus et al., 2004; Delaney et al., 2005; Miao et al., 2012; Li et al., 2014; Kalkan et al., 2020).

When the mechanical qualities of expansive soils are lower than those required, stabilization can be an option to improve performance, notably in enhancing its strength. Improvement of certain desired properties like bearing capacity, shear strength and permeability characteristics of soil can be undertaken by a variety of ground (Kalkan, 2013). The soil improvement techniques can be divided into four main categories. These categories are soil improvement without admixtures, soil improvement with admixtures or inclusions, soil improvement using stabilization with additives and grouting methods and soil improvement using thermal methods (Chu et al., 2009; Manar et al., 2015).

There are various methods of stabilization including either mechanical stabilization or chemical stabilization. Mechanical techniques densify the soil expelling air from the voids. Chemical techniques incorporate additives that improve the properties of problematic soils and the chemical stabilizers are characterized as traditional and non-traditional additives. Traditional stabilizers include calcium-based stabilizers such as lime and cement (Tingle et al., 2007; Pooni et al., 2019).

Several soil stabilization methods are available for stabilization of expansive clayey soils. These methods include the use of chemical additives, rewetting, soil replacement, compaction control, moisture control, surcharge loading, and thermal methods (Chen, 1988; Nelson and Miller, 1992; Yong and Ouhadi, 2007). Many investigators have studied natural, fabricated, and by-product materials and their use as additives for the stabilization of clayey soils.

All these methods may have the disadvantages of being ineffective and expensive. Therefore, new methods are still being researched to increase the strength properties and to reduce the swell potential of expansive soils (Akbulut et al., 2007; Al-Rawas et al., 2005; Asavasipit et al., 2001; Bell, 1996; Cetin et al., 2006; Guney et al., 2007; Kalkan and Akbulut, 2004; Kolias et al., 2005; Miller and Azad, 2000; Moavenian and Yasrobi, 2008; Prabakar et al., 2003; Puppala and Musenda, 2002; Senol et al., 2006; Sezer et al., 2006; Mohamedgread et al., 2019; Yarbaşı and Kalkan, 2019; Kalkan, 2020).

In this study, the pine tree sawdust as an organic material was used as additive material to stabilize the clayey soils. These soils were evaluated in an attempt to develop alternative stabilization material with high compressive strength for geotechnical applications. Also, obtained engineering properties of stabilized clayey soil samples with pine tree sawdust were presented and discussed.

2. MATERİLA and METHODS

2.1. Clayey Soil Material

The clayey soil material was supplied from the clayey soil deposits of Oltu-Narman sedimentary basin, Erzurum, NE Turkey. The clayey soil samples were taken 0,75 m deep. According to the United Soil Classification System, clayey soil are inorganic clays of high plasticity (CH). These soils have high expansion potential as a result of over consolidation, high-very high plasticity and montmorillonite content (Kalkan, 2003; Kalkan and Bayraktutan, 2008). The grain-size distribution of clayey soil was given in Figure 1.

2.2. Pine Tree Sawdust

Wood cutting factories, generates a by-product known as sawdust. The pine tree sawdust waste material was obtained from the carpenters in the industrial zone of Oltu (Erzurum), NE Turkey. The pine tree sawdust is an organic waste resulting from the mechanical milling or processing of timber (wood) into various standard shapes and useable sizes. Consisting of soil-like particulate materials that are lighter than soil, sawdust inexpensive and environmentally safe (Rao et al., 2012; Oyedepo et al., 2014). The grain-size distribution of the pine tree sawdust waste material was illustrated in the Figure 1.

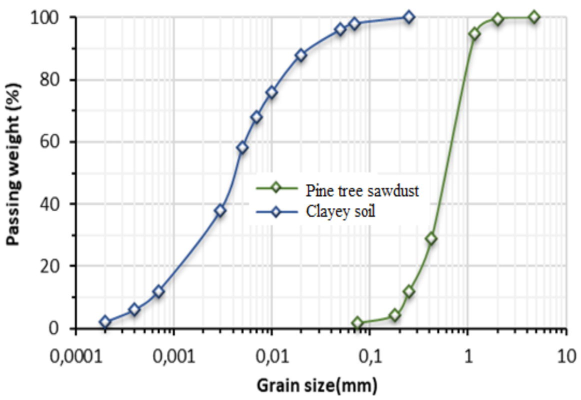

Figure 1. The grain-size distributions of clayey soil and pine tree sawdust

2.3. Preparation of the Samples

The clayey soil and pine tree sawdust were mixed under dry conditions to prepare mixtures of clayey soil-pine tree sawdust. The amounts of pine tree sawdust were selected to be 0,5%, 1% and 1,5 % of the total dry weight of the mixtures (Table 1). The dry mixtures were mixed with the required amount of water recognized to give the optimum water content. All mixing was done manually and proper care was taken to prepare homogeneous mixtures at each stage.

2.4. Unconfined Compression Test

The UCS values of clayey soils and stabilized clayey soil samples with pine tree sawdust were determined from the unconfined compression tests in accordance with ASTM D 2166. The unconfined compression test was carried out on the cylindrical samples compacted at optimum moisture content. The samples of unconfined compression tests had 35 mm in diameter by 70 mm in length. During the tests, at least three samples were tried for each combination of variables. In this study, three cylindrical samples were prepared and tested for each combination of mixtures. The unconfined compression tests were performed at a deformation rate of 0,8 mm/min.

Table 1. Clayey soil and pine tree rates of samples

Samples	Clayey soil	Pine tree sawdust	Total
SMP0	100	-	100
SMP1	99,5	0,5	100
SMP2	99,0	1,0	100
SMP3	98,5	1,5	100

3. Results and Discussion

3.1 Compaction Properties

The maximum dry unit weight in various clayey soil-pine tree sawdust mixture sample decreases with an increase in the percentage of pine tree sawdust contents, while the optimum moisture content increases. On the mixing the clayey soil with 0,5%, 1% and 1,5% pine tree sawdust, the maximum dry unit weight of mixtures decreased and the optimum moisture content increased. Similar results were reported by Okagbue (2007), Rao et al. (2012) and Shawl et al. (2017).

3.2 Effects of Pine Tree Sawdust on the Unconfined Compressive Strength

The effect of pine tree sawdust organic waste material on the unconfined compressive strength values of clayey soil was investigated by carrying out the unconfined compression tests under laboratory conditions. The tests were repeated for different contents of the pine tree sawdust and the changes in strength behaviors of stabilized clayey soil samples were examined. Also, the samples were cured for 1, 7, 28 and 90 days of curing periods. The results obtained from the experimental studies showed that the pine tree sawdust organic waste material improves the strength behavior of clayey soils and their unconfined compressive strength values increased with the addition of the pine tree sawdust organic waste additive (Figure 2).

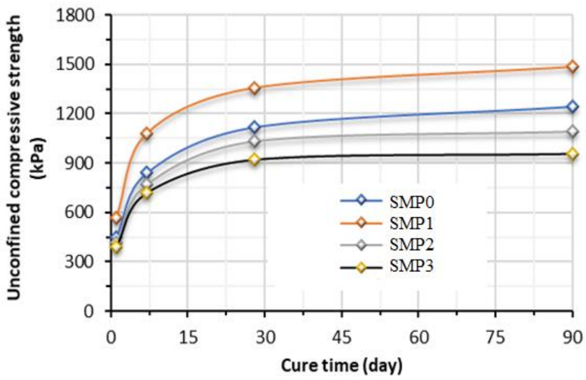

Figure 2. Change in the strength behavior of the samples with pine tree sawdust

At the same time, it was observed that the curing period played an important role on the strength behaviors of stabilized clayey soil samples with pine tree sawdust additive and the unconfined compressive strength values increased with the increasing curing period. Similar results were reported by Udoeyo and Dashibil (2002), Okagbue (2007), Okunade (2008), Mageswari and Vidivelli (2009) and Oyedepo et al. (2014). At the stabilization studies, it was observed that the maximum increase in the unconfined compressive strength was obtained with the 0.5% content of fine tree sawdust. Also, 90 days of curing period was the best time interval for the maximum unconfined compressive strength values of stabilized clayey soils.

4. CONCLUSIONS

In this study, the pine tree sawdust as an organic material was used as additive material to stabilize the clayey soils. The obtained results for different pine tree sawdust contents under different curing period were discussed. In all cases, the addition of pine tree sawdust to the clayey soils the maximum dry unit weight decreased and the optimum moisture content increased in the stabilized clayey soil samples. The unconfined compressive strength values of stabilized clayey soil samples with the pine tree sawdust increased due to the increase of the pine tree sawdust content. This increased strength contributed to the 0,5% the pine tree sawdust rate. As a result, the pine tree sawdust waste material can be used to improve the geotechnical properties of clayey soils in terms of strength behavior. In addition, the pine tree sawdust waste material can potentially reduce stabilization costs by utilizing wastes in a cost-effective manner.

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