

Account Charting and Financial Reporting At Accounting Module on Enterprise Resource Planning Using Tree Traversal Algorithm

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Abstract—Accounting is one of the main modules on enterprise resource planning, which monitors journal, chart of account, and create financial statements. Chart of account is a chart which controls all transactions in the enterprise. On chart of accounts, there are some parent-child relation between some accounts. Tree traversal algorithm is proposed on this paper to make steps on creating a chart of accounts more simple and more efficient. Tree traversal algorithm also implemented in financial statements. This proposed methods are used to optimize the process of making chart of accounts.

Keywords—Accounting, Chart of Accounts, Financial Statements, Tree Data Structure, Tree Traversal Algorithm.

I. INTRODUCTION

Enterprise Resource Planning is an application that used to maintain big company to integrate all of the resources, information, and activity to complete business processes.[1] ERP has several modules, one of the main modules is accounting.

Accounting is responsible on maintaining all transaction in the enterprise including movement of assets in and out of the inventory, operating expenses, financial records such as sales and purchases, etc.[2]

On accounting module, the process is not complicated because it only has 4 main processes: create accounts, set up accounting periods, create journals, and generate financial statements.[3] Starts with create a chart of accounts which uses to monitor all transaction based on their account number. Sets up accounting period to group some journals based on when it is created. Makes journals which will be used to monitor all transactions happened in the enterprise. Both account and period are used to make journals.[4] Financial statements then generate by combining all journals based on its period.[5]

Chart of account is one of the main foundation on accounting module besides period, because it controls journals and financial statements.[6] There are some ways of making a chart of accounts like adding an account combination submodule or selecting from which parent is this account on, etc. While all of those ways are created manually. Chart of account has a parent-child relation which triggers this paper to use tree algorithm to make it more efficient and simpler.

Besides chart of accounts, tree traversal algorithm also used on financial reporting. After the account tree is created, in the financial report, the account tree will be read on preorder traversal type based on tree traversal algorithm.

II. LITERATURE REVIEW

A. Enterprise Resource Planning

Enterprise Resource Planning is an information system designed for manufacturing companies and services that contribute to integrate and automate the business processes associated with aspects of the operation, production, and distribution in the company. So ERP is a thermology given to information systems that support transactions or operations on a daily basis in managing enterprise's resources including funding, people, machinery, time, materials and inventories.[7]

Advantages of using the ERP system includes integration of financial data, standardization of operating processes, standardization of data and information, inventory reduction and labor, increased service levels and financial control and decrease the time it takes to get information.

There are some departments or sections which are generally integrated including:

1. Finance Resource Management
2. Supply Chain Management
3. Manufacturing Resource Planning
4. Human Resource Management
5. Customer Relationship Management

B. Accounting

Accounting is the translating, measuring, or provisioning activity of information related to financial transactions in a systematic and comprehensive, which will help financial and the other department managers, stakeholders, and other decision makers to make allocation decisions between resources within companies and stakeholders. Accounting also served to make the process of analyzing and reporting those transactions and put it into accurate financial statements.[8] The financial statements should be clearly summarized financial operations in the company, the company's financial

position, and cash flows.[9] Accounting is also known as the language of business.[5]

Accounting mainly divided into financial accounting and management accounting. Financial accounting is responsible on recording any financial transactions that is happened in the company.[10] When management accounting is focusing on providing information the organization or the company needs to manage various processes. In short, financial accounting is focusing on what already happened, while management accounting is focusing on what will happen in the future.

Fig. 1 shows the financial accounting cycle, this cycle shows that accounting is not more than journals and periods which controls journals to start or stop.



Fig.1. Accounting Cycle

C. TreeData Structure

The tree can be defined both as a data type and as a data structure, the tree also is a widely used as ADT (Abstract Data Type) – or data structure implementing this ADT – which simulates a tree structure hierarchically.[11] Generally, a tree contains root, branch, and leaf, in the same way, tree data structure also contains root (parent node), branch (subtree), and leaf (child node).[12]

A tree data structure can also be defined as a group of nodes, where each node contains a value together with a pointer (“reference”) to the other node which is the child node. Each node does not contain any pointer to its own root (parent) and no reference is duplicated.[13]

Example of tree data structure is shown in Fig. 2.

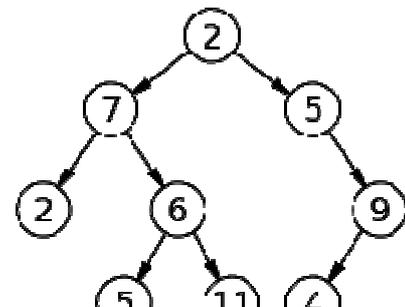


Fig. 2. Tree Data Structure Example

D. Preorder Traversal

Preorder Traversal is one of the methods from tree traversal algorithm which started from the root first then go to the left subtree and continue recursively based on the subtree[14].

The preorder traversal will keep traversing to the left most part of the tree until a leaf node (child node) is encountered. For example:

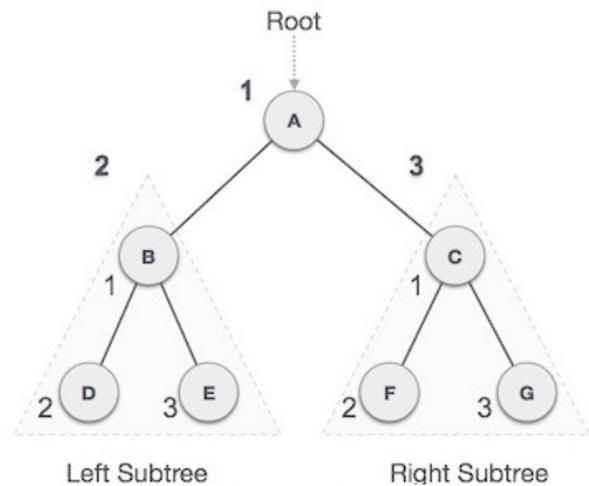


Fig. 3. Preorder Traversal

Preorder traversal algorithm will be started from the root which is A and then followed by the left subtree which is B. As shown in Fig. 3. that B also has left subtree which is D, so the next node will be D. And the process goes on recursively until all of the nodes are already visited. The output from this traversal method on Fig.3. will be $A \rightarrow B \rightarrow D \rightarrow E \rightarrow C \rightarrow F \rightarrow G$ [15]

E. Postorder Traversal

Postorder Traversal is one of the methods from tree traversal algorithm which started from the leftmost subtree, followed by the right subtree of the first node, then go to the root.[14] For example:

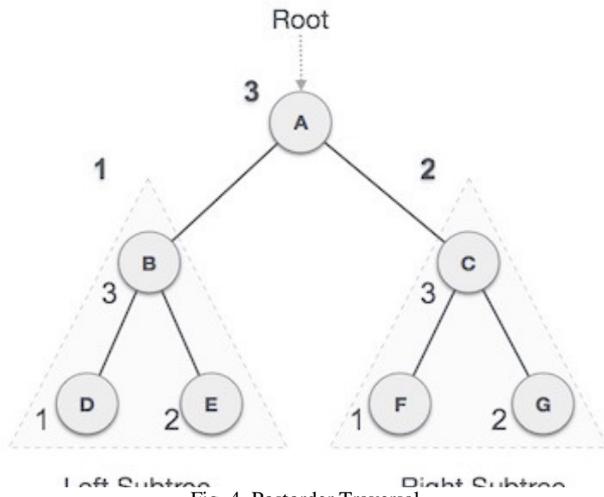


Fig. 4. Postorder Traversal

Postorder Traversal will be started from the leftmost subtree which is D, then followed by the right subtree (not the rightmost subtree), which is E. If there is no other subtree, go to the root, in Fig. II.4. the root of the subtree is B. And the process goes on recursively until all of the nodes are already visited. The output of this traversal method on Fig. II.4. will be $D \rightarrow E \rightarrow B \rightarrow F \rightarrow G \rightarrow C \rightarrow A$. [15][16]

III. METHODOLOGY

This section will explain how to make a chart of account and read the accounts of financial statements based on tree algorithm. The steps will be explained below:

A. List all accounts

To do this, list all account that has to do with the enterprise's business process. If the enterprise runs on manufacturing, there has to be *Inventory* account and *Machinery* account, if the enterprise runs only on reselling item, *Machinery* account is not needed.

Make sure all accounts that are listed already departed based on the needs, for example on *Machinery* account, this account can be departed into some accounts such as *Welding Machine*, *Molding Machine*, etc.

In this step, all of the accounts does not have to be ordinal, just make sure the account created is sufficient to the enterprise's needs.

B. Decide the parent and child

When the account is already listed, decide which one is the parent and which one is the child. To do this, each account has to be set with an account code. In some country, account codes are decided by some numbers, while some others country are combining characters and numbers.

To set the code for the account, definition of each account and which one is part of the other account has to be known. For example of some account using numerical code:

TABLE 1. CHART OF ACCOUNTS EXAMPLE

Code ₁	Code ₂	Code ₃	Acc Code	Acc Name	Status
1	-	-	1	Assets	Parent
1	1	-	11	Cash and Cash Equivalent	Child-1
1	2	-	12	Inventory	Child-2
1	1	1	111	Cash	Child-1-1

As stated in the Table 1, account *Cash and Cash Equivalent* has the same Code₁ as *Assets*, which doesn't have any Code₂, means that *Assets* is *Cash and Cash Equivalent*'s parent the same goes to *Cash* on *Cash and Cash Equivalent*.

These parent-child relations are not only to set the account code relation but also later on financial reporting on addition recursion between child's balance, in short, these relations are used to fulfill the equation:

$$Pb = Pb + \sum_0^n Cb \quad (1)$$

Pb : Parent Balance

Cb : Child Balance

n : Number of child

The balance point is decided by all journals that are created based on the account related. Parent is not always what on top node of the tree, in this example, *Child-1* is *Child 1-1*'s parent.

C. Create the tree using parent and child relation

After the parent-child relation already created, list all of the account using *Tree Traversal* algorithm. For example:

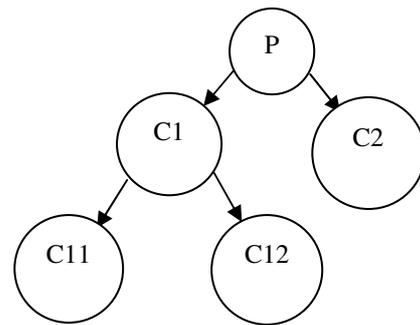


Fig. 5. Chart of Accounts on Tree Traversal

P : Parent

C1 : Child-1

C2 : Child-2

C11 : Child-1-1

C12 : Child-1-2

Some parent can have one or more child, or even does not have any, these relations are based on the account that listed before.

D. Calculate the Parent Balance

To calculate the account balance based on journal inputs and child account balance, as shown from (1), to calculate the parent balance, child balance and own parent balance is needed, to do this use postorder traversal algorithm.

Postorder traversal algorithm will check all of the child's balance first then go for the parent's balance. In short, all child's balance will be calculated first then will continue by adding parent's balance into the child's balance.

Shown in Fig.5. Postorder traversal will go from **C1-1 → C1-2 → C1 → C2 → P**.

If the traverse meets the parent, trigger equation (1) based on the balance of the children and the parents.

E. Create the Financial Statement

A financial statement such as balance sheet and income statement will show all account according to the type of the account. For the balance sheet, it will print all account related to assets, liabilities, and equities, then for the income statement, it will print all account related to revenues and expenses.

To do this, do preorder traversal algorithm which will read the account following with its balance (done on step III.D) from the top to the bottom. For the example shown in Fig.5. It will travel from **P → C1 → C1-1 → C1-2 → C2**.

Example of the results of this step is shown in Fig. 6.

Parent	x+y
Child-1	$x = x_1 + x_2$
Child-1-1	x_1
Child-1-2	x_2
Child-2	y

Fig. 6. Example of the Financial Statement

The result from this step will be two type of financial statements: balance sheet and income statement. As stated before, the difference between both financial statements is determined by the account type of each account.

IV. RESULTS

This section will explain the results from the methodology explained above and how to implement them step by step.

A. List all accounts

The result from this step is shown in Table 2.

TABLE 2. ALL ACCOUNT RELATED TO ENTERPRISE

Account Name
Assets
Liabilities

Account Name
Equities
Revenues
Expenses
Cash and Cash Equivalent
Cash
Inventory
Raw Materials
Finished Goods
Account Payable
Loan from Bank
Shared Capital
Sales
Sales Discount
Waging Expenses
Direct Labor
Indirect Labor
Utility Cost
Electricity

Table 2 shows some account that is related to the enterprise, in this case, a manufacturing enterprise.

B. Decide the parent and child

From Table 2, all account has been listed, then decide which one will be the other's parent and which one will be the other's child by setting up an account code on each account. The result from this step is shown in table 3.

TABLE 3. ALL ACCOUNT WITH EACH CODE

Acc Code	Account Name
1	Assets
2	Liabilities
3	Equities
4	Revenues
5	Expenses
11	Cash and Cash Equivalent
111	Cash
12	Inventory
121	Raw Materials
122	Finished Goods
21	Account Payable
22	Loan from Bank
31	Shared Capital
41	Sales
42	Sales Discount
51	Waging Expenses
511	Direct Labor
512	Indirect Labor
52	Utility Cost
521	Electricity

Table 3 shows all account from table 2 with each code on each account, the code on these account is based on how the parent-child relationship between accounts.

C. Create the tree using parent and child relation

Create the tree with using table 3 as a reference, the result is shown in Fig. 6.

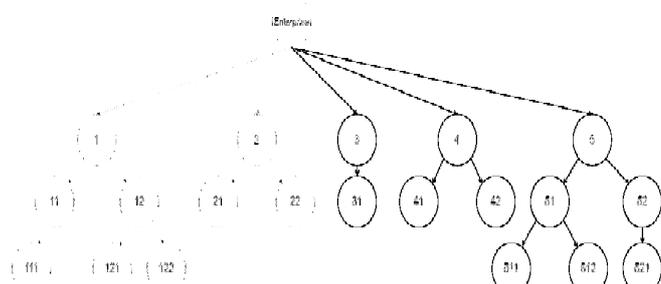


Fig. 6. Parent-Child Account Relationship Tree

D. Calculate the Parent Balance

Postorder Traversal from Fig. 6. will go from 111 → 11 → 121 → 122 → 12 → 1 → 21 → 22 → 2 → 31 → 3 → 41 → 42 → 4 → 511 → 512 → 51 → 521 → 52 → 5 → Enterprise. Which logically means, everytime the traversal met the parents, it will add the balance from the children to the parents. This will fulfill (1), for example:

$$1_b = 1_b + 11_b + 12_b \text{ or } 12_b = 12_b + 121_b + 122_b$$

The results of this step is shown in Fig. 7.

Assets	100.000.000
Cash and Cash Equivalent	50.000.000
Inventory	50.000.000

Fig. 7. Parent balance calculation implementation

E. Create the Financial Statement

To create a financial statement, as shown in Chapter III.E., preorder traversal is needed to be used because, in the financial statement, the account has to be printed from the parent to the child, not the other way.

Preorder Traversal from Fig. 6. will go from Enterprise → 1 → 11 → 111 → 12 → 121 → 122 → 2 → 21 → 22 → 3 → 31 → 4 → 41 → 42 → 5 → 51 → 511 → 512 → 52 → 521.

If we infer those results into a table it will form:

TABLE 4. CHART OF ACCOUNT AFTER PREORDER TRAVERSAL

Account Code	Account Name
1	Assets
11	Cash and Cash Equivalent
111	Cash
12	Inventory
121	Raw Materials
122	Finished Goods
2	Liabilities
21	Account Payable
22	Loan from Bank
3	Equities
31	Shared Capital
4	Revenues
41	Sales
42	Sales Discount
5	Expenses
51	Waging Expenses
511	Direct Labor
512	Indirect Labor
52	Utility Cost
521	Electricity

If both preorder traversal and postorder traversal has been implemented, it will results a report that shown in Fig 8. (Balance Sheet) and Fig. 9. (Income Statement).

Revenues	75.000.000
Sales	100.000.000
Sales Discount	-25.000.000

Fig.8. Balance Sheet Example using Preorder and Postorder Traversal

Fig. 8. which shows a balance sheet report, contains of 3 account type which is assets, liabilities, and equities.

Assets	100.000.000
Cash and Cash Equivalent	50.000.000
Cash	50.000.000
Inventory	50.000.000
Raw Materials	25.000.000
Finished Goods	25.000.000
Liabilities	50.000.000
Account Payable	30.000.000
Loan from Bank	20.000.000
Equities	50.000.000
Shared Capital	50.000.000

Expenses	
Waging Expenses	20.000.000
Direct Labor	15.000.000
Indirect Labor	5.000.000
Utility Cost	10.000.000
Electricity	10.000.000

Fig. 9. Income Statement Example using Preorder and Postorder Traversal

Fig. 9. which shows an income statements report, contains of 2 account type which is revenues and expenses.

V. CONCLUSION

In any business process, chart of accounts and financial statements are the entrance and exit of accounting, if the chart of accounts is already bad, it will end up worse at financial statements. So both of them are considered vital in accounting.

Tree postorder traversal algorithm and tree preorder traversal algorithm has different usage. While the postorder algorithm is working on balance addition between child and parent, and the other hand, the preorder algorithm is working on the sorting of the accounts.

What already exists shows a bit complicated step to make chart of accounts by adding some sub-module which is an account combination or manually checked on a checkbox which is the parent and which is not. Tree algorithm makes it simpler and more efficient by making a parent-child relationship between accounts and makes it easier to create a financial statement. Tree algorithm also makes it more reliable on making a high-level parent-child relationship, because all of the accounts needed can be created in way more time efficient.

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