

The Application of Decision Tree to Determine the Topic of Discrete Mathematics Paper

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Abstract— Paper writing has already been a mandatory assignment for Discrete Math course in Informatics Major since 2009. Since that, many of Informatics student experience difficulty to start writing, especially when it comes to determining the topic. This paper are made to help determining the topic of the paper.

Keywords—Decision, Tree, Topic, Paper.



Figure 1. A paper and a pen

(source : <http://lilinhaangel.com/2013/09/4-games-you-can-play-with-only-pen-and-paper/>)

I. INTRODUCTION

Writing has become a hobby for some people. Many people pour out their heart by writing. It could be a journal, paper, short story, novel, and many more. You can look through people's personality, habit, etc. by reading their paper.

Writing itself is a medium of human communication that represents language and emotion through the inscription or recording of signs and symbols. In most languages, writing is a complement to speech or spoken language. Writing is not a language but a form of technology. Within a language system, writing relies on many of the same structures as speech, such as vocabulary, grammar and semantics, with the added dependency of a system of signs or symbols, usually in the form of a formal alphabet [6].

Now then, you could write easier than before. By having a laptop, you don't have to take a paper and pen. There are many references you could take from the internet. Much easier by reading an E-book. Now then, open your laptop and start writing!

But before that, there are several things that we have to consider. It's by choosing a topic. After we have the topics, we could continue to the next step. To choose a topic there are many method that we could use, one of the example is by using a decision tree to make a decision what topic we could use.

In this paper, author tries to explain how a decision tree could have us to determine a topic of a paper. The paper that will be discussed in this paper is a discrete mathematics paper, although you could use it for writing another paper by following the same step.

II. WRITING

A. The History of Writing

Before we recognize writing that we know today, it first known as tokens as precursor of writing. The direct antecedent of the Mesopotamian script was a recording device consisting of clay tokens of multiple shapes (Schmandt-Besserat 1996).

The artifacts, mostly of geometric forms such as cones, spheres, disks, cylinders and ovoids, are recovered in archaeological sites dating 8000–3000 BC. The tokens, used as counters to keep track of goods, were the earliest code—a system of signs for transmitting information. Each token shape was semantic, referring to a particular unit of merchandise. For example, a cone and a sphere stood respectively for a small and a large measure of grain, and ovoids represented jars of oil. The repertory of some three hundred types of counters made it feasible to manipulate and store information on multiple categories of goods (Schmandt-Besserat 1992).



Figure 2. Envelope, tokens and corresponding markings, from Susa, Iran
(source <https://sites.utexas.edu/dsb/tokens/the-evolution-of-writing/>)

The token system had little in common with spoken language except that, like a word, a token stood for one concept. Unlike speech, tokens were restricted to one type of information only, namely, real goods. Unlike spoken language, the token system made no use of syntax. That is to say, their meaning was independent of their placement order. Three cones and three ovoids, scattered in any way, were to be translated 'three baskets of grain, three jars of oil.' Furthermore, the fact that the same token shapes were used in a large area of the Near East, where many dialects would have been spoken, shows that the counters were not based on phonetics. Therefore, the goods they represented were expressed in multiple languages. The token system showed the number of units of merchandize in one-to-one correspondence, in other words, the number of tokens matched the number of units counted: x jars of oil were represented by x ovoids. Repeating 'jar of oil' x times in order to express plurality is unlike spoken language[5].

Its history continue with Pictography, as an accounting device, Logography, as a shift from visual to aural, and then it begins to become an alphabet, and the last but not least, it is the modern writing like we know today. By using alphabet and a language, we could write like today by following the format. We can also handle some data by writing it into an abstract. Maybe in the future there will be some other way to write, who knows.

B. Scientific Paper

Paper its a noun that the definition is material manufactured in thin sheets from the pulp of wood or other fibrous substances, used for writing, drawing, or printing on, or as wrapping material[4].

But when it comes to the context of scientific paper, it's also could be defined as an essay that have these particular characteristics, as follows[3] :

- They are usually published in a periodical called a journal whose purpose is to publish this kind of work. Generally, journals differ greatly from general interest writing on scientific topics such as magazine articles and

science news (e.g. those in National Geographic, Scientific American, Discover, etc.) although some journals also have a section devoted to general interest writing. Occasionally scientific papers are compiled in book form but this is not the norm.

- They are peer reviewed. That means that the paper has been subjected to the scrutiny of several experts in the field who verify the quality of the writing and the accuracy of the analysis and conclusions drawn by the authors.
- They are citable. This means that: the content is stable, the journal is readily available in libraries and (usually) through the Web, and there are standardized methods of identifying a particular article. Thus an author can refer to a paper with confidence that a reader can easily look up that reference at any point in the future.
- They include citations. This means that the paper frequently makes reference to previous publications that are relevant to the work being discussed. All cited works are listed in a reference section at the end of the paper. Footnotes at the bottom of each pager are not used to make citations.
- The general outline/flow is as follows
 1. Title
 2. Author(s)
 3. Abstract
 4. Introduction
 5. Methods
 6. Results
 7. Discussion
 8. References/Literature cited
- They follow a standardized style of writing and data presentation.

C. Write a Paper

There are many results by writing, it could be a journal, a story, novel, paper, etc. What will we discuss here is about how to write a paper. Unlike the abstract writing, a paper here have some format, a paper must contain an introduction, basic theory, the discussion, conclusion, acknowledgement, and references. It's also forbidden to plagiarism from other source, or even yours. There are some way to cite, for example is APA format and MLA format. For example in APA citation format, you have to include the author name, for example if you cite from a book that have only one author : Smith, J. K. (Date). *Title* [8].

But before you write, there are some step that you could use to help you writing, as follows[7] :

1. How to start research topic?
2. Find information
3. Make your thesis statement
4. Make research paper outline
5. Oganize your notes

6. Write your first draft
7. Revise your outline draft

III. TREE

A tree is a connected undirected graph with no simple circuits. Suppose that $G = (V, E)$ is a simple undirected-graph and the number of its nodes is n . Then, the following terms are all equivalent [2]:

1. G is a tree.
2. Every pair of nodes in G is connected with a single edge.
3. G is connected and has $m = n-1$ number of edges.
4. G has no simple circuit and has $m = n-1$ number of edges.
5. G has no simple circuit and the addition of an edge to the graph will result to the formation of only one circuit.
6. G is connected and all of its edges are bridges (a bridge is an edge that if it is deleted from the graph, will separated the graph into two components).

All of the statement above can also be defined as another definition of a tree [2].

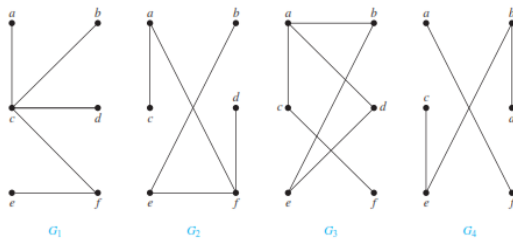


Figure 3. The Example of a Tree and a Non-Tree

(source : Discrete Mathematics and its application, Kenneth H. Rosen : 746)

A rooted tree with the "away from root" direction (a more narrow term is an "arborescence"), meaning[12]:

- A directed graph,
- whose underlying undirected graph is a tree (any two vertices are connected by exactly one simple path),
- with a distinguished root (one vertex is designated as the root),
- which determines the direction on the edges (arrows point away from the root; given an edge, the node that the edge points from is called the parent and the node that the edge points to is called the child),

together with:

- an ordering on the child nodes of a given node, and
- a value (of some data type) at each node.

It's also have some terminology in it, as follows are the terminology of a rooted tree :

1. Root
The top node in a tree.

2. Child
A node directly connected to another node when moving away from the root.
3. Parent
The converse notion of a child.
4. Siblings
A group of nodes with the same parent.
5. Descendant
A node reachable by repeated proceeding from parent to child. Also known as subchild.

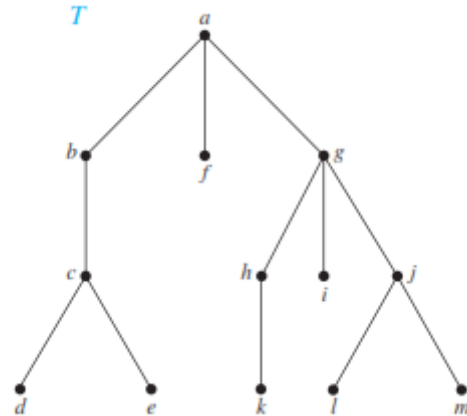


Figure 4. Rooted Trees

(source : Discrete Mathematics and its application, Kenneth H. Rosen : 753)

6. Ancestor
A node reachable by repeated proceeding from child to parent.
7. Leaf
A node with no children.
8. External node (not common)
A node with no children.
9. Branch node
A node with at least one child.
10. Internal node
A node with at least one child.
11. Degree
For a given node, its number of children. A leaf is necessarily degree zero.
12. Edge
The connection between one node and another.
13. Path
A sequence of nodes and edges connecting a node with a descendant.
14. Level
The level of a node is defined as: 1 + the number of edges between the node and the root.
15. Depth
The depth of a node is defined as: the number of edges between the node and the root.
16. Height of node
The height of a node is the number of edges on the longest path between that node and a leaf.
17. Height of tree
The height of a tree is the height of its root node.
18. Forest
A forest is a set of $n \geq 0$ disjoint trees.
19. m-ary trees

Rooted trees known as m -ary trees iff all edges on it has a child not more than m . A tree know as a full m -ary trees iff all edges on it has an exactly m child. 2-ary trees are known as a binary tree.

20. Decision Tree

Decision Tree is one of the application of rooted trees. Rooted trees is that its internal nodes that are corresponding with one decision and the childs are the solution of that decision is known as a decision tree. All the solution of a problem showed with a track to a leave from those trees.

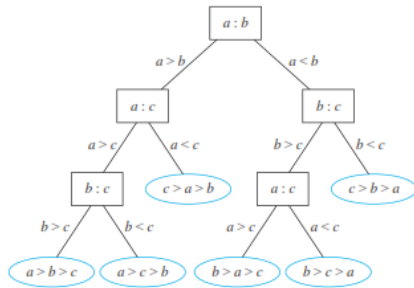


Figure 5. A decision tree to sort three different element

(source : Discrete Mathematics and its application, Kenneth H. Rosen : 761)

IV. THE APPLICATION OF DECISION TREE

To start writing, the first of all is we have to determine its topic first. We could use a decision tree to decide it. First, we have to decide whether in our paper, we want to discuss about an application in discrete math subject, or it could be the others, like comparing math complexity. If we choose to discuss about complexity, we could look around, what's trending right now, or we could discuss about our own hobby. After that, we could see whether what will we discussed is something related to math discrete subject or not. Here is an example of how to make the decision tree :

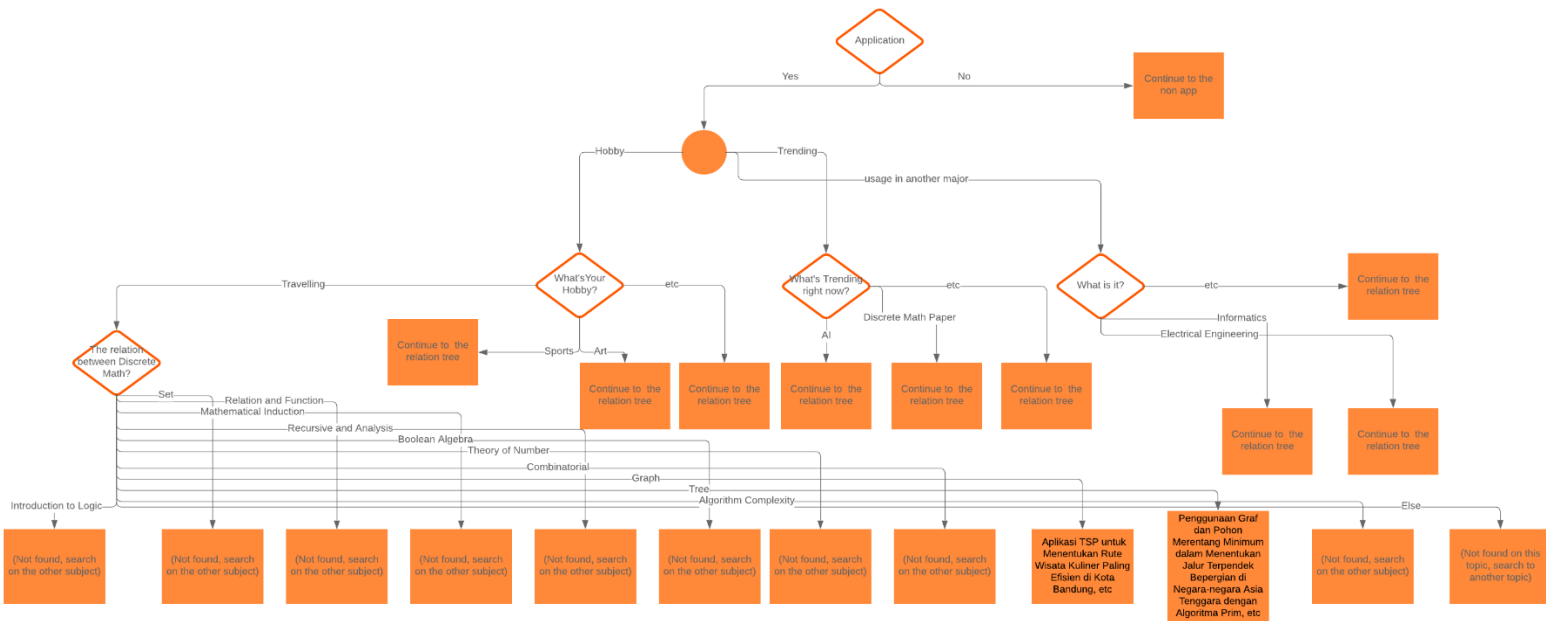


Figure 6. A decision tree to determine the topic

(source : personal, the topics are from Mr Rinaldi Munir's Page and IF17 database)

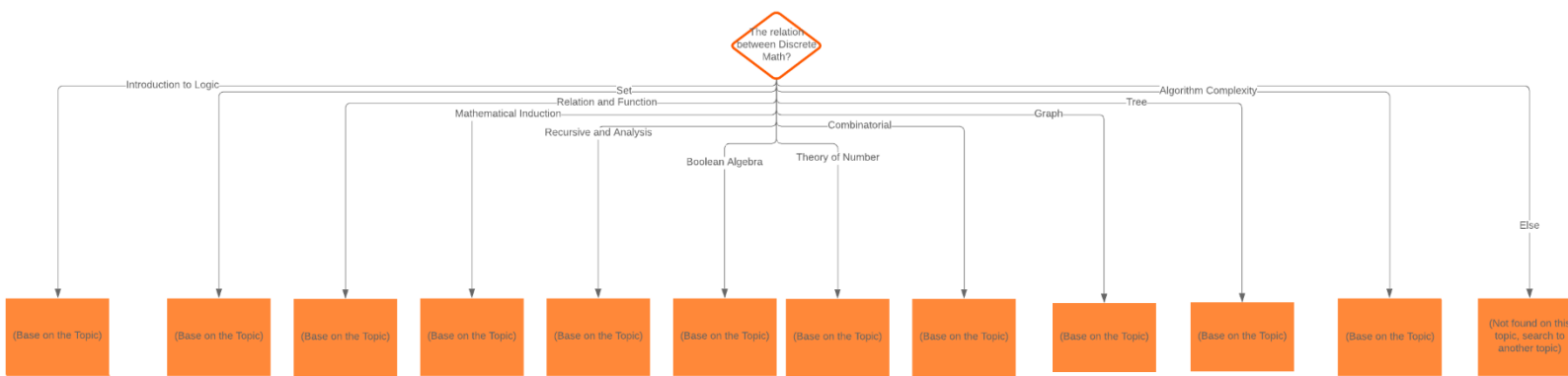


Figure 7. Relation Tree(A decision tree about relation to math discrete subject)
(source : personal)

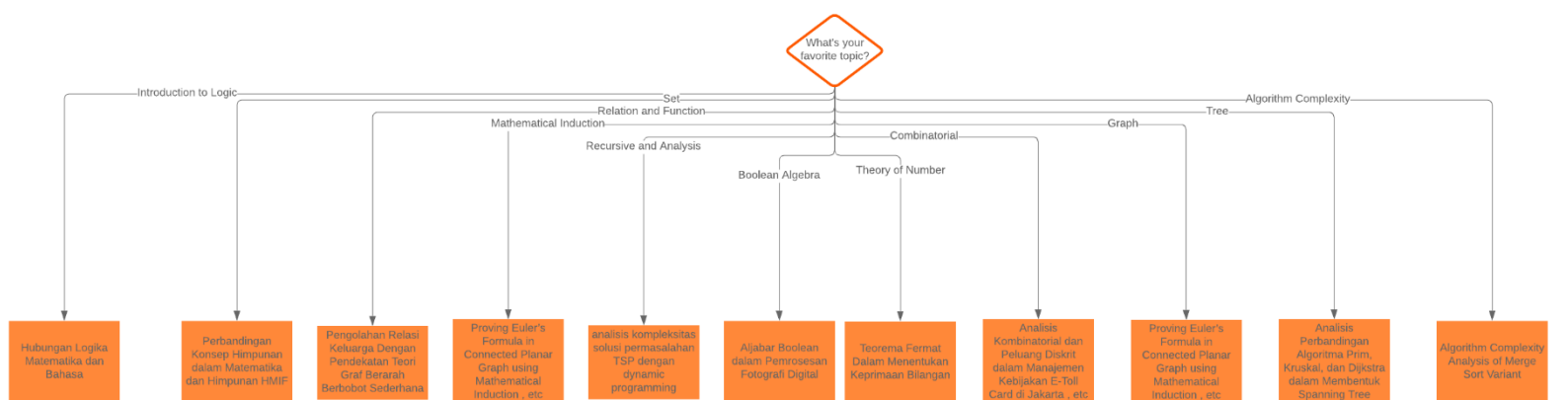


Figure 8. The Non – application branch
(source : personal, the topics are from Mr Rinaldi Munir’s Page and IF17 database)

On the pictures showed above is one example of the usage of decision tree to determine the topic of a discrete math paper. You could find your own topic by browsing into the leaves by fill in the “etc” or “anything” by your own choice. You could also continue the relation tree by filling whether it’s have a connection to discrete math subjects or not. You could also combine many subjects to become a topic.

On the non-application branch, maybe you could also find an application topic. Actually it’s the same, but it has different way to determine. The “application” branch is we determine by looking around us and connect it to math discrete subjects, while the “non-application” branch is by looking into math discrete subjects and make topic out of it.

Disclaimer : Those topics are only an example, I do not own the topic of the paper, it’s belong to the seniors, my friends, or my own remake and the source are included in the References.

V. CONCLUSION

Discrete Math Courses that taught in the class not only just to make the college students pass, but there are many usage in our daily, and the one of them is

tree.

There are many usage of tree in our daily life, like a spanning tree to make a travelling plan much cheaper and easier, a decision tree to make a decision, sort many different number, search a thing with its description, huffman code, and many more.

One of the usage that discussed in this paper is the application of decision tree to determine the topic for discrete math paper. And in this paper, we know that other subjects also have their own application, and we could breakdown into a decision tree. With this paper, writing is much easier, because we already know how to determine its topic.

VI. ACKNOWLEDGEMENTS

In this paper, surely many people have helped author by moral or material. First of all, author express deepest grateful to the one and only our Almighty God,Allah SWT. it’s all because of his mercy, author could finish this paper.

The author also thanks to Mr. Dr. Ir. Rinaldi Munir, M.T. as a lecturer for IF2120 Matematika Diskrit K-1 that already teach the author about many knowledge that’s priceless that finally used by the

author on the making of this paper. Author also says thank you to the author's parents that support the author in the making of this paper. Also thanks to my fellow generation, UNIX, especially for friends in K-1 IF 2017 that have helped author write this paper, also thanks to the seniors that already submit their paper so that I could use them as reference in this paper.

The last but not least, the author realize that are still this paper is still not perfect. Because of that, the author feels sorry for these mistakes. The author also feels sorry for my bad english. I'm also are in the process of studying and trying my best to put this paper into english. Hopefully this paper could help for those who read this paper.

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PERNYATAAN

Dengan ini saya menyatakan bahwa makalah yang saya tulis ini adalah tulisan saya sendiri, bukan saduran, atau terjemahan dari makalah orang lain, dan bukan plagiasi.

Bandung, 9 Desember 2018



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