

# Choosing The Appropriate Majors for Science Senior High School Student Using Decision Tree

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**Abstract**— On these days, science student at senior high school are hesitant to decide what majors they will take in the future. There's so many reasons why students are so hesitant, one of them is there's a lot option of the best university with different special majors in each college / university. In this case we can implement the theory of decision tree, students can consider the alternative possible choices majors in university they can take.

**Keywords**— Graph, Tree, Decision-Tree, Majors, University

## I. INTRODUCTION

Back on those days, students don't have many options of major field they can choose so there's different popular majors in the past with this present. The variety of majors field on these days, make students hesitant to decide what the best majors for they capability. Science senior high school student has more privilege than social student, the reason is science student can take the social majors field like business, psychology, and many more, the other side social student didn't have privilege as many as science student has, they can't take the science major field like biology, chemistry and many other science majors field.

Nowadays we can easily find the information about every major in each university, it's includes what lesson will they learn, how long they'll learn, and what proper jobs they can take in the future. But, it's not enough information for students can surely choose the best major for them, there's still many factors why students still hesitant to finally decide the major will they take, the factors are how much they'll spend money for tuition fees, living expenses at the university, accreditation of the major, and the connection with graduated person on the major.

In discrete mathematics we have learned about graphs and various types of graphs. Graphs are discrete structure be formed as vertices and edges that connect these vertices, graphs show the relation abouts one object to another object. There are different types of graphs, depending on whether edges have directions, whether more than one edges can connect the same pair of vertices and whether loops are allowed.

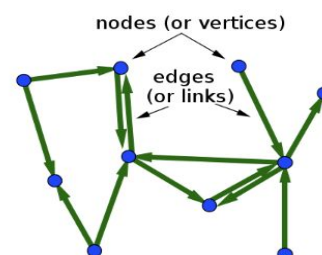
Tree is a connected graph that contains no simple circuits. Decision tree is one of many implementations of m-ary tree. Decision tree can help us to see all probability solution can happen by tracing the option of decision.

In this case, i'm using decision tree to help science senior high school students especially the 12th grade for see all probability solution on deciding what the best fit major they can take.

## II. GRAPH

A graph consists of a filled set of vertices (or nodes) and a set of edges. Each edge has either more than one vertices associated with it. In a simple graph, each of the edge connects two different vertices and there isn't two edges connected at the same pair of vertices. Multigraphs may have multiple edges connecting the same two vertices. When  $m$  different edges connect the vertices  $u$  and  $v$ , we can say  $\{u,v\}$  is an edge of multiplicity  $m$ . An edge that connects a vertex to itself is called a loop. A pseudograph may include loops, as well as multiple edges connecting the same pair of vertices.

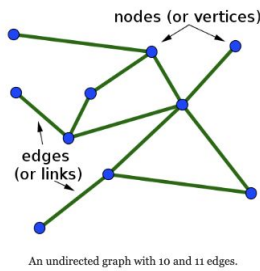
There's 2 basic types of graphs, directed graphs and undirected graphs. A directed graph (or digraph)  $G = (V, E)$  consists of a nonempty set  $V$  of vertices (or nodes) and a set  $E$  of directed edges (or arcs). Each edge is associated with an ordered pair of vertices. The directed edge associated with the ordered pair  $(u,v)$  is said to start at  $u$  and end at  $v$ . A graph can be called as undirected graph if the end point of an edge are not ordered.



A directed graph with 10 vertices (or nodes) and 13 edges.

**Figure 1. Examples of directed graph**

Source: [https://mathinsight.org/definition/directed\\_graph](https://mathinsight.org/definition/directed_graph)



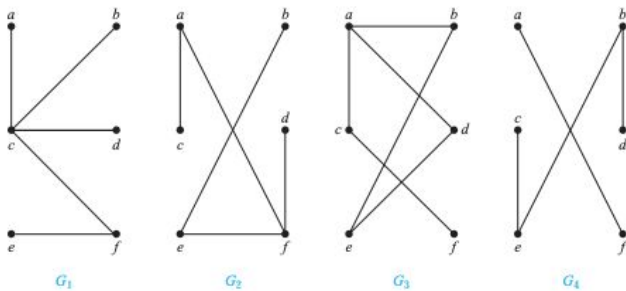
**Figure 2. Examples of undirected graph**

Source: [https://mathinsight.org/definition/undirected\\_graph](https://mathinsight.org/definition/undirected_graph)

III. TREE

A. Tree

A tree is an undirected graph that connect each other with no simple circuits. An undirected graph is a tree just only if there's a unique simple path between any two of its vertices. These are examples of tree :



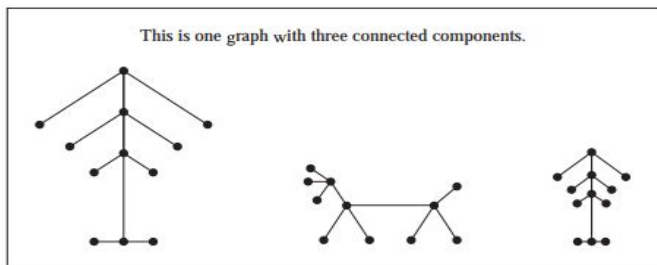
**Figure 3. Examples of tree(G1 and G2), and examples of non-trees(G3 and G4) graphs**

Source : Discrete Mathematics and Its Application

On the picture above we can say that G1 and G2 is a tree because they don't have a circuit on it and G3 and G4 is not a tree because they do have a circuit on it.

B. Forest

A graph with no simple circuit and not connected is a forest. The other side, each of the connected components in a forest is a tree. These are examples of forest :

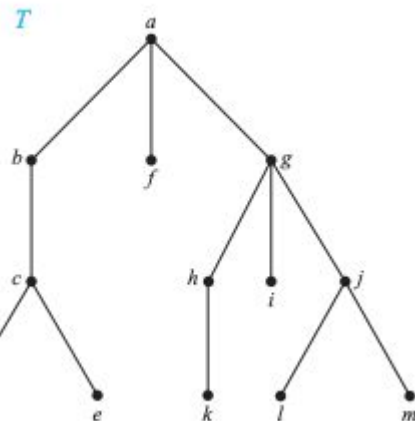


**Figure 4. Examples of forest**

Source : Discrete Mathematics and Its Application

C. Rooted Trees

Rooted tree is a tree with the node treated as a root and the edges have directions which are directed away from the root. The nodes which has zero degree are named leaves. A rooted tree can be created from an unrooted tree when one of the vertices is chosen as the root. An ordered rooted tree is a rooted tree where the children of each internal vertex are ordered. Ordered rooted trees are drawn so that the children of each internal vertex are shown in order from left to right. This following picture show the example of root tree :

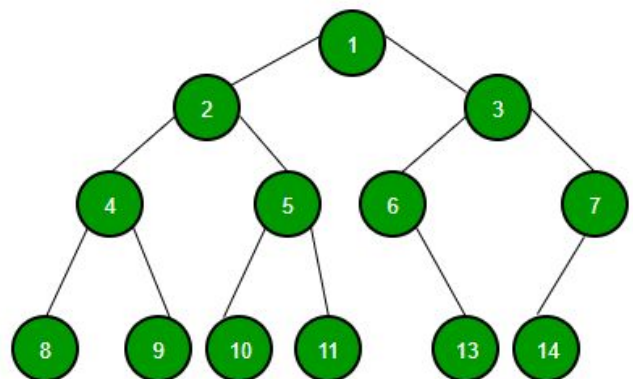


**Figure 5. Examples of root tree**

Source : Discrete Mathematics and Its Application

D. Binary Tree

A binary tree is an ordered rooted where each internal vertex has less than two children. If an internal vertex of a binary tree has two children, the first is called the left child and the second the right child. The tree rooted at the left child of a vertex is called the left subtree and the right child of a vertex is called the right subtree of this vertex. This following picture show the example of binary tree :

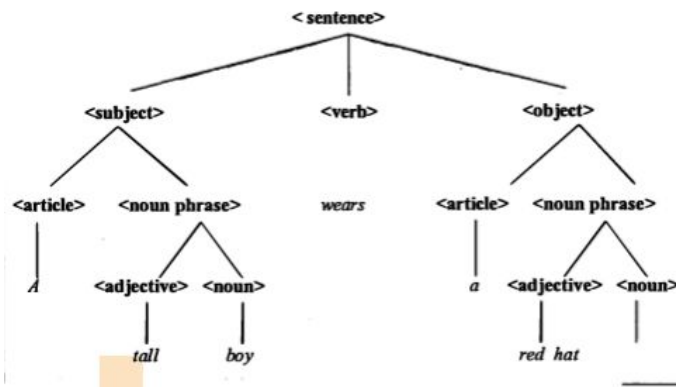


**Figure 6. Examples of binary tree**

Source: <https://www.geeksforgeeks.org/binary-tree-data-structure/>

### E. m-Ary Tree

M-ary tree can be defined as a rooted tree with every internal vertex has less than m children. If a three with every internal has exactly m children can be called a full m-ary tree. This following picture show the example of m-ary tree :



Gambar 9.16 Pohon parsing dari kalimat A tall boy wears a red hat

Figure 7. Examples of m-ary tree

Source: Munir, Rinaldi, Diktat Kuliah IF2120, Matematika Diskrit, Edisi Keempat, Program Studi Teknik Informatika, STEI, ITB, 2006.

### F. Decision Tree

Decision tree is one of many implementations of m-ary tree. Decision tree can be made of some decisions which are heading to some solutions, with the node represents as decision and leaf represents the solution. This following picture show the example of decision tree :

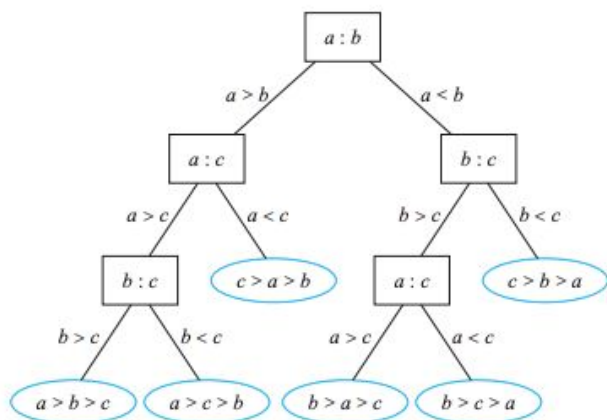


Figure 8. Examples of decision tree

Source : Discrete Mathematics and Its Application

## IV. MAJORS FIELD

There are many academic field on these days, but we can classified as several field of study :

1. Social Sciences
2. Natural Sciences
3. Humanity
4. Professions and applied sciences
5. Formal science

### A. Social Sciences

Social science is an academic discipline that concerned on human behaviour in its social and cultural aspects. These are the majors field on this disciplines, but aren't limited to:

- economics
- political science
- psychology
- sociology
- geography
- interdisciplinary studies

### B. Natural Sciences

Natural science can be called branch of science that defined as systematic enterprise that organizes knowledge in the form of explanations and predictions about the universe. These are the majors field on this disciplines, but aren't limited to:

- space science
- physics
- chemistry
- earth science
- biology

### C. Humanity

Humanities can be known as an academic disciplines that studies about human and the culture. These are the majors field on this disciplines, but aren't limited to:

- anthropology
- history
- linguistics and language
- religion
- philosophy
- arts

### D. Professions and Applied Sciences

Profession and applied sciences can be defined as an academic disciplines that studies about the implemented practical science in real life. These are the majors field on this disciplines, but aren't limited to:

- agriculture
- architecture and design
- business
- divinity
- education
- engineering and technology
- environmental studies and forestry
- family and consumer science
- human physical performance and recreation
- journalism

- media studies and communication
- law
- library and museum studies
- medicine
- military sciences
- public administration
- social work
- transportation

*E. Formal Sciences*

Formal sciences is an academic disciplines that uses formal systems to generate knowledge. These are the majors field on this disciplines, but aren't limited to:

- computer sciences
- system sciences
- logic
- mathematics

*F. Indonesia majors field*

In Indonesia most university classified their majors with each faculty their related on. Most university has more than a hundred majors but not as much as in other country universities has.

To narrow the scope of many majors field that exist in Indonesia, we can choose University of Indonesia as a sample. University of Indonesia has 3 main academic disciplines with 14 faculty inside. I could say the academic disciplines in University of Indonesia can be represents all of option students consider about.

These following tables are the details of classification academic disciplines with the faculty in University of Indonesia :

- Medical Science  
 Medical Science can be defined as an academic disciplines that studies about human biology and associated research skills such as laboratory techniques, statistics, and study design.

Faculty	Programs
Medicine	Medicine
Dentistry	Dentistry
Public Health	Public Health
	Environmental Health Study
	Nutritional Science
Nursing	Nursing
Pharmacy	Pharmacy

Source:<https://www.ui.ac.id/en/bachelor/undergraduate-programs.html>

- Science and Technology  
 Science and technology can be known as combination of formal sciences and professions and applied sciences that studies about the implemented practical science in real life using formal systems to generate knowledge.

Faculty	Programs
Math & Natural Sciences	Mathematics
	Physics
	Chemistry
	Biology
	Geography
Engineering	Civil Engineering
	Mechanical Engineering
	Electrical Engineering
	Metallurgy & Material Engineering
	Architecture
	Interior Architecture
	Chemical Engineering
	Industrial Engineering
	Naval Engineering
	Environmental Engineering
Computer Science	Computer Engineering
	Bioprocess Engineering
	Computer Science
	Information System

Source:<https://www.ui.ac.id/en/bachelor/undergraduate-programs.html>

- Social Science and Humanity  
 Social sciences and humanity can be known as combination of social sciences and humanity that studies about human behaviour in its social and cultural aspects.

Faculty	Programs
Law	Law

Economics & Business	Economics
	Management
	Accounting
	Islamic Economy dan Islamic Business
Humanities	Korean Study
	Dutch Study
	Archeology
	Philosophy
	Library & Information
	History Studies
	Arabic Study
	Chinese Study
	Javanese Study
	Indonesian Study
	English Study
	Japanese Study
	German Study
	French Study
	Slavic Study
Psychology	Psychology
Social and Political Science	Political Science
	Communication Studies
	Sociology
	Social Anthropology
	Criminology
	International Relations
	Social Welfare
Administration	Administration

Source: <https://www.ui.ac.id/en/bachelor/undergraduate-programs.html>

## V. IMPLEMENTATION OF DECISION TREE ON CHOOSING THE APPROPRIATE MAJORS FOR SCIENCE SENIOR HIGH SCHOOL STUDENTS

From the data of classification academic disciplines of University of Indonesia we have several different academic disciplines, faculty, and the majors. Although the fact on the reality still many side factors that makes students are confused about choosing the appropriate majors for them, we can

simplify the option of solution with decision tree by the interest of students and matching with all data we have.



**Figure 9. Decision tree on choosing the appropriate majors**

We all can see from figure 9, with the decision tree we have options solutions that we can take prefer by interests. As an example :

- Science students has opportunity to choose 1 of 3 different academic disciplines in University of Indonesia including the social science and humanity
- if the student chooses the social science and humanity, he/she has 6 different options what major he/she really interested to

- if he/she have interest on all about economics and business field, the final solution is take the economics and business major field

## VI. CONCLUSION

After all, we can conclude that decision tree can shows many options of possible solutions. I'm personally hope the decision tree can minimize a problem that needed to choose one from many options that exist, especially on the senior high school students problem with choosing the appropriate majors.

## VII. ACKNOWLEDGMENT

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## REFERENCES

- [1] Munir, Rinaldi. 2012 Matematika Diskrit. Bandung: Penerbit Informatika
- [2] Rosen, Kenneth H., Discrete Mathematics and Its Applications, New York: McGraw-Hill International, 2012, 7th ed
- [3] <https://nces.ed.gov/pubs2002/cip2000/> [Accessed 4 Dec. 2019]
- [4] <https://www.ui.ac.id/en/bachelor/undergraduate-programs.html> [Accessed 4 Dec. 2019]
- [5] <https://www.geeksforgeeks.org/binary-tree-data-structure/> [Accessed 4 Dec. 2019]

## PERNYATAAN

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Bandung, 3 Desember 2019



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