How to Choose a Coffee Shop to Go on a Date Using Decision Tree

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***Abstract*—On these days people are so obsessed with coffee. People start the day before work with coffee, hang out with friends with coffee, and stay up all night to do homework, of course, with coffee. Because of that, many coffee shops are popping up in the city, especially Bandung. Coffee shops become an alternative choice to go for meeting with clients, spending me time, or even getting on a date! But sometimes we are confused how to choose nice coffee shop for you and your dating partner. You can choose the coffee shop by seeing its popularity, price, ambience, or other things. To make it easier, we can use a lesson from Discrete Mathematics, which is Decision Tree.**

***Keywords*—About four key words or phrases in alphabetical order, separated by commas.**

I. INTRODUCTION

Graph is a way to represent discrete objects and relationships between those objects. For an instance, we use graph as a map, which connects the cities using road. In this case, the cities represent the discrete objects and the roads represent the relationships. Graph consists of vertices and edges. An edge connects a vertice to the other vertice.

Tree is one of applications of graph. The definition of tree is connected non-directed graph which does not consist of circuit. There are many kind of tree, one of them is n-ary tree. N-ary tree is a rooted tree which each node has at most n branches. Decision tree is one of applications of n-ary tree.

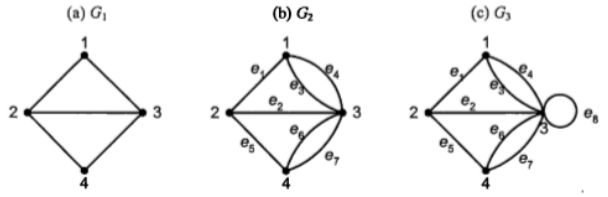
Decision tree helps us to obtain all probability of solution that can happen by tracing the decisions. Each node represents a decision and each leaf represents the solution.

Decision tree is used in many aspects of our life. A simple case is to sort three numbers from the smallest to the biggest or vice versa. Another example is to determine the winner in a match.

Decision tree is also can be used to determine which coffee shop fits us the most by seeing some indicators. Zomato is a site and application to help you find restaurants around you. From Zomato, we can get some information like distance, rating, price, and popularity. But still we can be confused to make a choice. Coffee shop A has good rating but its coffee costs high enough, while coffee shop B has a good and cheap coffee but it is too far so it costs you a lot of money to get there. This decision tree will help you out. You only have to choose top three coffee shop based on your opinion and look for its information in Zomato. Then this decision tree will shows you all coffee shops that might suit you based on those indicators.

II. GRAPH

Graph is defined as pair of set which consists of vertices or nodes and edge which connects a pair of nodes. A graph may not have edges, but a graph must has a node or more. Each node is named with alphabet or number, while edge is stated by (u,v), u and v stands for the nodes which are connected by this edge. Following pictures are few examples for graph.



Gambar 8.3 Tiga buah graf (a) graf sederhana, (b) graf ganda, dan (c) graf semu

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

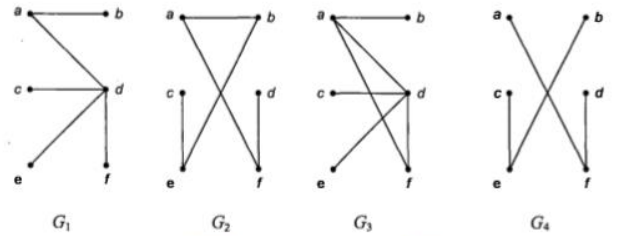
Based on the direction of the edges, graphs is divided into two parts:

1. Undirected Graph
   The edges of this graph do not have direction. (u,v) and (v,u) are the same edges.
2. Directed Graph
   As the opposite of the undirected graph, the edges of this graph have direction. (u,v) and (v,u) are different edges.

III. TREE

A. Tree Definition

Tree is connected undirected graph which does not have any circuit. Based on that definition, a tree has two important characteristics, which are connected and does not have any circuit. the following pictures are the examples.



Gambar 9.1 G_1 dan G_2 adalah pohon, sedangkan G_3 dan G_4 bukan pohon

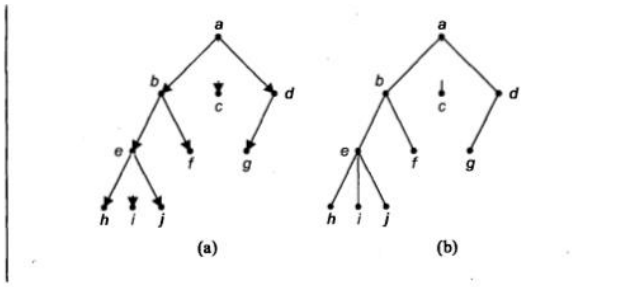
Source: Munir, Rinaldi, Diktat Kuliah IF2120, Matematika Diskrit, Edisi Keempat, Program Studi Teknik Informatika, STEI, ITB, 2006.

B. Characteristics of Tree

Each pair of nodes in graph are connected by single track. A graph is connected and has n nodes and n-1 edges. A graph does not have any circuit and adding one edge to a graph can make the graph has only one circuit.

C. Rooted Tree

The definition of rooted tree is a tree whose a node treated as a root and the edges have directions which are getting further from the root. The nodes which has zero degree are named leaves. Some examples of rooted trees are below.

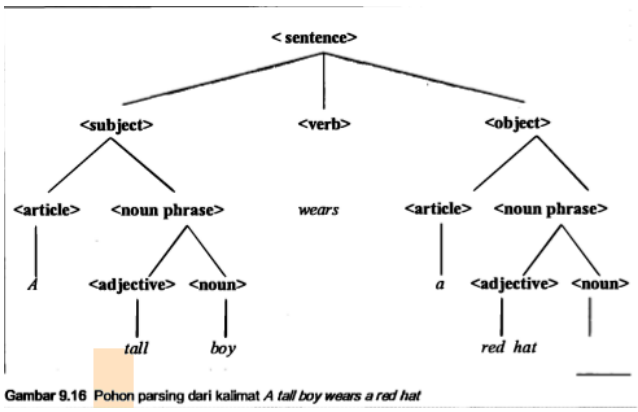


Gambar 9.9 (a) Pohon berakar, (b) sebagai konvensi, arah panah pada sisi dapat dibuang

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

D. m-Ary Tree

Rooted tree which each node has at most m children is called m-ary. m-ary tree is called full tree if each branch node has exactly m children. m-ary tree is used to represent a structure. Following picture is one of the examples that shows its application for structure.

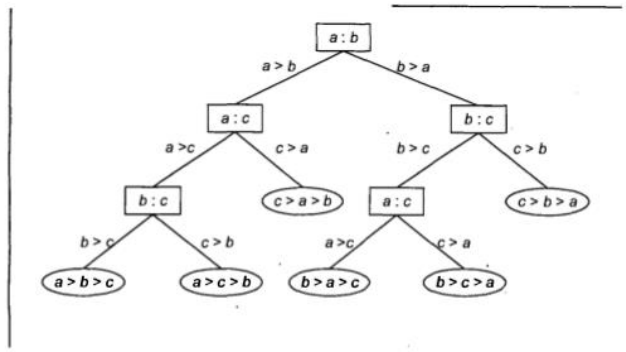


Gambar 9.16 Pohon parsing dari kalimat *A tall boy wears a red hat*

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

E. Decision Tree

Decision tree consists of some decisions which are heading to some solutions. Each node represents a decision, while leaf represents the solution. As an example, we want to sort three numbers in descending order. The picture of the tree is below.



Gambar 9.26 Pohon keputusan untuk mengurutkan 3 buah elemen

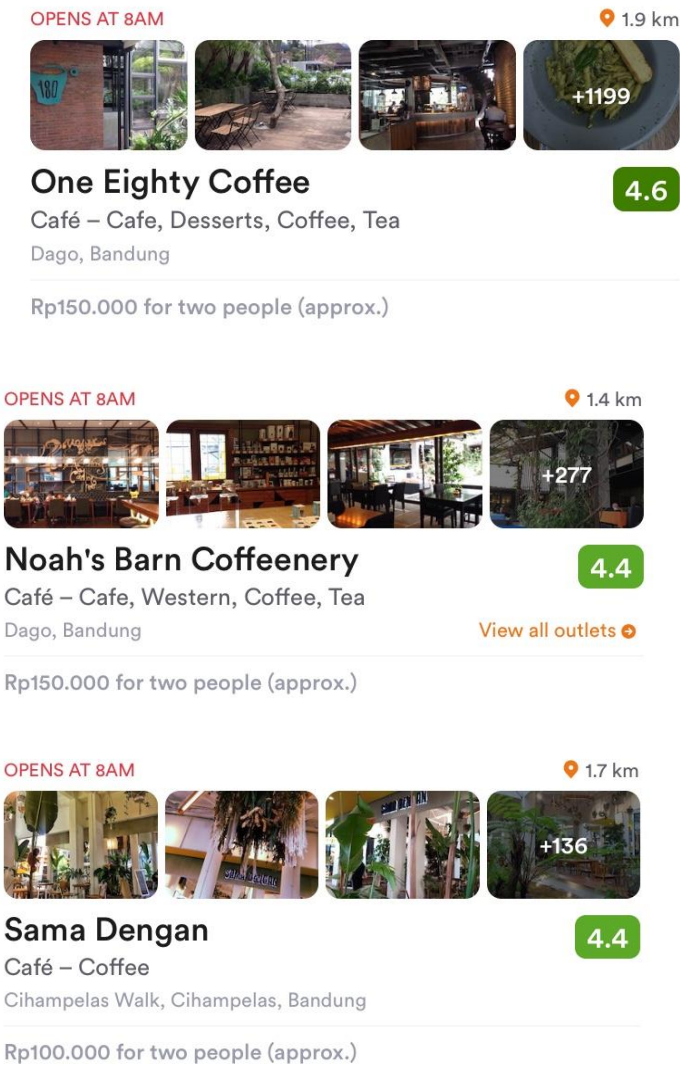
Source: Munir, Rinaldi, Diktat Kuliah IF2120, Matematika Diskrit, Edisi Keempat, Program Studi Teknik Informatika, STEI, ITB, 2006.

IV. EXISTING DATA ABOUT COFFEE SHOPS

In this sophisticated age, it is now easy to search anything, including the recommendation of coffee shops that you can visit. We do not have to come directly to the coffee shop to know the price and the ambience. One of the applications that simplify our life is Zomato. Zomato facilitates us with many information on many aspects about restaurant around us.

Zomato Application
Source: www.google.co.id

This application has some features, those are location, rating, price, reviews from the visitors, and many others.



Information of three coffee shops from Zomato
Source: Screenshot Zomato Application

Zomato pampers us by classifying the restaurant based on its kind. If we search coffee shops in Zomato, there will be so many options are shown. As an example, I randomly choose three coffee shops that might be perfect for you and your dating partner.

V. IMPLEMENTATION OF DECISION TREE IN CHOOSING COFFEE SHOPS

From data that we get, we have three different coffee shops with different distances, ratings, and prices as the examples. The details are

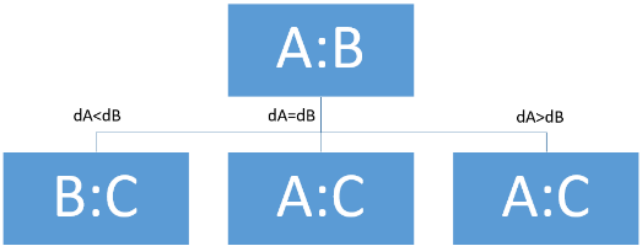
1. One Eighty Coffee
   Distance :1.9 km
   Rating :4.6
   Price :Rp150,000
2. Noah's Barn Coffeenery
   Distance :1.4 km
   Rating :4.4
   Price :Rp150,000
3. Sama Dengan
   Distance :1.7 km
   Rating :4.4
   Price :Rp100,000

The decision tree that I make has these rules:

1. The distance is more preferred than the rating.
2. The rating is more preferred than the price.

From those rules, we can figure out how to create a decision tree. If a coffee shop is the closest, has the best rating, and has the cheapest price, then this coffee shop will be chosen as a solution.

To make it easier to see, the explanation of the decision tree is written in points.



1) The first thing that we do is comparing the distance of two coffee shops A and B.

   a) If coffee shops A is closer to our location, then coffee shop A is the best and now we compare coffee shops B and C.
      i) If coffee shop B is closer than coffee shop C, then the order of coffee shops is A>B>C (A is better than B and B is better than C).
      ii) If coffee shop B is as close as coffee shop C, then we compare these two coffee shops again.
         (1) If coffee shop B's rating is smaller than coffee shop C's, then the order is A>C>B.
         (2) If the rating of coffee shop B and C are the same, then we compare again these two coffee shops.
            (a) If coffee shop B is cheaper than coffee shop C, then the order is A>B>C.
            (b) If the price of coffee shop B and C are the same, then the order is A>B=C (B is as good as C, but A is better).
            (c) If the price of coffee shop B is more

expensive then coffee shop C, then the order is A>C>B.

(3) If the rating of coffee shop B is bigger than coffee shop C, then the order is A>B>C.

iii) If coffee shop B is further than coffee shop C, then we compare coffee shop A with C.

(1) If coffee shop A is closer than C, then the order is A>C>B.

(2) If the coffee shop A is as far as C, then we compare this two coffee shops again.

(a) If coffee shop A has smaller rating than C, then the order is C>A>B.

(b) If coffee shop A has the same rating to C, then we compare this two again.

(i) If the price of coffee shop A is lower than C, then the order is A>C>B.

(ii) If coffee shop A and C has the same price, then the order is A=C>B.

(iii) If coffee shp A is more expensive than C, then the order is C>A>B.

(c) If the coffee shop A's rating is bigger than C's, then the order is A>C>B.

(3) If the coffee shop A is further than C, then the order is C>A>B.

b) If coffee shop A and B is at the same distance, then we compare coffee chop A and C.

i) If A is closer than C, then we compare between A and B.

(1) If A's rating is smaller than B's, then the order is B>A>C.

(2) If A and B has the same rating, then we compare these two coffee shops again.

(a) If A is cheaper than B, then the order is A>B>C.

(b) If A and B has the same price, then the order is A=B=C (one is as good as another).

(c) If A is more expensive than B, then the order is B>A>C.

(3) If A's rating is bigger than B, then the order is A>B>C.

ii) If A is as close as C, then we compare A and B.

(1) If rating A is smaller than B, then we compare coffee shop A and C.

(a) If rating of coffee shop A is smaller than C, then we compare coffee shop B and C.

(i) If coffee shop B's rating is smaller than C's, then the order is C>B>A.

(ii) If coffee shop B and C have the same rating, then we compare B and C again.

1. If coffee shop B is cheaper than C, then the order is B>C>A.
2. If coffee shop B and C have the same price, then the order is B=C>A.
3. If coffee shop B is more expensive than C, then the order is C>B>A.

(iii) If coffee shop B has better rating than C, then the order is B>C>A.

(b) If coffee shop A and C's ratings are the same, then we compare A and C.

(i) If coffee shop A is cheaper than C, then the order is B>A>C.

(ii) If coffee shop A is as cheap as C, then the order is B>A=C.

(iii) If coffee shop A is more expensive than C, then the order is B>C>A.

(c) If coffee shop A has better rating than C, then the order is B>A>C.

(2) If coffee shop A has rating which is as good as B, then we compare A and C.

(a) If coffee shop A's rating is smaller than C, then we compare A and B.

(i) If coffee shop A is cheaper than B, then the order is C>A>B.

(ii) If coffee shop A is as expensive as B, then the order is C>A=B.

(iii) If coffee shop A is more expensive than B, then the order is C>B>A.

(b) If coffee shop A has the same rating to C, then we compare A and B.

(i) If A is cheaper than B, then we compare A and C.

1. If A is cheaper than C, then we compare B and C.
   a. If B is cheaper than C, then the order is A>B>C.
   b. If the price of B and C are the same, then the order is A>B=C.
   c. If the price of coffee shop B is more expensive than C, then the order is A>C>B.
2. If A has the same price as C, then the order is A=C>B
3. If A is more expensive than C, then the order is C>A>B.

(ii) If coffee shop A has the same price with B, then we compare A and C.

1. If A is cheaper than C, then the order is A=B>C.
2. If A has the same price as C, then the order is A=B=C.
3. If A is more expensive than C, then the order is C>A=B.

(iii) If A is more expensive than B, then we compare A and C.

1. If A is cheaper than C, then the order is B>A>C.
2. If A has the same price as C, then the order is B>A=C.
3. If A is more expensive than C, then we compare B and C.
   a. If B is cheaper than C, then

the order is B>C>A.
b. If B has the same price to C then the order is B=C>A.
c. If B is more expensive than C, then the order is C>B>A.

(c) If coffee shop A has better rating than C, then we compare A and B.
(i) If A is cheaper than B, then the order is A>B>C.
(ii) If A is as cheap as B, then the order is A=B>C.
(iii) If A is more expensive than B, then the order is B>A>C.

(3) If coffee shop A has better rating than B, then we compare A and C.
(a) If the rating of A is worse than C, then the order is C>A>B.
(b) If the rating of coffee shop A and C are the same, then we compare A and C again
(i) If coffee shop Ais cheaper than C, then the order is A>C>B.
(ii) If coffee shop A has the same price as C, then the order is A=C>B.
(iii) If coffee shop A is more expensive than C, then the order is C>A>B.
(c) If the rating of A is better than C, then we compare B and C.
(i) If the rating of coffee shop B is worse than C, then the order is A>C>B.
(ii) If coffee shop B and C have the same rating, then we compare B and C.
1. If coffee shop B is cheaper than C then the order is A>B>C.
2. If coffee shop B and C has the same price, then the order is A>B=C.
3. If B is more expensive than C, then the order is A>C>B.
(iii) If coffee shop B has better rating than C, then the order is A>B>C.

iii) If A is further than C, then we compare A and B.
(1) If coffee shop A has worse rating than B, then the order is C>B>A.
(2) If coffee shop A and B have the same rating, then we compare again A and B.
(a) If A is cheaper than B, then the order is C>A>B.
(b) If A and B have the same price, then the order is C>A=B.
(c) If coffee shop A is more expensive than B, then the order is C>B>A.
(3) If the coffee shop A has better rating than B, then the order is C>A>B.

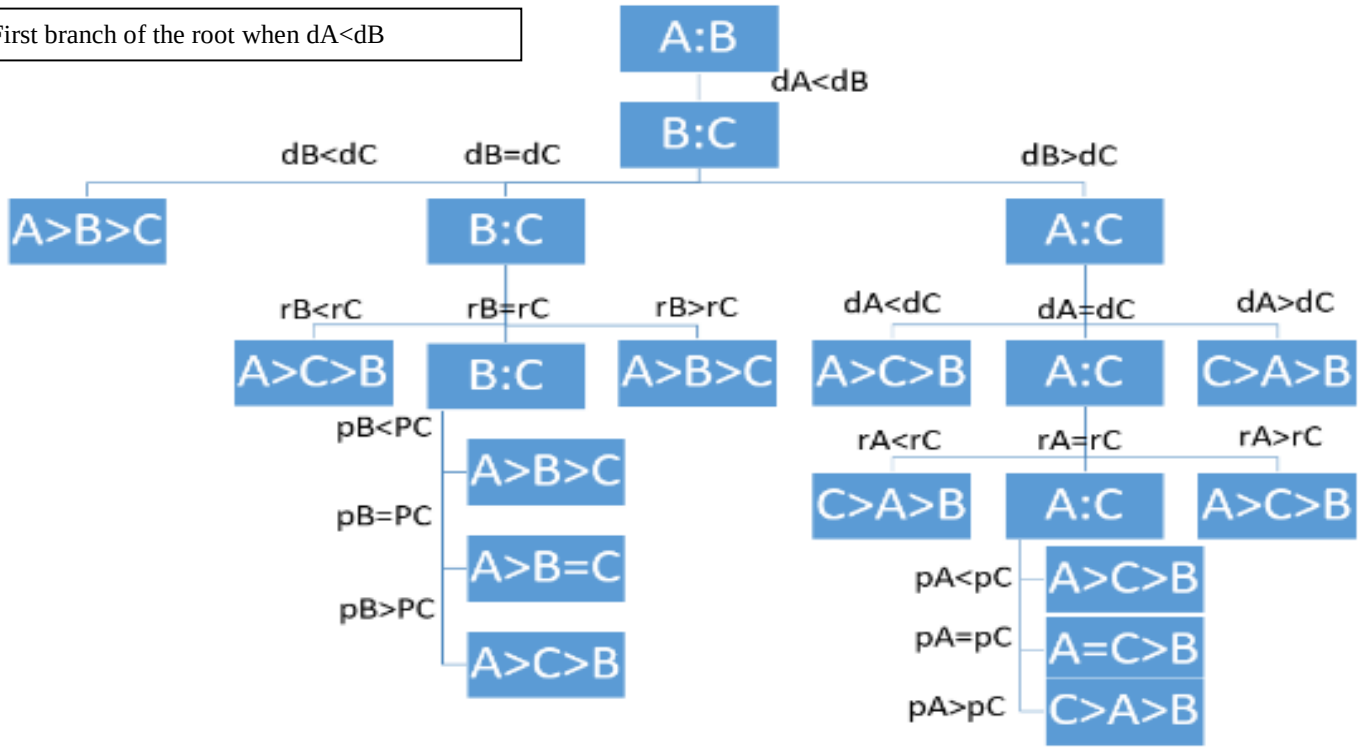
c) If coffee shop A is further than B, then we compare A and C.
i) If coffee shop A is closer than C, then the order is B>A>C.
ii) If coffee shop A is as close as C, then we compare A and C again.
(1) If coffee shop A has worse rating than C, then the order is B>C>A.
(2) If coffee shop A is as good as C then we compare A and C again.
(a) If coffee shop A is cheaper than C, then the order is B>A>C.
(b) If coffee shop A is as cheap as C, then the order is B>A=C.
(c) If coffee shop A is more expensive than C, then the order is B>C>A.
(3) If coffee shop A has better rating than C, then the order is B>A>C.

iii) If coffee shop A is further than C, then we compare B and C.
(1) If coffee shop B is closer than C, then the order is B>C>A.
(2) If coffee shop B is as close as C, then we compare B and C again.

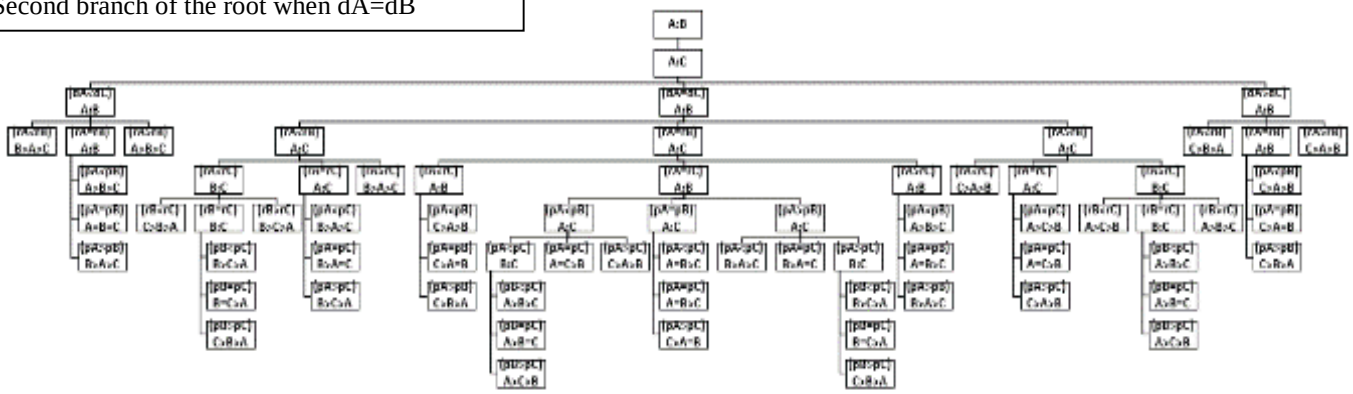
(a) If coffee shop B has wrose rating than C, then the order is C>B>A.
(b) If coffee shop B is as good as C, then we compare B and C again.
(i) If coffee shop B is cheaper than C, then the order is B>C>A.
(ii) If coffee shop B is as cheap as C, then the order is B=C>A.
(iii) If coffee shop B is more expensive than C, then the order is C>B>A.
(c) If coffee shop B has better rating than C, then the order is B>C>A.

(3) If coffee shop B is further than C, then the order is C>B>A.

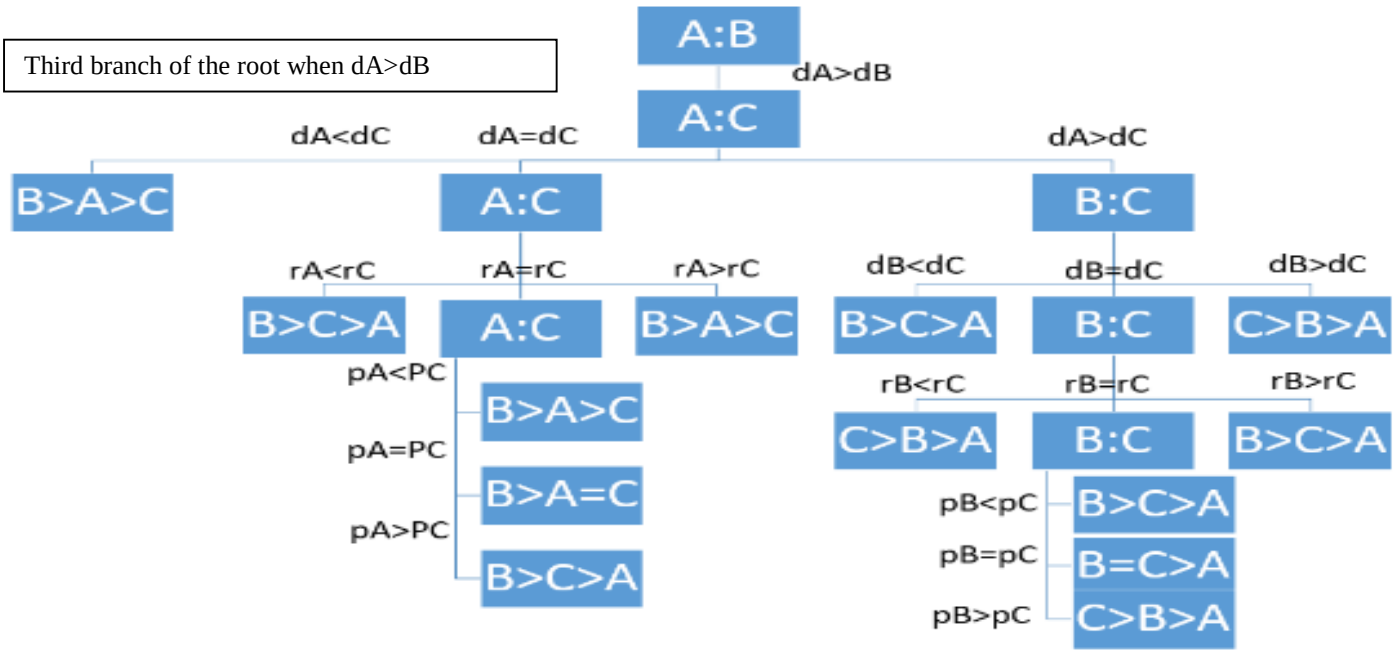
First branch of the root when dA<dB



Second branch of the root when dA=dB



Third branch of the root when dA>dB



V I. CONCLUSION

Tree can be used in many ways, one of them is decision tree. Decision tree is used to know the order of objects based on its characteristic. One of the examples is looking for an order of best coffee shops based on its location, rating, and price.

VII. ACKNOWLEDGMENT

First of all, I like to thank Allah SWT for guiding me in completing this assignment. I want to say thank you to my parents and my friends for supporting me. I also feel thankful for having Mr. Judhi as my lecturer who gave me all of these lessons. Last but not least, pardon me for some mistakes that I did in this paper. I hope this paper can bring benefit for those who read it.

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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, 10 Desember 2017

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