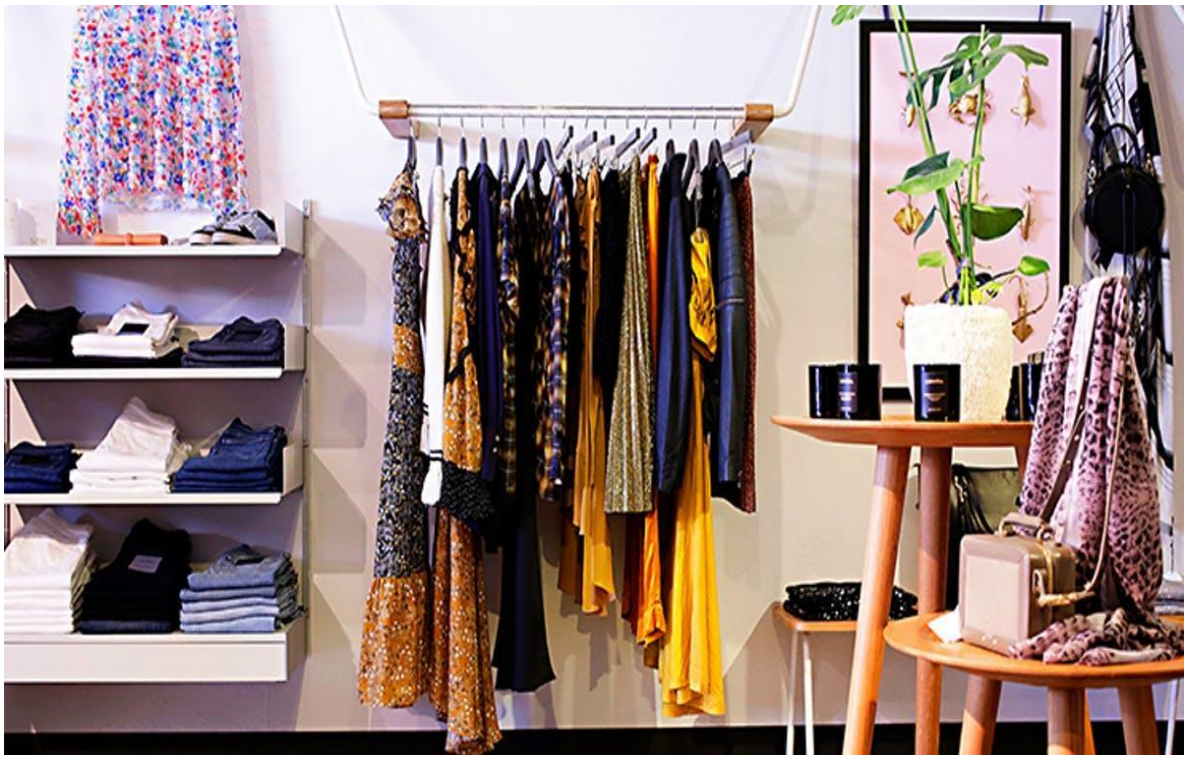

Ladies Boutique

QUESTION 2

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Introduction

Question 2 of the Mathematics Research Competition displays the necessity of mathematical conventions that fall under probability. It brings out aspects that were essential, which are the:

- Tree Diagram
- Conditional Probability

The tree diagram was used to be visually easier for understanding. In this report, condition probability was used to find the probability for few branches in the tree diagram e.g. white blouse and black blouse.

The categories in the report which are used to divide the garments are:

- **Tops**
- **Lower-Half Clothes**
- **Colors**
- **Shoes**

For **Tops** they are garments at the upper portion of the body like dresses, black blouse, and white blouse. In **Lower-Half Clothes** these are items that are in the lower body such as skirts and trousers. **Colors** refer to the shade of which the **Lower-Half Clothes** will be like red, white, and black. Then in **Shoes** it is given the color the shoes are which are black and not black. Not black refers to it being white.

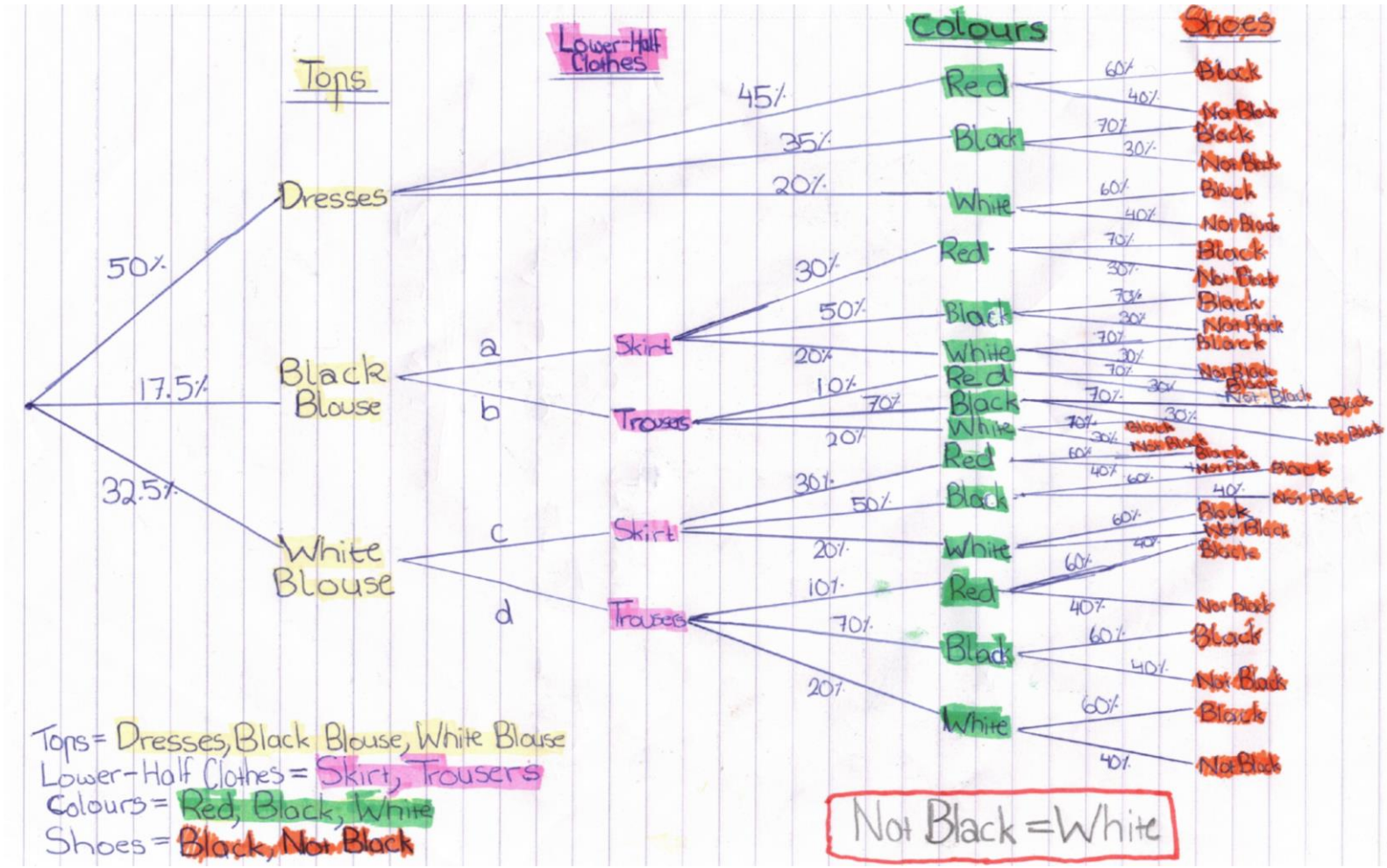
Situation

EXPLANATION

A ladies' boutique decides to offer specialised outfits for school formals. The shop has two members of staff, so they can serve up to 16 customers a day. Based on their experience there is a 50% chance that a customer will buy a dress, a 30% chance they will buy a skirt and a 20% chance they will buy trousers.

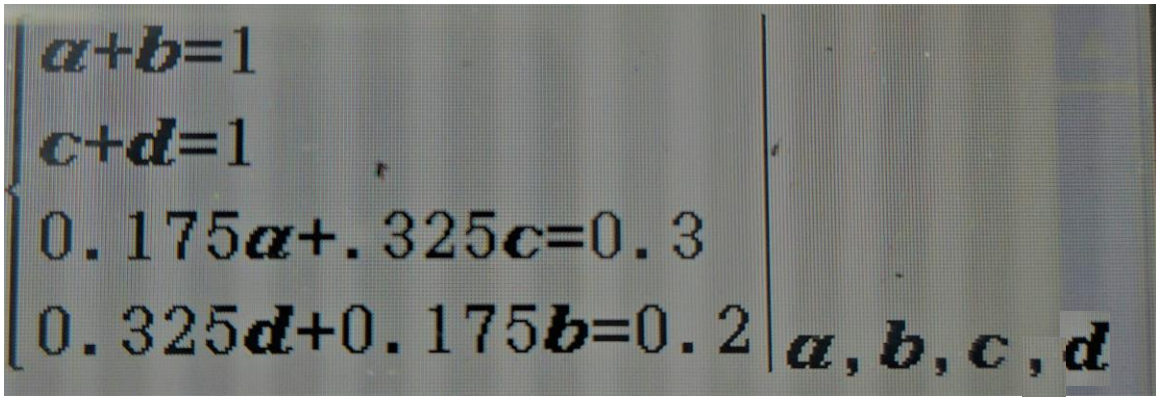
If they buy a dress then there is 45% chance it will be red, 35% it will be black, otherwise they will choose a white one. If they buy a skirt there is a 50% chance it will be black, a 30% chance it will be red, otherwise they will choose a white one. If they choose to buy trousers there is a 70% chance they will be black, 20% chance they will be white, otherwise they will be red. If they need a blouse there is a 35% chance it will be black, otherwise it will be white. If the top of the outfit is black then there is a 70% chance they will choose black shoes, but if the top is not black then they will only choose black shoes 60% of the time.

BREAKDOWN



Namik Rahman

All these branches are in respective of the probability given in the question except for the probability of getting a white or black blouse and the probability of getting **Lower-Half Clothes.** The probability of getting a white or black blouse was figured out by the probability given for one of these **Tops** that was told in the situation which gets multiplied to 50%. While to achieve the **Lower-Half Clothes** branch as the report shows, each of the **Lower-Half Clothes** branches were labelled with pronumerals. To find the answer for each branch, simultaneous equation was used in the class pad like this:



a+b=1 and c+d=1 are both expressions that show how the total amount of all probability coming out from one specific shoot within a column will be 100%. Whilst 0.175a + 0.325c =0.3 and 0.175b + 0.325d =0.2 shows the probability of getting each type of multiplied to the **Tops** they are under and add it with another **Tops** which is the same as the latter, as that will be the prob of getting that item. They add up to the probability of getting a **Lower-Half Clothes**. Let x be answer in decimals: Therefore, by using answers in class pad, **a**= $\frac{13x-1}{7}$, **b**= $\frac{-(13x-1)}{7}$, **c**= $(1-x)$ and **d**=x

ASSUMPTIONS

It is assumed:

- from the shoe color of 'not black' refers to white shoes. As the most generic color shoes used for school formals are either black shoe or white shoes. Since there is already a black shoe choice in the tree diagram, we referred to not black as a white shoe.
- as well that the stock in the ladies boutique is an infinite amount. Where if a customer purchases an outfit, the outfit chosen will be restocked back immediately after it is bought. This is not applied on a busy day.
- when there is an unexpected amount of duty for a day then a few volunteers are brought.

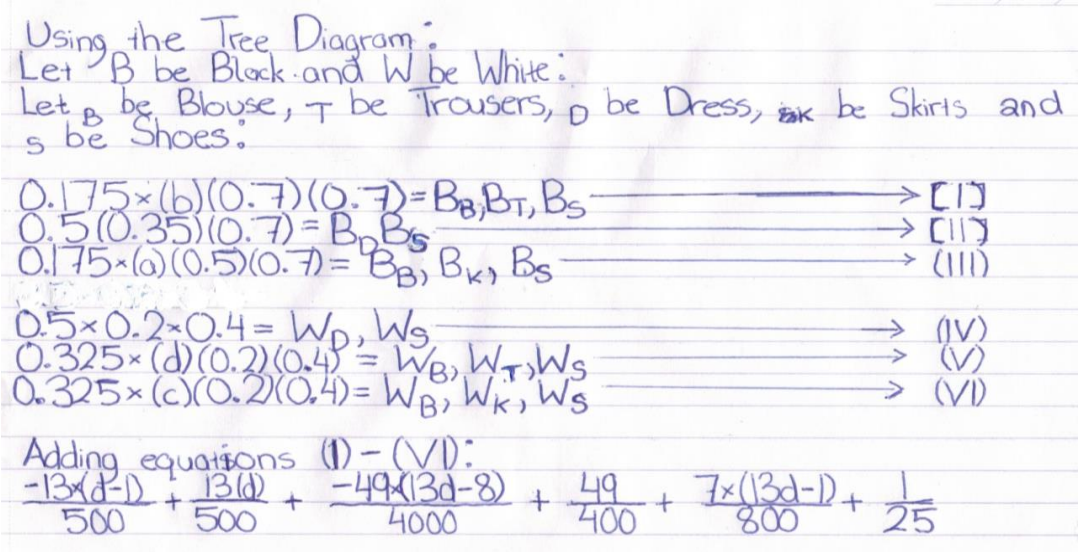
Part A

PROBLEM

What is the probability that the first customer will choose an outfit that is all one color?

CALCULATIONS

The 1st assumption about 'not black' shoes being white can be applied to the working out.



In this working out each equation from I – VI are calculated using a classpad.

RESULT

Using a classpad in the equation and simplifying it , the answer will then be...[1]

$$\left(\frac{-13\cdot(d-1)}{500}+\frac{13\cdot d}{500}+\frac{-49\cdot(13\cdot d-8)}{4000}+\frac{49}{400}+\frac{7\cdot(13\cdot d-1)}{800}+\frac{1}{25}\right)$$

$\frac{-91d}{2000}+\frac{1111}{4000}$. Hence, the probability that the first customer will choose an outfit that is all one color is $\frac{-91d}{2000}+\frac{1111}{4000}$.

[1]The following image is taken by 3 camera shots of the same equation due to its longevity it could not be in a singular shot. After an image, the equation gets continued to the one image consecutive to it. It has not been altered at all.

Part B

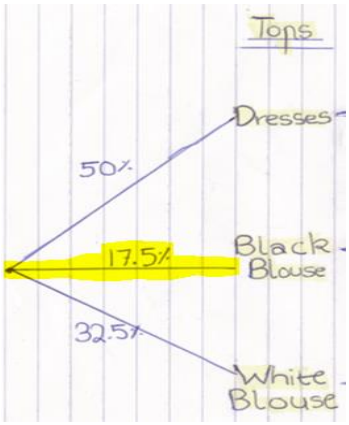
PROBLEM

If the first customer chooses a black blouse, what is the probability that the next customer will purchase an outfit with a black blouse as well?

CALCULATION

Using the 2nd assumption, where the stock is infinite and that a customer purchases an outfit, the outfit chosen will be restocked back.

Then the tree diagram can be used as the black blouse the 1st customer is using is getting replaced.



RESULT

This independent event explains the probability of getting another black blouse. Therefore, probability that the next customer will purchase an outfit with a black blouse after the first customer chooses a black blouse is $\frac{175}{1000}$ or 17.5%.

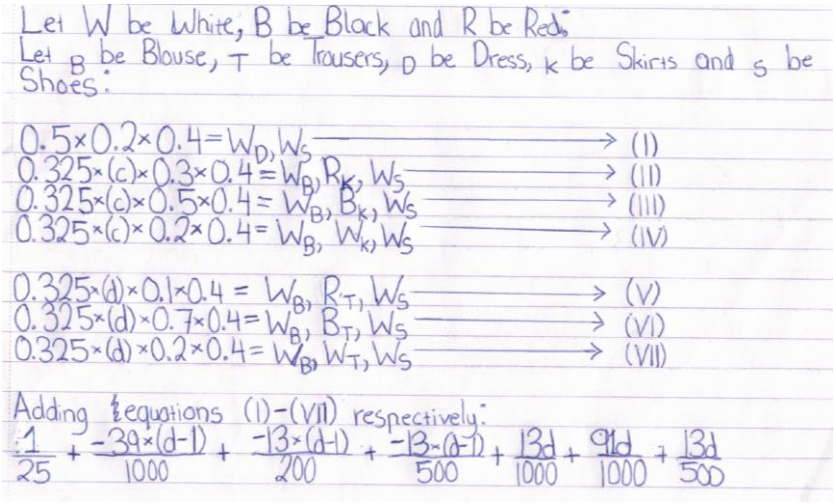
Part C

PROBLEM

If the first customer chooses a pair of white shoes, what is the probability that her outfit has a white top?

CALCULATION

This part requires a white top which is either dress and blouses, it as well requires a white shoe. This proves the 1st assumption where it is thought that there not black mean't white shoes. Hence, the tree diagram can be used to find the probability for each type of outfit possible within this situation.This can be used with conditional probability:



Furthermore, using simplify in the classpad and putting the equation that are adding up all 7 equations give an answer of $\frac{17}{100}$. Meaning that the probability that her outfit has a white shoe with a white top on is 17%.

$$P(A|B)=\frac{P(A\cup B)}{P(A)}$$

$$P(\text{White Top}|\text{White shoes})=\frac{P(A\cup B)}{0.1+0.325}=\frac{0.17}{0.425}$$

RESULT

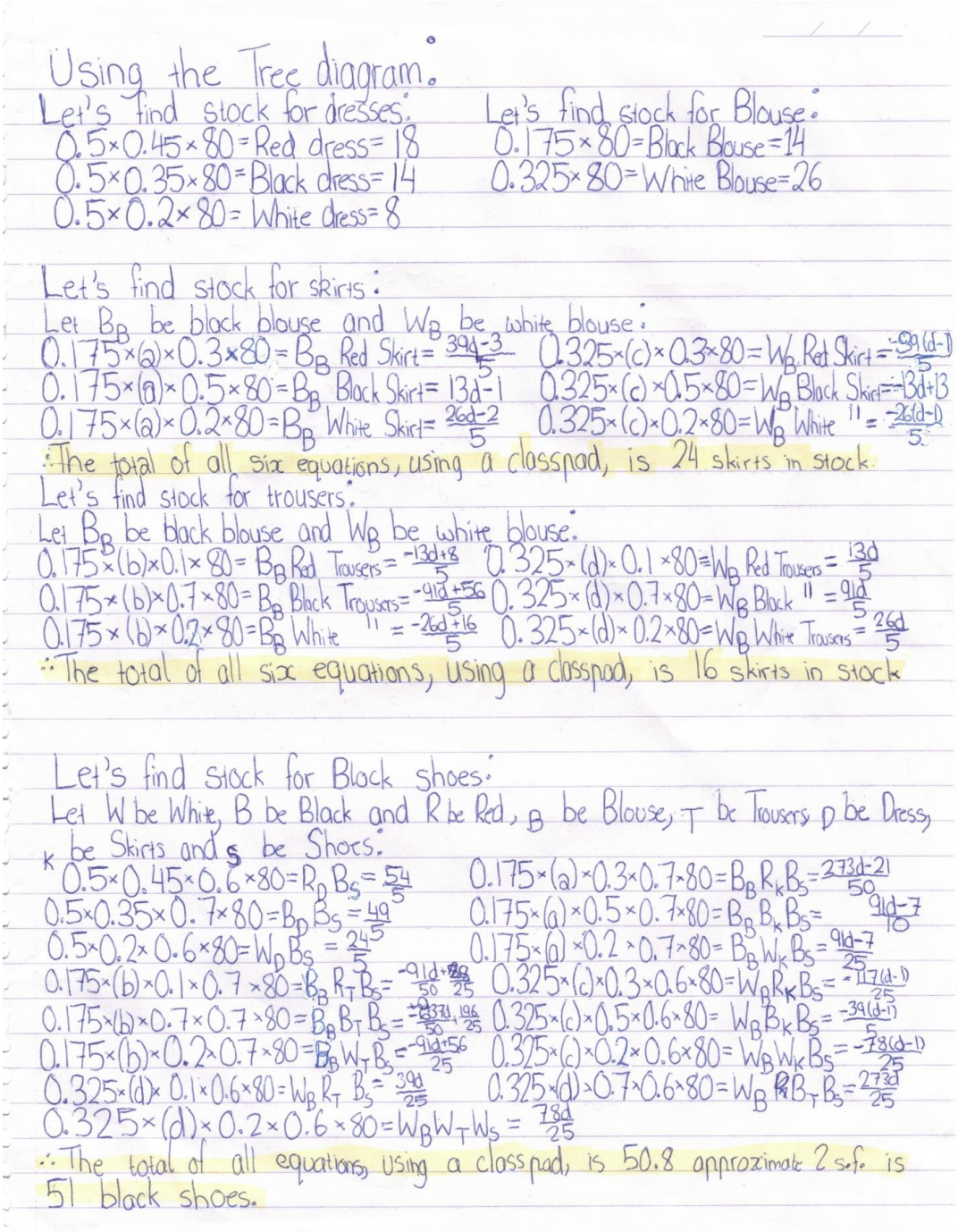
Therefore, the first customer chooses a pair of white shoes, the probability that her outfit has a white top is $\frac{0.17}{0.425}$. This probability can be simplified to 40%.

Part D

PROBLEM

If they are expecting about 80 customers in total, how would you recommend they stock the shop? State any assumptions and conditions that you apply.

CALCULATION



RESULT

By the results in the calculations it displays the minimum amount of stocking items such as 18 red dresses are needed to suffice, a predicted amount of 80 customers coming on a specific day. These amounts that are shown under the calculation subheading displays the minimum amount needed for the company to have in their stock. The store should give more than the minimum amount as there may be a customer who purchases two of the same item or might not follow the probability that was given for choice of clothing.

The store should make the most of surplus stock. Damaged and defective products should be accounted for separately from other inventory. An excess of damaged or defective products may reflect a systemic problem in the supply chain, quality control issues, or problems with the distribution.

In this report it is stated from one of the assumptions that the stock is restocked after an item is purchased. This only applies when the day is not busy.

Conclusion

This following report shows the probability of a customer choosing an item which will be part of the outfit for the customers (female) school formal. This information can be attained using the tree diagram which is displayed through a category of: **Tops, Lower-Half Clothes, Colors** and **Shoes.** These categories have as well a few subcategories underneath it such as; Dress, Trousers, etc. A tree diagram was used as it helps calculate the number of possible outcomes of an event or problem, and to cite those potential outcomes in an organized manner and it helps visualizing the condition.

Some of the working out shown like in Part A and Part C display the usage of multiplying probabilities along the branches to find a probability of a specific event. The probabilities are add down the columns of those events. This was done to find a probability of an independent event. Then with the use of conditional probability the evidence is the values of the measurements, or the features on which the classification is to be based. This can help the reader to understand the possibility of choosing a specific item of a certain feature.

If there was further extensions to this research it would be the addition of more categories to make it more specific such as more colors, textures, etc.

Probability are not just a theoretical tool used the in the classroom—they are used by scientists and statisticians in many branches of science, research, and government. For example, a probability forecast is an assessment of how likely an event can occur in terms of percentage and record the risks associated with weather. Meteorologists all throughout the planet utilize various instruments to foresee climate changes. They gather the climate gauge information from around the world to assess the temperature changes and the probable climate conditions for a specific time frame.

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- *Tree Diagram*. (n.d.). Investopedia. Retrieved July 15, 2021, from https://www.investopedia.com/terms/t/tree_diagram.asp#:%7E:text=A%20tree%20diagram%20is%20a,outcomes%20in%20an%20organized%20way.
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