

The Application of Decision Tree to Build a Lone Wolf Character in Divinity: Original Sin 2

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Abstract—Divinity: Original Sin 2 is a story-heavy role-playing game (RPG) where you can interact with non-playable characters (NPC) and use tactics in a turn-based combat to proceed the story. The interaction and combat are based on your stats, races, origin story, etc. A slight change in those choices can lead to a whole different story and even cause the death of your character. This paper will discuss the choices that the player can make and the best choices for each playstyle of a lone wolf character using decision tree.

Keywords—Divinity: Original Sin 2, Choices, Lone wolf, Decision tree

I. INTRODUCTION

Video games are electronic games which uses user interface, for example controller or keyboard, to generate feedback. Video games have become a big part of many people lives. There are a lot of games companies that have popped up, from big ones to indie ones. Video games are mostly used for entertainment. Some people play games as a job, making videos about it or participate in a game competition with big reward. Some people just want to play to elevate stress. Video games are also a great way to tell a story, like a movie or a comic. A type of game that is heavily based on the story is call a role-playing game, or RPG for short.



Figure 1.1. Cover Art of Divinity: Original Sin 2

(Source:https://store.steampowered.com/app/435150/Divinity_Original_Sin_2_Definitive_Edition/)

Divinity: Original Sin 2 is a role-playing game made by the developer and publisher Larian Studios. This game was first released in September 2017 for Microsoft Windows, and then in August 2018 for PlayStation 4, then in January and September

2019 for macOS and Nintendo Switch, and the latest one is in May 2021 for iPadOS. This game is the sequel to Divinity: Original Sin which was first released in 2014. Divinity: Original Sin 2 (or DOS2 for short) in the first two months sold over a million copies.

Players can have up to four characters in their party, or just play as a lone wolf character, which has only one character in their party. Playing as a lone wolf is harder to play in combat because there is only one damage output, but it is easier to manage because players only need to focus on one character.

The focus of this paper is to use decision tree based on the playstyle of the player and choose what is best for them. There are many playstyles to choose from, such as melee or ranged, mainly use magic or not, high on defense or great at dodging, etc. This paper does not focus on items and loots such as armor, weapon, etc. because these things can be obtained randomly, and the stats are also random. This paper also does not focus on the story nor the interaction with non-playable characters (NPC) because we want to focus on the stats of the player character.

II. THEORETICAL BASIS

A. Graph

In graph theory, a graph is a structure with objects called vertices (also called nodes or points) in which pairs of vertices are related. The related pairs of these object are called an edge. A graph is defined as a pair $G = (V, E)$, which V is the set of vertices ($V = \{v_1, v_2, v_3, \dots\}$), and E is the set of edges ($E = \{e_1, e_2, e_3, \dots\}$) [1].

Based on the amount of loop (an edge that starts and ends at the same node) or paralel edges (two edges that start and end at the same node with each other), graphs can be divided into two types:

1. Simple graph

A simple graph is a graph that does not have a loop nor a paralel edge.

2. Unsimple graph

An unsimple graph is a graph that has a paralel edge (multi-graph), or a loop (a pseudo-graph).

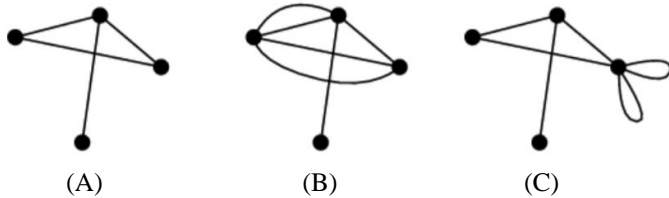


Figure 2.1. (A) a simple graph, (B) a multi-graph, (C) a pseudo-graph
(Source: <https://mathworld.wolfram.com/SimpleGraph.html>)

Based on the direction of the edges, graph can be divided into two types:

1. Undirected graph
This graph does not have a direction on its edges, for example Fig. 2.1
2. Directed graph
Directed graphs (or Digraphs) does have a direction on its edges

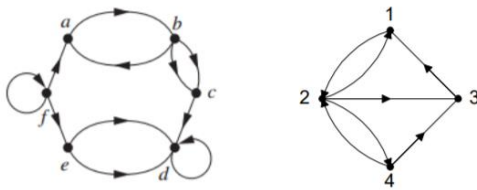


Figure 2.2. Examples of directed graphs
(Source: <https://informatika.stei.itb.ac.id/~rinaldi.munir/Matdis/2020-2021/Graf-2020-Bagian1.pdf>)

B. Tree

A tree is an undirected graph that does not have a circuit [2]. If $G = (V, E)$ is an undirected graph and is a tree with n vertices, then:

1. Every pair of vertices in G is connected by a single edge
2. If m is the number of edges, then $m = n - 1$
3. G does not have a circuit
4. If one edge is added to G , then there would be only one circuit
5. G is connected and all its edges is a bridge

a) Rooted tree

A rooted tree is a tree where there is one node that acts like a root and all its edges are directed so that it becomes a directed graph. [3]

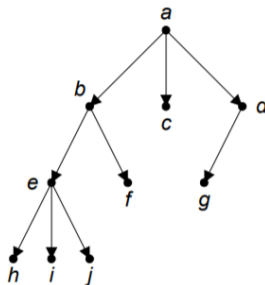


Figure 2.3. A rooted tree
(Source: <https://informatika.stei.itb.ac.id/~rinaldi.munir/Matdis/2020-2021/Pohon-2020-Bagian2.pdf>)

Terminologies of a rooted tree:

1. child and parent
Child node is the successor of a parent node, and parent node is the predecessor of a child node (in Fig 2.3, b, c, and d is the child, and a is the parent).
2. path
Path is the number of edges to go from a node to another.
3. sibling
Sibling nodes are nodes that have the same parent node.
4. subtree
A subtree is a smaller tree that is within a tree.
5. degree
The degree of a node is the number of child nodes that node have, where else the degree of a tree is the biggest degree one of its nodes have.
6. leaf
A leaf is a node that does not have a child node.
7. internal nodes
Internal nodes are nodes that have a child.
8. level
Level is the number of predecessors a tree has from its root.
9. height/depth
The height/depth is the biggest level a tree has.

b) N-ary tree

An n-ary tree is a tree which every node in it has at most n child.

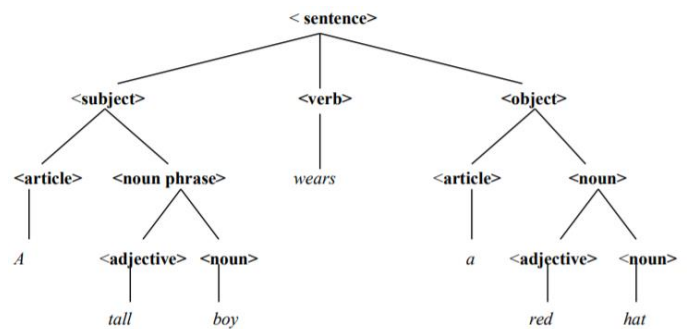


Figure 2.4. An n-ary tree
(Source: <https://informatika.stei.itb.ac.id/~rinaldi.munir/Matdis/2020-2021/Pohon-2020-Bagian2.pdf>)

c) Decision tree

A decision tree is an implementation of n-ary tree in which each internal node represents a test of an attribute, every edge represents all possible outcomes of a test, and every leaf node represent the result of the test.

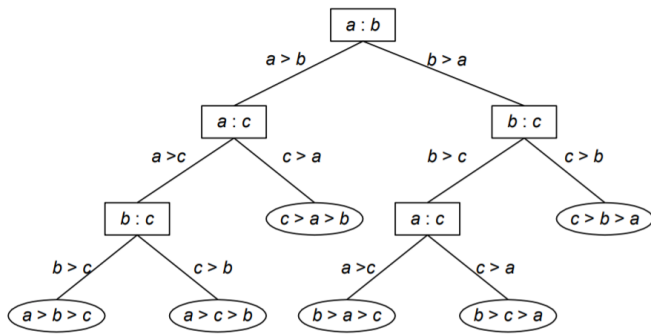


Figure 2.5. A Decision tree to sort three elements

(Source: <https://informatika.stei.itb.ac.id/~rinaldi.munir/Matdis/2020-2021/Pohon-2020-Bagian2.pdf>)

C. Divinity: Original Sin 2

Divinity: Original Sin 2 is a role-playing game made by the developer and publisher Larian Studios. This game was first released in September 2017 for Microsoft Windows, and then in August 2018 for PlayStation 4, then in January and September 2019 for macOS and Nintendo Switch, and the latest one is in May 2021 for iPadOS. This game is the sequel to Divinity: Original Sin which was first released in 2014. Divinity: Original Sin 2 (or DOS2 for short) in the first two months sold over a million copies.

Players can have up to four characters in their party. Players can also choose several pre-made characters, which have a background story of their own, or make a custom one and choose their stats, races, gender, and origin story to start. Players can also play with up to three friends, each controlling a character, and possibly have a different interaction with NPCs (Non-Playable Characters) because of their traits.

a) Story

The story of the game is based around a world called Rivellon, centuries after the story in Divinity: Original Sin 2. Every living being contains an energy called Source. There are individuals that can manipulate this energy, and they are called Sourcerers. Sourcerers can use this energy to cast spells or enhance their combat abilities. The Seven Gods of Rivellon gave some of their collective Source to a person named Lucian, known as the Divine, and use his power to hold back the Void. However, Lucian died before the start of the game, and the border between the Void and Rivellon weakened. Thus, creatures called Voidwoken and their deity, the God King, invaded Rivellon. These creatures are drawn to Source, so an organization called the Divine Order are tasked to oppress Sourcerers.

The player is playing as a Sourcerer that was chosen by one of the Seven Gods to reach Divinity, become one of the gods. After that, whatever the player chooses always has consequences.

b) Combat



Figure 2.6. Combat Mode

When the player is in combat, their turn in combat is based on their initiative. In their turn, they can attack normally with their weapon, cast a spell, move, or use an item. These action cost Action Point (AP) and their cost differs. When the battle start, each character gets four AP, and restore 4 AP each turn. When the player ends their turn with some AP left, they store that AP for the next turn. Each character can store up to six AP. The damage of the characters attacks and spells are based on their stats. The bigger the stats, the bigger the damage.

c) Attributes

Each character has their own stats, and one of those stats is attributes. Attributes serve as the "innate qualities" that a creature possesses. These determine how strong, agile, or smart they are as a creature. Here is the list of attributes:

Table 1. Attributes in Divinity: Original Sin 2

Attribute	Summary
Strength	Increases the damage dealt with strength-based weapons and skills, as well as the carry weight and the ability to move heavier objects.
Finesse	Increases damage dealt with finesse-based weapons and skills.
Intelligence	Increases damage dealt with intelligence-based weapons and skills.
Constitution	Determines the amount of Vitality, or Health Points (HP) the character has.
Memory	Determines how many Skills can be memorized at any one time.
Wits	Affects your Critical Chance, Initiative, and ability to detect traps and find hidden treasures.

d) Abilities

Another type of stats is Abilities. These acts as another foundation for your character stats. Abilities are divided into two, combat abilities and civil abilities. Here is a list of combat

abilities:

Table 2. Combat Abilities in Divinity: Original Sin 2

Weapons	
Abilities	Description and Effect
Dual Wielding	increases damage and dodging when dual-wielding two one-handed weapons. +5% Damage and +1% Dodge Chance.
Ranged	increase damage and Critical Chance when using bows and crossbows. +5% Damage and +1% Critical Chance.
Single-Handed	increase damage and Accuracy when using a one-handed weapon (dagger, sword, axe, mace, or wand) with a shield or empty off-hand. +5% Damage and +5% Accuracy.
Two-Handed	increase damage and critical multiplier when using two-handed melee weapon (Sword, axe, mace, spear, or staff). +5% Damage and +5% Critical Multiplier.
Defense	
Leadership	grants dodging and resistance bonuses to all allies in a 5m radius. +2% Dodging and +3% to all Resistances.
Perseverance	restores Magic Armor after you recover from Frozen or Stunned, and restores Physical Armor after knocked down or petrified. +5% Armor restored.
Retribution	reflects received damage to your attacker. 5% damage reflected.
Skills	
Aerotheurge	increase all Air damage you deal. Air attacks deal +5% more damage.
Geomancer	increases all Poison and Earth damage you deal, and any Physical Armor restoration you cause.
Huntsman	increases the damage bonus when attacking from high ground. +5% Damage from high ground.
Hydrosophist	increases all Water damage you deal, and any Vitality healing or Magic Armour restoration that you cause. Water attacks deal +5% more damage, +5% Vitality healed, +5% Magic Armour from skills and potions.
Necromancer	Heals you every time you deal damage to Vitality. Damage from reflection effects yields half heal. Also increase the damage dealt by Necromancy skills. Heal +10% of the damage dealt to Vitality, also Necromancy attacks deal +5% more damage.
Polymorph	provides one free attribute point per point invested. +1 Attribute Point.
Pyrokinetic	increase all Fire damage you deal.

	+5% Damage.
Scoundrel	increases movement speed and boosts your Critical Modifier. +5% Critical Multiplier, +0.3 Movement speed.
Summoning	increases Vitality, Damage, Physical Armour and Magical Armour of your summons and totems. Summons starts with 5% more Vitality, Damage, Physical Armour and Magical Armour.
Warfare	increases all Physical damage you deal. Physical attacks deal +5% more damage.

Here is a list of civil abilities:

Table 3. Civil Talents in Divinity: Original Sin 2

Ability	Description and Effect
Lucky Charm	increases your likelihood of finding extra treasure whenever loot is stashed. Every time the character opens a loot stash, Lucky Charm gives a chance that it will have more loot than usual . A unique sound and animation will play if Lucky Charm successfully triggers.
Persuasion	Persuasion helps you convince characters to do your bidding in dialogues and increases how much characters like you. Increases base Attitude with strangers by 5 per point.
Bartering	Bartering improves your haggling skills with traders. Bartering improves your haggling skills. With each point invested, traders' items become 2% cheaper and your items become 4% more expensive.
Loremaster	Loremaster identifies enemies and allows you to identify items. Increasing Loremaster allows you to identify more, faster. To identify, use an identifying glass and click on the item you want to identify. To examine a monster or NPC, right click them and choose Examine. Higher level equipment will need higher Loremaster.
Telekinesis	Telekinesis allows you to move items telepathically regardless of weight. Range of telekinesis is 4m per point.
Sneaking	Sneaking determines how well you can sneak without getting caught. A higher sneaking ability improves your movement speed while sneaking and shrinks NPC sight cones.
Thievery	Thievery improves your lockpicking and pickpocketing skills. To lockpick, use a lockpick and click on the item you want to lockpick. Or right-click the item and choose from the menu.(+2kg and xx gold value)

e) Talents

Talents are passive abilities that can change player characters in subtle or drastic ways. Some talents have requirements to be unlocked, often tied to leveling or investment in specific Skills. Some talents are incompatible with others. Here is a list of talents:

Table 4. Talents in Divinity: Original Sin 2

Talents	Description and Requirements
All Skilled Up	Grants 1 additional Combat Ability Point and 1 extra Civil Ability Point. Requirement: Level 2
Ambidextrous	Reduces the cost of using grenades and scrolls by 1AP if your offhand is free. Requirement: None
Arrow Recovery	Grants a 33% chance to recover a special arrow after firing it. Requirement: None
Bigger and Better	Immediately grants 2 extra attribute points. Requirement: Level 2
Comeback Kid	Once per combat, if an enemy lands a fatal blow, Comeback Kid will help you bounce back to life with 20% health. If you die and are resurrected in combat, Comeback Kid will be available again. Requirement: None
Demon	Gain 15% fire resistance and 15% water weakness. Max fire resistance also increases by 10. Cannot be used with Ice King. Requirement: Pyrokinetic 1
Duck Duck Goose	Lets you evade attacks of opportunity. Requirement: Huntsman 1
Elemental Affinity	Lowers the Action Point cost of spells by 1 when standing in a surface of the same element. Requirement: None
Elemental Ranger	Arrows will deal bonus elemental damage depending on the surface the target is standing in. Requirement: Huntsman 1
Escapist	Allows you to flee combat even when enemies are right next to you. Requirement: None
Executioner	Gain 2 AP after dealing a killing blow (once per turn). Does not work with The Pawn. Requirement: Warfare 1
Far Out Man	Increase the range of spells and scrolls by 2m. Does not affect melee and touch-ranged skills. Requirement: None
Five-Star Diner	Doubles the effects of foods and potions. Requirement: None
Glass Canon	You start every combat round with Maximum AP, but Magic and Physical Armour do not protect you from statuses. Requirement: Incompatible with Lone Wolf.

Guerilla	While sneaking, your attack damage is increased by 40%. Reduces the AP cost of sneaking in combat by 1 AP, to 3 AP. Requirement: Sneaking 1
Hothead	While you are at maximum Vitality, Hothead grants you an extra 10% critical chance and 10% more accuracy. Requirement: None
Ice King	Grants +15% Water resistance and +15% fire weakness. Max water resistance is raised by 10. Cannot work with Demon. Requirement: Hydrosophist 1
Leach	Heals you when standing in blood. Requirement: None
Living Armour	35% of all healing you receive is added to your Magic Armour. Requirement: None
Lone Wolf	Lone Wolf provides +2 Max AP, +2 Recovery AP, +30% Vitality, +60% Physical Armour, +60% Magic Armour, and doubles invested points in attributes - up to a maximum of 40- and combat abilities (except Polymorph ability) - up to a maximum of 10, while you are adventuring solo or with at most one companion. This bonus is temporarily removed while there are more than two members in the current party. Requirement: Incompatible with Glass Cannon
Mnemonic	Gives you 3 extra points in your Memory attributes. Requirement: None
Morning Person	When resurrected, you resurrect to full health. Requirement: None
Opportunist	Gives you the ability to perform attacks of opportunity. Requirement: None
Parry Mater	Gives you a 10% bonus dodge chance while dual wielding. Requirement: None
Pet Pal	Enables you to talk to animals. Requirement: None
Picture of Health	Grants +3% extra Vitality for every point of Warfare. Requirement: Warfare 1
Savage Sortilege	Gives all magical skills a critical chance equal to your critical chance score. Requirement: None
Slingshot	Adds an extra 5m range to your grenade throws. Requirement: None
Stench	Decreases everyone's attitude towards you by 25, but melee combatants will find you less attractive. Requirement: None

The Pawn	Permits your character 1 AP worth of free movement per turn. Does not work with Executioner. Requirement: Scoundrel 1
Torturer	With Torturer, certain statuses caused by you are no longer blocked by Magic or Physic Armour, and their duration is extended by one turn. Burning, Poisoned, Bleeding, Necrofire, Acid, Suffocating, Entangled, Death Wish, and Ruptured Tendons are affected by this talent. Requirement: None
Unstable	You explode upon death, dealing 50% of your vitality as physical damage in a 3-meter radius. Requirement: None
Walk It Off	Reduces all status durations by 1 turn. This also affects positive statuses. Requirement: None
What a Rush	Increases your recovery and maximum Action Points by 1 when your health is below 50%. Requirement: None
Spider's Kiss	Spider's Kiss gives you -2 CON and +2 to another Attribute (depends on your choice in quest) . Requirement: A Web of Desire (A quest in which you kiss a woman that's actually a giant spider)
Trader's Secrets	Gives +1 Bartering from eating Garvan's head Requirement: Aggressive Takeover (A quest in which you kill an NPC named Garvan)
Ancestral Knowledge	Gives you +1 to Loremaster. Requirement: Elf race
Corpse Eater	Lets you eat body parts to access the memory of the dead. Requirement: Elf race
Dwarven Guile	Gives you +1 in Sneaking. Requirement: Dwarf race
Sturdy	Gives you +10% max Vitality and +5% Dodging. Requirement: Dwarf race
Ingenious	Gives you 5% bonus Critical Chance and 10% extra Critical Multiplier. (Was +2 Initiative and +5% Critical Chance) Requirement: Human race
Thrifty	Gives +1 to Bartering Requirement: Human race
Sophisticated	Gives you +10% Fire Resistance and +10% Poison Resistance. Requirement: Lizard race
Spellsong	Gives you +1 to Persuasion Requirement: Lizard race
Undead	Lets you heal from poison, but regular healing will damage you instead.

	Requirement: Undead race
Rooted	Gives you 3 extra points in your Memory attribute. Requirement: Sebille talks to Elven Scion after The Mother Tree Quest

III. APPLICATION OF DECISION TREE

A. Playstyle of the Player

We must first analyze playstyles of the player. These playstyles can be referred as Classes. There are 14 classes in DOS2, they are:

- a) Battlemage
Close-range character that uses abilities from Warfare and uses status effects from spells.
- b) Cleric
Dealing damage from close range and have healing spells from Hydrosophist and damage-dealing spells from Necromancer.
- c) Conjurer
Conjurers does not attack directly. They summon incarnates and totem to fight for them.
- d) Enchanter
Enchanter uses both Hydrosophist and Aerotheurge to deal damage and cast debuffs to enemies.
- e) Fighter
Fighters uses a shield and a one-handed weapon to damage enemies. They keep a high armour stat and uses Warfare and Geomancer skills.
- f) Inquisitor
This class uses Warfare and Necromancy. Warfare allows them to deal high damage while Necromancy drain the enemy life.
- g) Knight
Knight uses two-handed weapons and Warfares to damage foes. This class focus more on damage, while a fighter has more protection.
- h) Metamorph
Metamorph can change their shape and gain abilities from other animals. This class uses the polymorph skill set.
- i) Ranger
This class uses Huntsman and Pyrokinetic. If possible, they attack from a high place to increase their damage.
- j) Rogue
This class have a variety of Scoundrel skills and focuses on backstabbing enemies to increase damage.
- k) Shadowblade
This class is like rouge but uses Polymorph to keep things more varied.
- l) Wayfarer
Wayferer is a mix of Huntsman and Geomancer. Geomancer allows them to slow enemies.
- m) Witch
Witch is a class with access to both Scoundrel and Necromancer abilities.

n) Wizard

This is a pure mage class that uses Geomancer to spread oils and poison, and Pyrokinetic to burn those and deal damage to a big area.

B. Implementation

Based on the playstyle of the player, we can implement the decision tree .

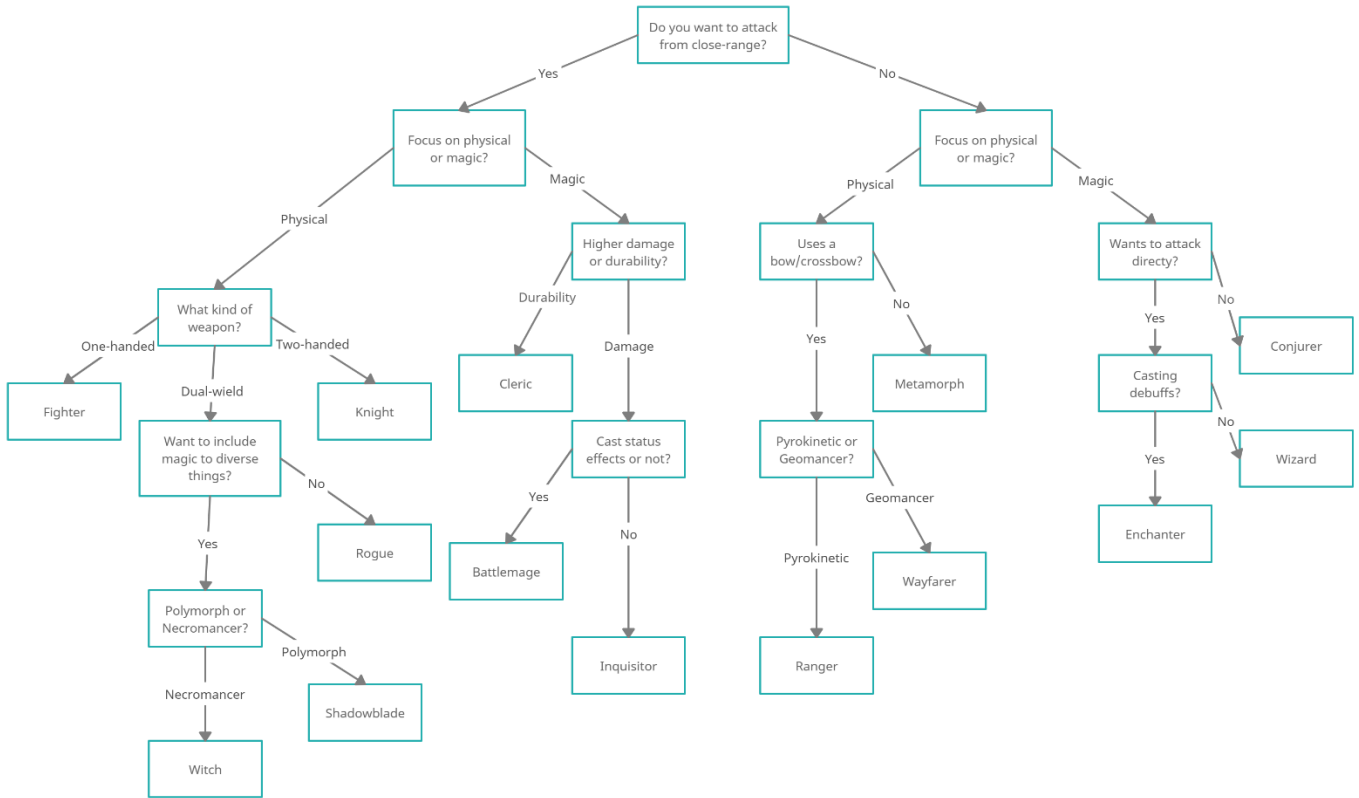


Figure 3.1. Decision Tree of The Player Playstyle

C. Stats for Each Class

After choosing the classes, the player must build their character stats. There are a must have stats for lone wolf characters, such as the talent Lone Wolf that increases their stats if they only have one or two players in their party. There are also useless stats for lone wolf character, such as the talent Morning Person because there are no party members to resurrect the player. Here are the stats for each class:

- a) Battlemage
Attributes: Focus on Strength and Constitution
Abilities: Focus on Two-handed, Warfare, and Aerotheurge/Pyrokinetic.
Talents: Lone Wolf, Comeback Kid, Picture of Health
- b) Cleric
Attributes: Focus on Intelligence and Constitution
Abilities: Focus on Hydrosophist and Necromancer
Talents: Lone Wolf, Savage Sortilege, Comeback Kid
- c) Conjurer
Attributes: Focus on Intelligence and Memory
Abilities: Focus on Summoning
Talents: Lone Wolf, Mnemonic
- d) Enchanter
Attributes: Focus on Intelligence and Memory
Abilities: Focus on Aerotheurge and Hydrosophist

- Talents: Lone Wolf, Torturer, Walk It Off
- e) Fighter
Attributes: Focus on Strength and Constitution
Abilities: Focus on One-Handed and Warfare
Talents: Lone Wolf, Comeback Kid, Executioner, Picture of Health
- f) Inquisitor
Attributes: Focus on Intelligence and Constitution
Abilities: Focus on Warfare and Necromancy
Talents: Lone Wolf, Comeback Kid, Executioner
- g) Knight
Attributes: Focus on Strength and Constitution
Abilities: Focus on Two-Handed and Warfare
Talents: Lone Wolf, Comeback Kid, Executioner, Picture of Health
- h) Metamorph
Attributes: Focus on Intelligence and Strength
Abilities: Focus on Polymorph
Talents: Lone Wolf, Bigger and Better, All Skilled Up
- i) Ranger
Attributes: Focus on Finesse and Wits
Abilities: Focus on Ranged, Huntsman, Warfare
Talents: Lone Wolf, Arrow Recovery, Far Out Man
- j) Rogue
Attributes: Focus on Finesse and Wits

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, 14 Desember 2021



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- Abilities: Focus on Dual Wielding and Scoundrel
Talents: Lone Wolf, The Pawn, Executioner
- k) Shadowblade
Attributes: Focus on Finesse and Wits
Abilities: Focus on Dual Wielding, Scoundrel, Polymorph
Talents: Lone Wolf, The Pawn, Executioner
- l) Wayfarer
Attributes: Focus on Finesse and Wits
Abilities: Focus on Ranged, Huntsman, Geomancer
Talents: Lone Wolf, Arrow Recovery, Far Out Man
- m) Witch
Attributes: Focus on Finesse and Wits
Abilities: Focus on Dual Wielding, Scoundrel,
Necromancer.
Talents: Lone Wolf, Arrow Recovery, Far Out Man
- n) Wizard
Attributes: Focus on Intelligence, Memory
Abilities: Focus on Geomancer, Pyrokinetic
Talents: Lone Wolf, Savage Sorcery, Far Out Man

IV. CONCLUSION

Decision Tree is a method to make a decision. There are many ways a player can play this game, from melee or ranged, to using elemental spell or not, and we can use a Decision Tree to find the best playstyle for a player. The stats for each class above do not secure the win in a combat because there are many other things to consider, such as critical hits from enemies, sudden ambush from invisible enemies, etc., but it does increase the chances of winning.

V. ACKNOWLEDGMENT

I wish to show my appreciation to Mr. Rinaldi Munir because he taught a lot of students about Discrete Mathematics, and this assignment taught me a lot of things that I should consider in a Decision tree. I also want to show my appreciation to Larian Studios for making such a great game for me and my friends to enjoy.

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