

Ragnarok Online: Implementing Tree Theory to Build Royal Guard Skillwise

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Abstract—Ragnarok Online is a Massively Multiplayer Online Role Playing Game. Being an RPG game, surely there are countless builds available for players to make. Including Royal Guard as one of the top classes available. By explaining Ragnarok Online Royal Guard's skills as well its skill tree, players can apply tree theory to decide which build suits their play style. This paper will cover basic Royal Guard skill knowledge and display the decision players can take to build their Royal Guard skill wise by implementing tree theory.

Keywords—Tree, Ragnarok Online, Royal Guard, Skill.

I. INTRODUCTION

Daily life in general consists of three major activities, first is to rest. Resting could be done with eight hour sleep at night or a little nap in the afternoon. Second is to work, work here is not inclusive to working defined by adults but also consists of studying for younger generations. Third is to make sure that your own health stays strong and healthy. Of course it is not only about physical health, but also mental health. Generally, to stay healthy mentally is to stay happy. That is where entertainment comes. Entertainment is a form of activity that holds the attention of an audience or gives pleasure and delight. Entertainment as stated above comes in many forms as in movies, various shows, and games. In this day and age, video games are becoming more numerous and creative. One such game is Ragnarok Online, Ragnarok Online is a Massively Multiplayer Online Role Playing Game (MMORPG). It was created by the Gravity Corporation based in Seoul, South Korea.

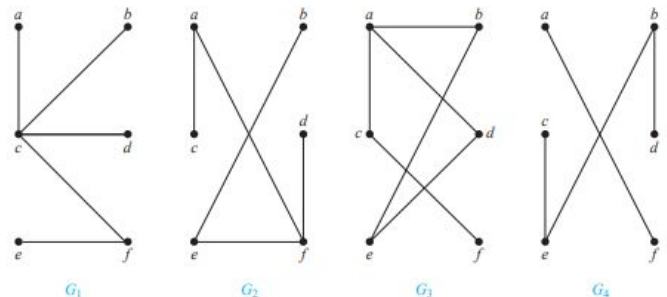


Ragnarok Online (RO) allows you to create a virtual character, customize it, and partake in epic adventures across exotic lands. Although it launched many years ago, some people are still playing it. Other than the players itself, a couple of creative people also try to expand the game's content. Being

a Role Playing Game (RPG), Ragnarok Online of course came with a variety of classes people can choose. One such class is Swordsman. Along with many expansions released from day one, the already existing classes got an upgrade and can be accessed by doing quests and increasing the player's level. Because the upgrades are numerous and the playstyle available is not few, tree theory to enhance the experience of making the character to be most desirable can be applied.

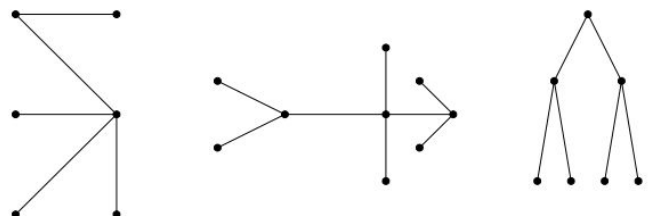
II. TREE THEORY

A connected graph that contains no simple circuits is called a tree. The example is below,



As displayed above, there are 4 graphs available and from those 4, there are 2 trees. By the first definition of tree, which stated that a tree is a connected undirected graph with no simple circuits, it can be concluded that G1 and G2 are both trees because they both are connected graphs with no simple circuits. G3 is not a tree because there is an existing simple circuit and G4 is not connected meaning that it is also not a tree.

Forest is a group of trees that are not connected, or simply a bunch of graphs that can be applied by the definition of tree.



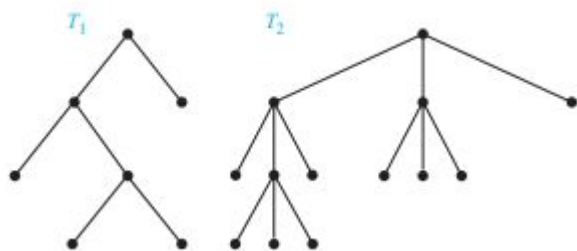
In the applications of trees, a particular vertex of a tree is designated as the root. By the first theorem that stated that an

undirected graph is a tree if and only if there is a unique simple path between any two of its vertices, we can direct each edge away from the root. Thus, a directed graph consisting of a tree together with its root is produced. This notion defines another definition that is a rooted tree is a tree in which one vertex has been designated as the root and every edge is directed away from the root.

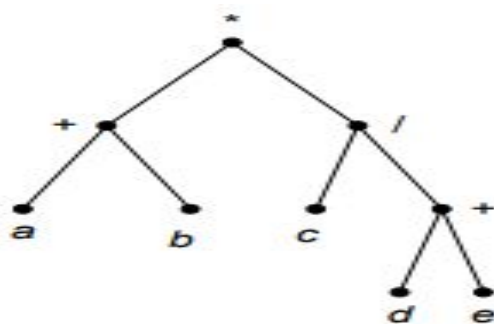
Rooted trees have some terms, which consists of:

1. Children and Parent
Children is a node connected directly to another node and positions itself further from the root than its counterpart. Its counterpart is the parent (closer to the root).
2. Path
Path denoted how many paths that could be taken to move from the root to the designated target node.
3. Sibling
Sibling is two different children nodes that have the same parent.
4. Subtree
Subtree is a smaller rooted tree that applies its bigger counterpart rooted tree theory recursively.
5. Degree
Degree is the total count of children nodes that a parent node has.
6. Leaf
Leaf is a node that does not have any children or simply put, 0 degree.
7. Internal Nodes
The counterpart of a leaf.
8. Level
Level denotes how deep a designated node is, by counting the path it takes from the node to the tree's highest root.
9. Height or Depth
The maximum number of levels that a tree has.

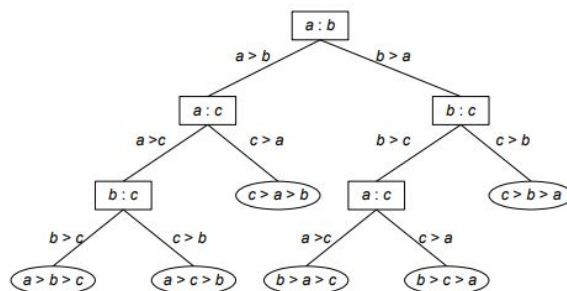
Another definition by expanding the last definition of rooted tree theory is that a rooted tree is called an m -ary tree if every internal vertex has no more than m children. The tree is called a full m -ary tree if every internal vertex has exactly m children. An m -ary tree with $m = 2$ is called a binary tree. Here is a display of a binary tree and a 3-ary tree.



Binary Trees have some application and usage, the first is the expression tree which denotes a simple math equation with a binary tree. By using the leaves as the operand and internal nodes as the operator, the math equation can be pictured easily. Here is an example of $(a+b)*(c/(d+e))$,



Second is the decision tree, for the parents of the binary tree, they would only have 2 childrens. This can be used for deciding the path we should take by using the parents as a conditional expression and its children are the aftermath of the decision taken beforehand. By that definition, it can be concluded that the decision tree is quite handy for some real life problems and it can be applied freely while covering quite a number of cases that could come up on a single problem.



III. RAGNAROK ONLINE ROYAL GUARD

A. Classes

Ragnarok Online as a massively multiplayer online role playing game surely has quite a number of classes available. Here is the full table of classes available for players to choose,

First Class	Second Class (2-1)	Second Class (2-2)	Transcendent Second Class (2-1)	Transcendent Second Class (2-2)	Third Class (3-1)	Third Class (3-2)
Swordman	Knight	Crusader	Lord Knight	Paladin	Rune Knight	Royal Guard
Mage	Wizard	Sage	High Wizard	Scholar	Warlock	Sorcerer
Archer	Hunter	Bard/Dancer	Sniper	Minstrel/Gypsy	Ranger	Maestro/Wanderer
Merchant	Blacksmith	Alchemist	Mastersmith	Biochemist	Mechanic	Geneticist
Thief	Assassin	Rogue	Assassin Cross	Stalker	Gullotine Cross	Shadow Chaser
Acolyte	Priest	Monk	High Priest	Champion	Arch Bishop	Sura

Here we have the 6 basic classes (excluding 4 extended classes which will be excluded). At launch, there only exist the two leftmost columns of the table. The game only has the first class which will be acquired once players hit level 10 on their respective job level and then completing a quest. After spending some time on the basic classes, at job level 40 they can upgrade to the second class that will elevate the player's combat abilities. After updates and expansion, now we have the cream of the crop, that is, third class which can be leveled up to level 175 character wise and level 60 class wise. Here is the general overview of the basic classes.

1. Swordsman
Swordsman are honest and as stubborn as the strong waves of the ocean. With strong physical attacks, defense, and a sense of command, a Swordsman can

become a headstrong leader to others. Swordsman continuously train to gain more skill and strength.

2. Mage

Mages rely on their skills as their main source of damage, and such attacks are magically based and only take into account the target's Magical Defense, and not their Physical Defense. Furthermore, all of a Mage's spells are elemental, thus meaning the accurate use of the correct spell against the correct monsters is highly important.

3. Archer

Archers are experts at long-range combat with Bows and Arrows. Their range gives them several advantages, which includes the ability to change the element of their weapon by changing the arrow type and by attacking from long range they can defeat slow-moving or even stationary opponents that are stronger than the player's current level.

4. Merchant

Always on the lookout for profit, Merchants are the economic experts of Ragnarok Online. Setting out to make a fortune, playing as a Merchant will allow the player to get the most out of every last zeny. Merchants are also handy with items, being able to carry far more than other classes thanks to their Enlarge Weight Limit and Pushcart abilities.

5. Thief

Waiting in the shadows, planning where they'll strike next, the mischievous Thieves are a force to reckon with. Swift and powerful, few can keep up with a Thief's attack speed and power, whether they're slashing their way in battle with a sharp dagger, or striking from afar with a bow. Striking them down isn't easy either, coupling their high flee with the ability to become invisible and poison their pursuers, Thieves have only magic to fear.

6. Acolyte

Acolytes live their lives serving the Catholic Church and following the religious teachings. They train to become selfless and devoted individuals, aiming to help all that they meet. While the main location for Acolytes, like other members, is the Church in Protera, it isn't uncommon to find Acolytes travelling with adventurers around the world, especially adventurers recruited by King Tristan III.



Display above is the character design of each class. According to the table, there are 42 classes available to play and each of them have their own basic job description about their in-game roles. Roles in Ragnarok Online generally consist of two parts, damage dealers and tankers. Assume healers as damage dealers because they simply deal damage

but in negatives and to another player or simply put, allies.

B. Royal Guard

According to the class table above, the royal guard is in the second row and the last column, meaning that the royal guard is one of the pinnacle classes also called third class. Here is the character design for royal guards,



The general overview is, Royal Guards are an elite order of Crusaders and Paladins that originally served under King Schmidt of Glast Heim. King Schmidt knew that to defend his kingdom from the terrors and chaos of the world he would need a special defense unit that answered only to him. That is how the Griffon-riding Royal Guards came to be. Their name is often abbreviated and then referred to as just "RG".

At a glance, this class has a relatively good HP pool and an excellent SP pool, when compared to their class counterpart. Unlike Rune Knights, which are typically forced into Dragon Breath types of builds, the Royal Guard has the option of playing with builds that involve Banding two or more Royal Guards together; a Royal Guard can play Defense or Offense very effectively, given proper foresight of his/her skill tree. In addition to gaining new and powerful offensive skills, the Royal Guard can easily draw upon its older skills, such as Guard, Spear Quicken, Sacrifice, and Rapid Smiting. This makes for one very powerful, vastly dynamic, and exciting class.

Royal Guard is the cream of the crop, meaning that players need to experience the game first and foremost and also goes through its earlier or weaker versions. After using swordsman, players can choose to ascend or to aspire to be a crusader. After that, comes another transcendental class that is paladin before players can become a fully fledged Royal Guard. That means, top players here have numerous skills to work with. Royal Guard itself have a whopping 21 different skills available, add this number to the previous swordsman and paladin skills. Those 21 skills and their descriptions are:

1. Moon Slasher

Damages surrounding enemies and forces them to sit. This skill is quite basic and one of the foundations of other skills of the Royal Guard. Also, solid pick for every build possible.

2. Exceed Break

Gather all of your strength into the tip of your weapon and strike once for great damage. A general upgrade to auto attack but branded as an active skill. This one can be skipped for some build.

3. Cannon Spear

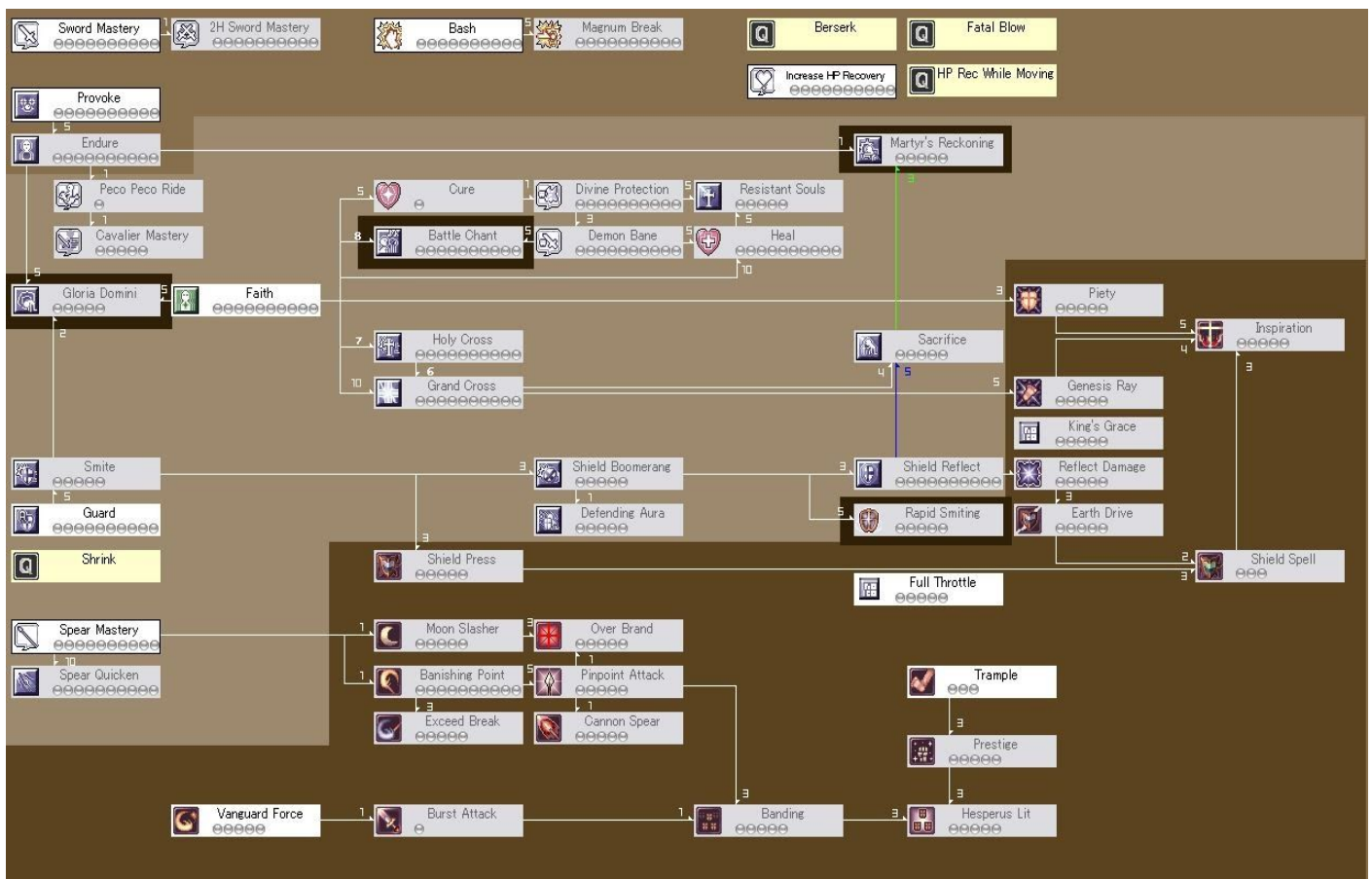
Attack all enemies in a 3 cell radius of an 11 cell line from the caster. Another straightforward offensive attack. Absolutely not necessary and can be skipped.

4. Vanishing Point

Attack an enemy within seven cells of the caster. This

skill is a straightforward spamming skill, with enough attack speed players will not notice any delay besides their internet connection. This skill is also one of the foundations of other skills and generally used almost everytime by players.

5. Pinpoint Attack
Rush against and strike a target's vital spot for a chance to break their armor or inflict a negative effect. This is the upgraded version of vanishing point, it hits harder and has additional effect relative to its skill level. It has a noticeable delay so it will not be as spammable as vanishing point but a solid pick for every Royal Guard player.
6. Overbrand
Brand all enemies six cells in front of the caster with a bloody cross and smash them into obstacles for large damage. A strong skill especially for damage dealer Royal Guard builds, basically an AOE pinpoint attack but only similar on its damage plus a knockback effect that can increase its damage potential by knocking enemies into obstacles.
7. Vanguard Force
Increases the caster's defense, max HP, and number of wrath counters when receiving damage. Totally new skill with no prerequisite from earlier classes. Used for burst attacks.
8. Burst Attack
Release all wrath counters onto a single enemy to deal damage. This skill is the application of vanguard force usage.
9. Banding
Increase attack and defense and share HP with any partied Royal Guards in range with the skill activated. A turtle stall skill and can only be used with other Royal Guards in vicinity. Very strong self enhancement and a solid pick for a trained group of RGs in PvP.
10. Trample
Tramples the ground to attempt to destroy any traps surrounding the user. New skill with no prerequisites, also a solid pick for PvP players.
11. Prestige
Increases defense rate and gives a chance to avoid magic attacks for a short while. Self buff turtling skill. A prerequisite for an important PvP skill.
12. Hesperus Lit
Royal Guards under the effect of Banding or Inspiration strike an enemy for large damage. A nuke or burst skill used for PvP, can be used by multiple Royal Guards that activate Banding skill first or a single royal guard with Inspiration active. Solid pick for coordinated or trained group of RGs in PvP.
13. Piety
Blesses surrounding party members' armor with the holy element. Simple buff for allies, prerequisite for inspiration user.
14. Genesis Ray
Royal Guards under the effect of Banding or Inspiration cast a powerful Holy element ray which may blind Demon or Undead monsters. Another nuke skill like hesperus lit, but AOE and much more powerful. Its mechanic is mostly the same as Hesperus Lit.
15. Reflect Damage
Reflects physical damage received to surrounding enemies. Simple buff to reflect damage taken to the enemies. Can be used while turtling with other skills for survivability or even damage dealing.
16. Earth Drive
Slams the ground with your shield to deal Earth property damage to surrounding enemies. A prerequisite for Inspiration user.
17. Shield Spell
Casts random magic based on the shield of the caster. Simple self buff skill, its usage is relative to the skill level.
18. Inspiration
Increases accuracy, stats, ATK, Max HP, also removes and protects against negative status effects for the duration of the skill. A self buff skill allowing a Royal Guard player to be as powerful as 3 royal guards using Banding together. Comes with a demerit but negligible for top players that are qualified to use this skill in PvP.
19. Shield Press
Slams your shield into the enemy in an attempt to stun them. Simple stun with chance based skill, prerequisite for Inspiration user.
20. King's Grace
Bestow royal blessings to the caster and allies around the caster to recover HP and protect against status effects and damage. A powerful skill to remove debuffs from one self and allies.
21. Full Throttle
Fully restores HP when cast and increases movement speed increases for the skill's duration. All stats +20%. A basic skill for all third class to use, simple attributes and movement buff but when expires will rebound the user.



Here is the full display of the Royal Guard skill tree consisting of all skills from swordsman up to all royal guard skills. It applies the concept of a tree that has no circuits and that each node is connected. Except for a couple of unique skills with no prerequisites and do not act as a prerequisite.

Character skill building comes with a cost, that is limited investment. For third class, players can increase their job level up to level 60. That means, there would be 59 skill points available to invest. On the display above, the blank circle under each skill name is the available skill level for each skill. By investing one skill point, the skill level will increase by one, meaning that players need to plan before actually investing their available skill points.

IV. IMPLEMENTING TREE TO BUILD ROYAL GUARD

After years of gameplay, some Royal Guards builds have been established and now we can make designated arguments to decide which build player wants to take as a to be Royal Guards. First step is to differentiate the path between focusing on Player versus Player gameplay or Player versus Environment gameplay (fighting AIs or monsters endgame wise). Both gameplay will have two general paths, to be the tanker (keeping allies alive) or to be a damage dealer. Overall there would be 4 different paths for players to take skillswise. That seems like a big number. However, considering that the total skills Royal Guard itself has is only 21 skills. There would be many intersections made between each build or path.

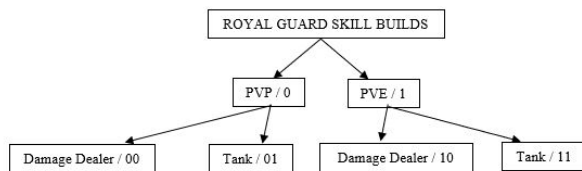
Because each argument above will result in 2 different approaches, decision tree can be used. To simplify the tree

itself, here is the list of 4 different builds available represented by binary numbers.

1. 00 - PvP Damage Dealer
This build will focus on maximizing pinpoint attack to break other player's equipment. By spending just enough points on vanishing point, players can unlock pinpoint attack and thus spending more points on pinpoint attack on skill level. Overbrand is also a solid pick to knock enemies. Invest just enough on banding if a player wants to synergies with some friends. Other than that, just focus on genesis ray, hesperus lit, and inspiration for solo playing.
2. 01 - PvP Tank
This build will focus on maximizing self buffs and abusing banding usage with other players. Royal Guard is very strong at being alive especially together with others with banding active. Few remaining skill points left after upgrading every essential defensive skill can be invested in upgrading pinpoint attack and overbrand or upgrading paladin's skills as paladin have numerous defensive buffs available.
3. 10 - PvE Damage Dealer
This build will focus on maximizing Overbrand because of its amazing damage. Other than that, just maximize every direct offensive skill available such as vanishing point, pinpoint attack, exceeding break, and moon slasher. Few remaining skill points left after being satisfied with offensive capabilities can be spent on essential self buff skill and a few numbers of PvP usage skills such as Banding.

4. 11 - PvE Tank

This build will focus on maximizing Inspiration usage, all while using reflect damage and utilizing overbrand to lessen the burden of tanking. Although royal guard is an excellent tanking class, for some very powerful enemies it will not survive because royal guard only relies on its high HP and its high defense. Royal guard does not have any damage mitigation skills. Therefore, if a boss hits hard enough, tanking with royal guard will not be viable at all. However, generally this build is a solid pick if a royal guard player has a friend to play with. Other than that, just do a damage dealer build or PvP centered build.



Here is the display of the simplified decision tree. For royal guard build, there would be 4 viable builds overall skillwise. For decision based on PvP, there would be 2 different builds based on roles. Same with choosing PvE. All the difference lies within skill point investments as explained above.

V. CONCLUSION

Tree theory has many applications in real life. In Ragnarok Online, it helps people to depict skill investment paths as simply as possible. That is because the in-game user interface of Ragnarok Online does not consist of the skill tree. Other than being incredibly useful to depict classes skills investment paths, tree theory can also be implemented for people to decide which skill to invest in for a particular gameplay style.

VI. APPENDIX

All in-game skill descriptions can be accessed freely on the internet especially on irowiki.org or ratemyserver.net

VII. ACKNOWLEDGMENT

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PERNYATAAN

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