## Fights analysis

### Premises

Here follows the numerical analysis of the fights in the level. The analysis is conducted with the following premises:

1. The analysis is conducted under the assumption that Health points will be completely restored after each fight.
2. The analysis is conducted under the assumption that Mana points will be completely restored after each fight.
3. The analysis is conducted under the assumption that the player uses Minerva’s most powerful attack spell, Incendio, in every round of every combat. At this point in the game, Minerva has access to two attacking spells: Stupefy and Incendio. Incendio is more powerful, but mana cost should be taken into account. At this point in the game, Minerva has 1500 points of mana available. Incendio costs 200 points of mana. The player should be able to cast Incendio 7.5 times for each combat. Assuming the player will use Incendio in every round of every combat in the level, there is only one combat that lasts more than 7.5 rounds. This combat is located towards the end of the level. At that point the player will most likely have access to at least one Mana potion (which restores one third of Minerva’s Mana points).
4. The analysis is conducted under the assumption that Incendio will hit only one enemy every time it is casted. Incendio has a 3m diameter circle range. Despite the presence of multiple enemies fights, the case in which two enemies will find each other in the same 3m range is not very likely. This is supported by the fact that every enemy in the level uses a long distance approach when attacking Minerva.

### Objectives

The goal is to ensure that the player is, on average, slightly favored on his enemies in every fight. The information the analysis is focused on is the number of turns it takes for a character to defeat another character. Therefore, the number of turns it takes to Minerva to defeat all the enemies in a fight should always be slightly less than the number of turn it takes to the enemies in order to defeat Minerva.

### Parameters and formulas

In the following formulas, in case of ambiguous notation, a subscript “d” denotes a parameter relating to the defender and a subscript “o” denotes a parameter relating to the offender.

Some of the characters’ parameters are noted as follows:

|  |  |
| --- | --- |
| HP | Total Health points of the character |
| AC | Armor class of the character |
| DC | Difficulty class of the character |

Some of the character’s attacks parameters are noted as follows:

|  |  |
| --- | --- |
| #dice | Number of dice to roll for the attack |
| #faces | Number of faces the dice has |
| dmg\_mod | Modifier to the damage roll for this attack |

A single parameter depends on both the attack and the offending character and is noted as follows:

|  |  |
| --- | --- |
| hit\_mod | Modifier to the attack roll for this attack |

A single parameter depends on both the attack and the defending character and is noted as follows:

|  |  |
| --- | --- |
| save\_mod | Modifier to the saving throw for this attack |

Some other parameters used for the analysis are computed from the ones above and they are noted as follows:

|  |  |
| --- | --- |
| #rounds | Number of rounds needed for the offender to defeat the defender |
| true\_avg\_dmg | Average damage dealt by the character per round |
| avg\_dmg | Average damage dealt by the the character per round, assuming the attack hits and the defender fails the saving throw |
| hit% | Chance for the offending character to hit with its attack |
| save% | Chance for the defending character to save itself from the attack |

These parameters are computed as follows:

|  |  |
| --- | --- |
| #rounds | HPd / true\_avg\_dmgo |
| true\_avg\_dmg | hit% \* (avg\_dmg \* (1 – save%) + (avg\_dmg / 2) \* save%) |
| avg\_dmg | (#dice \* (#faces + 1) / 2) + dmg\_mod |
| hit% | (20 + hit\_mod – ACd) / 20 |
| save% | (20 + save\_mod – DCo) / 20 |

Some notes on the presented formulas:

* when a fight includes more than one enemy, their Health points are summed up, thus clearly approximating the problem.
* hit% and save% are probabilities, therefore their value should be rounded up to 0, if less than 0, and rounded down to 1, if greater than 1.

### Minerva

Minerva’s relevant statistics for the analysis are the following:

|  |  |
| --- | --- |
| HP | 21 |
| AC | 10 |
| DC | 13 |

Incendio, Minerva’s most powerful attacking spell at this point in the game, has the following parameters:

|  |  |
| --- | --- |
| #dice | 2 |
| #faces | 8 |
| dmg\_mod | +0 |

When Minerva attacks using Incendio, the following parameter is considered:

|  |  |
| --- | --- |
| hit\_mod | +5 |
| avg\_dmg | 9 |

Incendio true\_avg\_dmg is of course depending on the enemy Minerva is facing. The parameters that come into account are the enemy AC, that effects the attack hit%, and the enemy dexterity modifier, that acts as save\_mod and effects the attack save%.

### Enemies

Every enemy in the level is detailed in its respective section’s chapter. Here follows a summary of their relevant statistics:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | HP | AC | save\_mod | #dice | #faces | dmg\_mod | hit\_mod |
| Enchanted book | 5 | 10 | 0 | 1 | 4 | +1 | +2 |
| Somnium | 12 | 13 | 0 | 1 | 4 | +0 | +2 |
| Pallium Umbra | 25 | 12 | 2 | 1 | 6 | +2 | +2 |
| Onorius Durandall | 50 | 10 | 0 | 1 | 6 | +0 | +3 |

Given that their unique enemy is Minerva, some parameters can be computed in advance:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | avg\_dmg | hit% | save% | true\_avg\_dmg | #rounds |
| Enchanted book | 3.50 | 0.60 | 0.35 | 2.1 | 10 |
| Somnium | 2.50 | 0.60 | 0.35 | 1.5 | 14 |
| Pallium Umbra | 5.50 | 0.60 | 0.45 | 3.3 | 6.37 |
| Onorius Durandall | 3.50 | 0.65 | 0.35 | 2.28 | 9.23 |

### Fights

# Main section

In the Main section Minerva faces one fight. The fight is against three enchanted books. As anticipated in the premises, the total health points of the three enemies will be used for the formulas. Considering that the enemies are enchanted books and the total HP for three of them is 15, Minerva’s parameters in this fight are as follows:

|  |  |
| --- | --- |
| Save% | 0 |
| hit% | 0.75 |
| true\_avg\_dmg | 5.57 |
| #rounds | 2.69 |

It takes 10 rounds for one enchanted book to defeat Minerva and it takes 3.33 rounds for three enchanted books to defeat her. Therefore, on average, Minerva is 0.64 rounds advantaged in these three fights.

# Botany section

In the Botany section Minerva faces two fights. The two fights are the same and only one of them will be analyzed. The fight is against two Somniums. As anticipated in the premises, the total health points of the two enemies will be used for the formulas. Considering that the enemies are Somniums and the total HP for two of them is 24, Minerva’s parameters in this fight are as follows:

|  |  |
| --- | --- |
| Save% | 0 |
| hit% | 0.6 |
| true\_avg\_dmg | 4.46 |
| #rounds | 5.39 |

It takes 14 rounds for a Somnium to defeat Minerva and it takes 7 rounds for two Somniums to defeat her. Therefore, on average, Minerva is 1.61 rounds advantaged in these two fights.

# Spellbook section

In the Spellbook section Minerva faces three fights. The three fights are the same and only one of them will be analyzed. The fight is against one Pallium Umbra. Minerva’s parameters in this fight are as follows:

|  |  |
| --- | --- |
| Save% | 0 |
| hit% | 0.65 |
| true\_avg\_dmg | 4.53 |
| #rounds | 5.51 |

It takes 6.37 rounds for a Pallium Umbra to defeat Minerva. Therefore, on average, Minerva is 0.86 rounds advantaged in these three fights.

# Restricted section

In the Restricted section Minerva faces one fight. The fight is against Onorius Durandall. Minerva’s parameters in this fight are as follows:

|  |  |
| --- | --- |
| Save% | 0 |
| hit% | 0.75 |
| true\_avg\_dmg | 5.57 |
| #rounds | 8.98 |

It takes 9.23 rounds for a Onorius to defeat Minerva. Therefore, on average, Minerva is 0.25 rounds advantaged in this fight.