Game Balancing Logs

Tutorial level:

Goal: Win in 1 turn

Player group: Archer

Enemy group: Enemy_mage

X = Average Player group dmg /turn = 10 (Arrow) / 1 ability

Y = Average Enemy group dmg /turn = 20 (Ice Shard) / 1 ability

Player group health >= 5Y

Enemy group health <= 1X

Player group health >= 5 * 20, use 175 for leniency

Enemy group health <= 1* 10 = 10

Reasoning: We want player to be able to kill enemy in 1 turn, because we want the player to get through the tutorial quickly after they have learned the basic mechanics. And we want the player to be able to survive at least 5 turns, therefore we need to set player health = 5Y, where Y = enemy damage / turn, and enemy health = 1X, where X = player damage / turn.

Hypothesis: Set archer health to 175 and enemy_mage health to 10, so that we can win in 1 turn for the tutorial level.

Result: The calculated damage numbers were correct and we defeated the enemy group after the first turn.

Level 1:

Goal: Win in 4 turns

Player group: Archer

Enemy group: Enemy_mage

X = Average Player group dmg /turn = 10 (Arrow) / 1 ability

Y = Average Enemy group dmg /turn = 20 (Ice Shard) / 1 ability

Player group health >= (4 - 1)Y >= 5Y

Enemy group health <= 3X

Player group health >= 5 * 20, use 175 for leniency

Enemy group health <= 3* 10 = 30

Reasoning: We want player to be able to kill enemy in 4 turns, because we want the player to try a bit harder than the tutorial to kill the enemy. We expect the enemy_mage to heal during turn 3, so it takes 4 turns in total to win. And we want to let the player survive at least 3 turns, because they need 4 turns to kill the enemy, but the player goes first so they can kill the enemy before the enemy can attack during the fourth turn, therefore we need (4 - 1)Y for the player group health. But we want to give the player some room for inaccuracy, so we will instead let them survive for at max 5 turns.

Hypothesis: Archer health remains as 175 and set enemy_mage health to 30, so that we can win in 4 turns for the level 1.

Result: The calculated damage numbers were correct and we defeated the enemy group after the fourth turn.

Level 2:

Goal: Win around 6 turns

Player group: Archer, Player_mage

Enemy group: Enemy_swordsman, Enemy_mage

X = Average Player group dmg /turn =

10 (Arrow) / 1 damaging ability +

(20 (Ice Shard) + 30 (Fireball) + 10 (Rock) / 3 damaging abilities

= 10 (Archer) + 20 (Player_mage) = 30

Y = Average Enemy group dmg /turn = 20 (Ice Shard) + 15 (melee) = 35

Player group health >= (6 - 1)Y >= 7Y

Enemy group health <= 6X

Player group health >= (175+Z) = 7*35 = 245 ; Z = 70 = player_mage hp

Enemy group health <= (30+A) = 6*30 = 180; A = 150 = enemy_swordsman hp

Reasoning: Starting from level 2, player has multiple abilities, so we need to estimate the number of turns required to win rather than an exact number, as there can be many different sequences for the player's ability usage. Then, we want player to be able to kill enemy in around 6 turns, because we want them to have enough turns to try out all the different abilities and experience the enemy AI. We expect the enemy_mage to heal the enemy_swordsman most of the time. And we want to let the player survive at least 6 turns, and for first time players it may require around 8 turns, so we want to allow the player to survive for max 8 turns.

Hypothesis: Archer health remains as 175, enemy_mage health remains as 30, set player_mage health to 70, set enemy_swordsman health to 150, and can win around 6 turns.

Result: The calculated damage numbers were correct and we defeated the enemy group after the sixth turn on average with a few trials, which means the player can win around 6 turns.

Level 3 (Phase 1 & Phase 2):

Goal: Win around 10 turns

Player group: Archer, Player_mage, Player_swordsman

Enemy group: Necromancer_phase_one, Necromancer_minion, Necromancer_phase_two

X = Average Player group dmg /turn =

10 (Arrow) / 1 damaging ability +

(20 (Ice Shard) + 30 (Fireball) + 10 (Rock) / 3 damaging abilities +

15 (Melee) / 1 damaging ability

= 10 (Archer) + 20 (Player_mage) + 15 (Player_swordsman) = 45

Y = Average Enemy group dmg /turn =

25 (Necromancer_phase_one Lightning) + 15 (Necromancer_minion melee) + 15 * 3 (Necromancer_phase_two AOE) + 15 (Necromancer_phase_two melee) + 5 (Necromancer_phase_two bleed) = 105

Player group health >= **(4 - 1)Y >=** 6Y

Enemy group health <= 10X

Player group health >= (175+70+Z) = 6*105 = 630 ; Z = 385 = player_swordsman hp

Enemy group health <= (30+10+A+B) = 40*10 = 400; 360 = A + B, Pick A = 160, Pick B = 200

Reasoning: We want the player to win the last level around 10 turns, since it is the boss battle and we want the player to experience all of the necromancer boss's abilities, we plan to have 5 turns for the first necromancer phase and 5 turns for the second necromancer phase. We want to let the player survive at least 4 turns, and for first time players it may require around 6 turns, so we want to allow the player to survive for around 6 turns without healing. We pick the necromancer_minion health to be 10, since we want the player to be able to kill it in one ability. The necromancer_phase_one will keep summoning the necromancer_minion once it is dead, so the player can force the necromancer_phase_one to keep summoning the minion and not lose hp on the player_swordsman, or the player can ignore the minion and attack the necromancer, which will result in less time taken but more damage taken for the player_swordsman. For necromancer_phase_two, we pick its health to be higher than the phase one, since phase two should be considered more powerful and has more abilities.

Hypothesis: Archer health remains as 175, player_mage remains as 70, set player_swordsman health to 385. Set necromancer_minion health to 10, set necromancer_phase_one health to 160, set necromancer_phase_two health to 200.

Result: We tested and realized that the player_swordsman health is too high, if the player chooses to play smart, then they will end up winning with a lot of health remaining on the player_swordsman. Therefore, we adjusted the health to 250 in order to make it less likely to always win. Otherwise, the calculated damage numbers were correct and we defeated the enemy group after the tenth turn on average with a few trials, which means the player can win around 10 turns.