

# A5 - Optimization

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## PART I - Optimization of Pillars

### Objective Function

Assuming that the simulation has no crashes, the objective function can be written as

$$J(\theta) = - \left( \sum_{r \in R} \frac{\theta}{t_{AVG}(r)} \right) / |R| ,$$

where  $\theta$  is the number of agents who completed their task,  $R$  is the set of results, and  $t_{AVG}(r)$  is the average time of the agents in result  $r$ , as defined by:

$$t_{AVG}(r) = \frac{\sum_{(x,y) \in r} t(x,y)}{|r|}$$

Each result  $r$  is represented as a set of pairs  $(x, y)$  for each agent, where  $x$  is the time elapsed (if available) of the agent, and  $y$  is a binary integer indicating if the agent completed. If the agent did not complete, then the time elapsed is taken from the simulation settings. This distinction is made with the function:

$$t(x, y) = \begin{cases} x, & y = 1 \\ (\text{NUMFRAMES} / \text{FPS}) \cdot U, & y = 0 \end{cases} ,$$

where  $\text{NUMFRAMES}$ ,  $\text{FPS}$ , and  $U$  are constants provided in the simulation settings.