

# Scheduling Optimization for Santa's Workshop Tour using Artificial Immune System

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## Project Idea:

We will consider the problem of scheduling optimization on an example of Santa's Workshop Tour, link of the example task: <https://www.kaggle.com/competitions/santa-workshop-tour-2019/overview>.

To solve the scheduling optimization problem for Santa's Workshop tours, we will apply a natural-inspired method known as the Artificial Immune System (AIS) algorithm. The project's aim is to minimize Santa's additional costs by assigning each of the 5,000 families a specific day for their visit, adhering to capacity constraints and their date preferences.

## Method/Technique:

The Artificial Immune System (AIS) is an optimization algorithm that mimics the adaptive immune response in biological systems. AIS efficiently handles complex tasks like scheduling due to its learning and adaptive capabilities. In this project, AIS will be responsible for distributing families across available days, maintaining the daily visitor limit (between 125 and 300), while minimizing penalty costs.

## Dataset Explanation and Accessible Link

The dataset includes information on 5,000 families, their sizes, and their top 10 preferred days for visiting Santa's workshop. The days are represented as integers counting down to Christmas. Access to the dataset can be found via the link: <https://www.kaggle.com/competitions/santa-workshop-tour-2019/data>.

## Timeline (approximate):

- **Week 6-7:** Understanding the problem and hypothesis formulation.

- **All the members:** Review the scheduling problem and explore related literature on AIS. Develop the project hypothesis and set up the Python development environment.
- **Week 8-9:** Model development using AIS.
  - **All the members:** Design and implement the AIS model focusing on core algorithm components. Conduct iterative testing to refine the model using sample data.
- **Week 10:** Model optimization and final testing.
  - **All the members:** Optimize the AIS algorithm and finalize testing with complete data. Ensure the model meets performance and accuracy goals.
- **Week 11-12:** Preparing the final report and presentation.
  - **All the members:** Document the project process and results. Develop and rehearse the presentation for clear communication of findings.

## References

1. De Castro, L. N., & Timmis, J. (2002). Artificial immune systems: A new computational intelligence approach. Springer.
2. Kaggle, Santa's Workshop Tour 2019 Competition: <https://www.kaggle.com/competitions/santa-workshop-tour-2019>.
3. Python libraries for optimization: NumPy, SciPy.