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MSCB 02-601 Placement Project Proposal

**Overview**:

As the growth of the coronavirus pandemic slows, mass entertainment events such as sports and concerts will resume and begin to admit live spectators. However, in order to optimize for social distancing requirements, we will need methods of generating seating arrangements that maximize the distance between attendees.

While this is simple for a single rectangular block of seats and single-persons, the task becomes more difficult (and interesting) when taking into account groups of attendees in the same household who could be seated together without violating social distancing guidelines, and also when considering possible spaces/gaps due to aisles and walkways.

From a computational perspective, various algorithmic approaches could be used to tackle this problem, including greedy, divide-and-conquer, heuristics and tree search. It is non-obvious how such approaches would compare in terms of both speed and quality – this would be an interesting point of analysis.

This project would not require external data, but will probably make use of NumPy and SciPy for representing seats, calculating distances and finding nearest neighbors.

**Details, Scope and Feasibility:**

I will need to define a metric to measure the quality of a seating arrangement. I am considering something like “average distance to nearest non-group-member neighbor”.

In order to ensure that the project is feasible, I plan to add the following constraints:

* The number of attendees and their groupings will be preset and treated as fixed for each run of the algorithm
* The seats will be treated as having width and length of 1
* Aisles and walkways will have whole-number-dimensions
* Seat grids will be aligned in perfect rows and columns

I believe the project can be broken up into 4 parts

1. A generator that produces seating arrangements and attendees in groups
2. An object that stores the state of the arrangement and abstracts the placement of people, and can be used to visualize the placement and the final results
3. Various algorithms that create the seating arrangements, with saved runtimes
4. Method to evaluate the arrangement’s quality