1. Here we’d like to put emphasis on the novel structure of the model that we proposed in our essay. Unlike conventional models, in our essay, we added a *mathematical analysis* part, mostly theoretical and led by two seemingly unrelated claims which we’ll explain later. This added part provides adequate justifications for not only the concepts, such as parallelity, in our model, but the result as well. On the other hand, the proposal of this section significantly simplifies the optimization process. Instead of letting computers run time-consuming algorithms, we use pure math to search for the optimum and verifies only the possible verges. The graph you’d see here elaborates on our modelling work, with multiple verifications ensuring authenticity and accuracy.
2. The main work in our first model is mathematical deduction. Indeed, there are multiple purposes for putting emphasis on this part. First, by describing the different situations using formulas, we can make our model accurate and variable-based, which is very important in the modelling process. Also, optimization will also be aided with simple formulas rather than complex computer-based processes. Therefore, we are convinced to say that this deduction process plays a vital role in our model.
3. In addition, we conducted some improvements on our model to make it direct and clear. First, we used multiple variables to describe our model, which prevented interference of irrelevant numeric coefficients. We also avoided excessive intermediate variables with algebraic simplifications in our model. For example, in the final conclusive equation, constants are adopted to replace those invariant values with respect to a specific type of aircraft. Finally, this part lays the foundation for the linear properties that will be extensively utilized in the future.
4. We use matrixes to describe the states of passengers. This is because it can mathematically describe the originally abstract states into the simple three matrixes, making the model easier to understand and the calculation simpler. Besides this, we used a constant transforming matrix to calculate the state matrixes according to the pre-existing ones, ensuring the linearity.
5. Instead of being a concept that just appeared out of nowhere, parallelity has sound foundations which are mainly aided by the linearity of the previous calculations after algebraic simplifications. It also ensures its equivalence with the original time-minimizing task. We know that equivalent conversions are usually made to alter the problem’s external modality but maintain its inherent structure with equivalence, and that’s exactly what parallelity does. It converts the complex multi-variable formula of total time into a simple univariate optimization of parallelity, which significantly eases the burden of exhaustively searching all the cases.
6. In our presentations, we’ve already introduced two aspects of *optimal* – the dissatisfaction index and parallelity. Coincidentally, disembarking can meet both requirements at the same time. We used the adjustment method to achieve this, keeping parallelity at the optimum. Since the first two factors of dissatisfaction remain constant for any optimal scheme for time, we only need to minimize the standard variance of the boarding time of same-row passengers. In the end, we got the optimal disembarking scheme as shown before.
7. When defining the total dissatisfaction index, we consider three factors: queueing, offering seats and same-row passengers separation. The third factor is because some family or fellow passengers may be split, causing dissatisfaction.
8. The weights of the three factors are respectively 1, 250 and 10. 1 is for standardization and the other two are to unite the magnitudes and importance, preventing the total index from tending to one of them, thus making the ultimate dissatisfaction index of all passengers linear and plausible.
9. When generating the data of discompliance index, we used the Sigmoid Model. When analyzing the sensitivity of each plan, we innovatively used goodness of fit as an index, as it can reflect the regularity of the data and thus show the sensitivity. The result is that Random is far more sensitive than the other two strategies when measuring standard variance and timestep. When considering the overall time and timestep, the result is similar. We found that both Methods are **Sensitive** which makes a **Big Impact** on **Total Results**, as shown on the graph, the points are irregularly distributed. We use the sigmoid model because it’s commonly used in statistics and its usage can be determined by nature of function.
10. For multi-aisle aircrafts as TETA and Flying Wing, we decide to divide them into smaller parts similar to the ordinary one-aisle aircraft because we want to unify our models. To be specific, we divide these aircrafts into smaller blocks according to aisles the seats are near. This is plausible because these aisles don’t intersect with each other, thus passengers in different blocks wouldn’t disturb each other.
11. And for the optimal strategy, it’s obvious that we need to ensure both the efficiency of in-group boarding and between-group sequences. As a result, our work can be reduced to finding a best between-group sequence, as we can use the strategy shown before when deciding in-group sequences.