Plane boarding and disembarking

- Essay
  - Section 1 Introduction
    - Explaining the way each passenger follows when boarding and disembarking
      - queueing?
        - go straight towards the specific seat (causing a queue when storing luggage)
        - wait
          - move forward
      - enter the aircraft
    - Restating the problem
      - Develop a model to calculate the total time of a specific strategy
      - Consider different situations
      - Apply the model to real-life planes
    - Assumptions
      - Putting luggage just above their seat
      - Storing and removing luggage are reversible
      - Aisle can contain just one passenger in width
      - The speed of passengers is the same
      - Passengers don't go backward
      - First and business class are prioritized to board first to make the model more realistic
  - Sections 2-5 Models & SA
  - Section 6 S & W
    - S
      - Accuracy
        - Taking several situations into consideration
      - Universality
        - Can simulate the process of different strategies
      - Efficiency
        - Using computer programs to facilitate the calculations
    - W
      - Complexity
        - Too many variables
      - Difficult to operate
        - Strict rules
  - Section 7 Letter
  - Section 8 References
- Optimization
  - Complexity
    - Rename the variable v(A) as it could cause misunderstanding or additional complexity
  - Operation difficulty
    - More flexible boarding system (e.g.: we can board passengers in advance of the sequence if this wouldn't cause a significant decrease in efficiency)
- Models
  - Model A
    - Define the variables such as time and speed and their relations
    - Calculate the total boarding time
      - Getting to the seat
        - Moving in cells
          - Calculate the speed in each cell according to the variable D (Density)
            - The distribution of passengers
              - Get the speed of each passenger
          - The speed of passengers is no larger than that of the passenger ahead of him
        - Someone ahead is taking seat
          - The time taken stowing luggage varies
            - variable λ
          - Getting seated
            - Someone in the outed seat has already been seated
              - Offering seats (taking some time and causing some dissatisfaction)
      - Calculating the total time
        - The total time a passenger spends is the sum of the time he/she spends in each cell (before he/she gets to the seat) and the time to get seated
        - Final time is the maximum of the total times of all the passengers
    - Strategy optimization
      - Parallel boarding
        - Parallelity is the number of aisle cells occupied by passengers (deciding the used efficiency of the cells)
          - The higher the parallelity, the more passengers can be in the process of boarding, and the more efficient the boarding strategy is
        - The best strategy is to keep the cells as occupied as possible
      - Strategies
        - (Fig. 6)
    - Disembarking
      - Let all cells be occupied
        - All the passengers become a row
          - Aisle-Middle-Window disembarking
            - 12min 18sec
  - Model B
    - Reoptimizing
      - Passengers' satisfaction
        - Factors
          - Queueing
          - Offering seats
          - Walking (?)
            - Should be split families?
      - Different strategies
        - Common
          - Row number
            - ftb
            - btf
          - Seat position
            - Random wma
            - ftb-wma
            - btf-wma
          - Random
            - Absolutely random
        - Introduced
          - Steffen perfect
          - Five sections
          - Steffen subperfect
      - Computer simulation to find the best strategy
  - SA
    - Discompliance
      - Longer stowing time
        - Sigmoid function to generate data
          - The function of total timesteps to average discompliance index and the variance of discompliance index
            - Random is the most sensitive
      - Queue jumping
        - Random: not a large impact since it's already randomized
        - btf/ftb: no clear pattern
        - A great impact
    - Less passengers
      - Optimal strategy wouldn't change
    - Conclusions
      - Random is the most sensitive
      - btf performs best
  - Model C
    - Flying Wing
      - Four blocks
        - Optimal strategy inside each block
        - Ensuring the aisles are full
        - Boarding: 26min 49sec; disembarking: 20min 54sec
    - TETA aircraft
      - Reorganize blocks
      - Approximately neglect the impact of Business class
      - Divide into two parts (left and right)
        - Halve each part, using the similar strategy as Flying Wing