Criteria A

Description of Problem:

With the struck of Covid-19 in 2020, the flight service market was struck hardly, leaving many companies lacking consumers off the service, even now, as the situation improves, people concerned for covid continues. This results in inconvenience for both the business owners and the passengers of the plane, and demands urgent address. Wei Chang, a frequent China Eastern passenger and architectural designer and internal designer of airports and planes, describes the current situation like this: “with the spread of covid, going on the airplane or not is a decision of life or death.” In the isolated system of the airplane insides, the chances for covid infection have risen with the exceedingly contagious Omicron variation of the virus. Thus, in front of the flight service market in the verge of collapse, and the inconvenience covid caused, it is higher demanded for optimization of boarding and seating methods.

Proposal of Method and Rationale:

The Client, in the email from our first interactions (appendix 1.3), highlighted two particular demands from the product: seating distribution, and boarding order. He explained that the boarding order affects the efficiency of boarding, which directly relates to the time of close body contact of passengers, and that the boarding distribution affects the probability of COVID spreading in flight.

Based on these two requests, I proposed two core components to the product:

Request:	Component	Why?	Alternatives
The program needs to output the most efficient boarding order	Cellular Automata Simulation	**It provides a realistic and random simulation for the comparison of boarding methods. Different boarding methods can be implemented iteratively in the simulation. Can account for different parameters for passengers like disabilities and luggage**.	Mathematical Model - reject, because not enough chance is involved. Hard to visualize.
			Other types of simulation- Reject, because too heavy weight.
The program needs to output the most optimal seating	Genetic Algorithm Optimization based on Fluid dynamics mathematical model.	**It provides a probability based self-regulated optimization process based on a mathematical to find the absolute best distribution. Since all passengers are equal when seated, a mathematical model is**	Euclidean distance optimization- reject, because virus transmission does not have a linear correlation with distance between passengers.

		the best for the process.	

The final product will look like an app that has windows to address the functions demanded with the following components:

Python will be used for the GUI windows interface of the product:

- There are lightweight GUI libraries that will both look nice and function with minimal memory usage, reserving memory for the memory heavy algorithms.
- **A GUI is required for abstraction of the input and output of algorithm for user experience**

Java will be used for the Genetic algorithm.

- Genetic algorithm takes up heavy memory for its continuous calculations and scoring based on the fluid dynamic model.
- Java, being a compiled language, is at advantage in terms of efficiency when treating these tasks compared to Python.

Python will be used for the Cellular Automata Simulation

- The simulation is highly based upon probability, which will benefit from python libraries like PyProbs that deals with probability.

Both the Simulation and the optimization algorithms will need to take in parameters to account for unique, independent samples.

- The number of passengers is needed for the generation of the seating distribution because each flight is different in terms of passenger counts from random chance.
- Number of passengers with luggage/ disabilities is needed for accurate simulation of the boarding methods, because they are all factors in real-life that affects boarding speed.

A chatting function was initially proposed for the product, but it was rejected by conversation with client (appendix 1.4 [2]).

The final program will, through the optimization of seating plan and boarding method, minimize the risk of COVID transmission before and on flight. Thus, people will be more willing to attend flights, benefiting both the consumers of airlines, like Wei Chang, and airlines themselves.

Criterions for success:

Criterion	Description
1: Interface	The solution must provide a simple interface, along with simple actions to interact with it for users to use.

Criterions for success:

Criterion	Description
2. Seating Optimization	There must exist a process for seating plan optimization to provide passengers a safe flight, reducing the risk of covid transmittance during the flight.
3: Boarding order	There must exist a process to provide the most optimal boarding order for passengers for them to board efficiently, reducing risk of covid transmission when boarding the plane.
4: Visualization	There must be visualization for the users of the program for them to understand the results of the processes above.
5. Error Handling	The program must be able to handle wrong inputs.

With consultation with the client, this was the finalized version of the criterions for success (Appendix 1.4 [2]).

Word Count: 505