

# Elevators - Etude05 Report

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## 1 Introduction

To assure we could provide an efficiently operated elevator system, we devised strategies which would help benefit your building. To ensure fair testing between the different approaches we will be talking about, we made it so; each situation the elevator starts on the first floor, for each strategy we simulated tests with a different amount of customers being 5,15,30 respectively, and for each amount of customers tested three times. Attached in the appendix are some of the results from our simulations in case you were interested in the specific numbers.

## 2 Strategy 1 - Collective Control

This strategy comprises of the idea that the elevator will start at the ground floor and when buttons are pushed will go up to the top level and back down repeatedly picking up and dropping off passengers along the way. This process means it will be going in the same direction until it reaches the top or bottom floor where it will then reverse the current direction. The benefits of this strategy is that the travel time remains consistent at around 70-80 seconds regardless of the amount of customers, when running our simulations the average was 80 seconds across all tests and amounts of customers. However, the downside is that travel time can at times be quite long for a small amount of customers; even if it is the same for a large amount. The average waiting time across all simulations was 184.5 seconds.

### 3 Strategy 2 - Longest Queue

This strategy is priority based. If the elevator is empty, it will go toward the first button pressed. If someone gets in the elevator and presses a button then it will prioritise passengers in the elevator over passengers that are waiting. The elevator will then continuously move toward the direction of the first button that was pressed, picking up and dropping off people on the way as it is able to. The upside of this is that travel times can at times be extremely fast, even if the queue for the elevator is quite busy. However, wait times can sometimes be extremely long even for a small amount of people if they are many floors apart as the elevator will prioritise people that are already inside. The average travel time across all simulations for this strategy was 78.6 seconds while the average wait time was 163.8 seconds.

### 4 Conclusion

On average, the longest queue strategy would likely be the most efficient with your current situation. Across all simulations, it was overall 22.1 seconds faster than the collective control strategy. However, if the number of people using the elevators is low you may consider opting for collective control instead as longest queue can have disproportionately long wait times for a small amount of users depending on the floor that the customers are calling the elevator from. We hope that the service we provided you meets your standards and that you may consider recommending us to others you know who may have similar problems.

### 5 Appendix

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Average Elevator Travel Time for 5 Passengers: 90s  
Average Wait Time for 5 Passengers: 75s  
  
Average Elevator Travel Time for 15 Passengers: 85s  
Average Wait Time for 15 Passengers: 126s  
  
Average Elevator Travel Time for 30 Passengers: 88s  
Average Wait Time for 30 Passengers: 309s
```

Figure 1: Collective Control Results (One simulation)

```
Average Elevator Travel Time for 5 Passengers: 59s  
Average Wait Time for 5 Passengers: 51s  
  
Average Elevator Travel Time for 15 Passengers: 96s  
Average Wait Time for 15 Passengers: 183s  
  
Average Elevator Travel Time for 30 Passengers: 72s  
Average Wait Time for 30 Passengers: 229s
```

Figure 2: Longest Queue Results (One simulation)