Lifts

Peter Rowlett

Sheffield Hallam University

p.rowlett@shu.ac.uk

Lifts

▶ Today we are going to think about how lifts are programmed.
▶ They do not make decisions in the moment — they implement a pre-determined algorithm.
▶ And lifts don't all work the same.
▶ Think about some lifts you have used. How did they work?

Case 1

There is one lift serving a 10 storey building. It is currently stationary on floor 9.

Someone enters the building at the ground floor and calls the lift wanting to go up.

A fraction of a second later, someone on the 10th floor calls the lift wanting to go down.

What should the lift do?

Some approaches

- ▶ First come first served
  - ▶ what about if the first person was on the 1st floor and wanted to go down to the ground floor, and the 2nd person was on the 9th floor wanting to go up to the 10th floor, and, while the lift was dropping the 1st person off on the ground floor a third person arrived on the 1st floor also wanting to go to the ground floor...
- ▶ Prioritise the closer person
  - ▶ what about if, as lift leaves floor 9 to pick up the person on floor 10, s/o else arrives at floor 9 and calls it, and then on its way back down to 9, someone arrives at floor 10 and calls it, so it goes back up to 10 . . .
  - ▶ the person at floor 1 is still waiting.

Case 2

There are three lifts serving a 10 storey building. There are 'up' and 'down' buttons outside the lift, and inside are buttons to choose a destination floor. Suggest some sensible rules for deciding which lift should pick up which passengers in particular scenarios. (i.e. think of different scenarios, decide on the most sensible course of action for the lift in this situation, and then try to generalise into a rule that can be given to the lift as an instruction).

Case 3

There are three lifts serving a 10 storey building. There are buttons outside the lift to select your destination floor, and you are then directed to a particular lift.

Suggest some ways that this is different from the previous case (e.g. what opportunities are there to improve efficiency with this approach?)

Evaluating the model

▶ Imagine we create a simulation model to investigate how our approach to programming the lifts would operate.

▶ The number of passengers, and the types of journeys they make, can be varied but the simulation has been developed to show the typical demands on the lifts at different times during the day.

▶ Identify some of the things you will want to count / measure / keep track of.

▶ Are these things inputs to or outputs from your model?

▶ Are the things you would like to measure parameters or variables?

   ▶ Parameters: quantities that are fixed as you use a model, but might vary as you set up the model for different circumstances (different buildings, for example).

   ▶ Variables: quantities that vary as your model is being used.

Stakeholders

- ▶ Groups:
  - ▶ Passenger
  - ▶ Health and Safety rep
  - ▶ Maintenance crew
  - ▶ Company paying the bills
- ▶ In each case think about what it is that you think is going to be most important to you when evaluating the models.
- ▶ Can you frame this into a precise mathematical question that you would want to answer?
- ▶ Can you think of any reasons that your priorities might 'clash' with those of the other interest groups?