Modelling Project

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The report on the wheelchair problem of airline companies

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Chapter 1

Definition phase

1.1 Context

1.2 Problem definition and purpose

1.2.1 Model purpose

1.2.1.1 Three questions

First things first, we have to answer three questions.: Can you choose, does it output numbers and should your model produce value or knowledge. Can you choose between solutions? Yes, there are different configurations for different sets of people, area and whatsoever belongs to the problem. Does it output numbers? Yes, the model should produce a number of escort or wheelchairs to calculate the cost of the solution to the problem. Does our model produce value or knowledge? Value, because it does not bring new knowledge, but it brings a more or less optimized solution to the problem. Conclusion from this is: it is that the purpose of the model is a *optimization*. It should produce the best possible solution for the owner.

1.2.2 Model dimmensions

1.2.2.1

Now that we have figured out what our purpose, we have to figure out what the dimensions are:

1.2.2.2 Continue or discrete

First thing this is a discrete model, because all the input variables are whole numbers and the output number are also whole numbers. Most of our inbetween values are discrete numbers.

1.2.2.3 Deterministic or stochastic

We assume that this is deterministic, because the owner of the problem can decide on almost all the input. They have influence on how these values are delivered to the problem. Also we can assume that the amount of wheelchairs and disabled people follows pretty much in a deterministic pattern.

1.2.2.4 Black box or glass box

Glass box, because there is insight in what happens. It is all know by the owner. The owner knows how many disabled people travel and where and when planes arrive and leave. Also they know the price for everything.

1.2.2.5 Static or dynamic

Static, time does not matter, because the model is just about one moment or one arrival time and one leaving time. All the input values are set before the model executes and they are valid through the entire model.

1.2.2.6 Calculating or reasoning

Calculating, because we eventually want to know a number. All the input values and quantities are known to be numbers.

1.2.2.7 Geometrical or non-geometrical

Non-geometric, because we are not talking about a geometric setting, we do not define a airport as a geometrical figure. The only thing where we use distance is between gates and that is allowed to be just an abstract number.

1.2.2.8 Numerical or symbolic

It is probably a little bit of both, because we start of using only symbols for the input eventually creating formulas, but the model will be used with concrete values for the input to be used to determine the output, which is going to be numerical.

1.2.2.9 Material or immaterial

Immaterial model, because there is no real airport modelled here. It is just a concept in our mind that we project into this immaterial model. It will sort of look like a modelling from scratch, the only difference is that we have a discrete model.

1.2.3 Conceptual definition of the problem

Given a description of the airport, incoming flights and outgoing flights: how many resources do we at least need to get all flights of the ground with all immobile people on board?

1.3 Sub-questions

1. How will the number of wheelchairs influence the amount of time of a transfer between two flights?
2. How will the location of the wheelchair depot influence the time?
   (a) What will this mean for the distance between the gates?
   (b) What will this mean for the time required to travel between to gates?
   (c) What will this mean for the maintenance of the wheelchairs
      i. Who will do the maintenance of the wheelchairs?
      ii. How much service does each wheelchair require?
      iii. Where will those wheelchairs be bought?
   (d) How will this influence the amount of escorts?
      i. How many escorts do I need for one wheelchair?
   (e) Will the storing of the chairs at one location decrease the costs of guarding them?
      i. Will hiring additional security to guard the wheelchairs result in less damage/stolen chairs?
      ii. If the escorts guard the chairs, how will this influence security?
         A. Do we have to hire more escorts if they handle security?
3. What kind of wheelchairs will we take?
   (a) Will the quality of the chair influence the amount of maintenance required?

(b) Will the quality of the chair influence the amount of money we can ask for the service?

(c) How will the quality of the wheelchair influence the customer satisfaction?

i. How will this distinct us from other airliners?

ii. Will this create an increase in customers?

(d) Which wheelchair has the best price/quality rate?

i. How much is the difference in price?

A. How will the difference in price influence the total costs?

B. What is the price of each wheelchair?

4. How will the amount of escorts influence the total costs?

(a) What kind of people will escort the disabled?

i. Will the use of students influence the amount of customers that want to use the service?

ii. Will the use of athletes influence the average travel speed of an wheelchair?

iii. What kind of education/degree do they need?

(b) How much will we pay the escorts?

i. Will the salary of the escorts influence how hard they run?

ii. Will a bonus for fast deliveries increase the efficiency?

A. Will this endanger the passengers?

(c) Will the use of electric wheelchairs decrease the amount the escorts?

i. Can everyone use an electric wheelchair?

5. How does the distance between gates influence the cost of transfer flights?

6. How does the walking speed of escorts influence the cost of transfer flights?

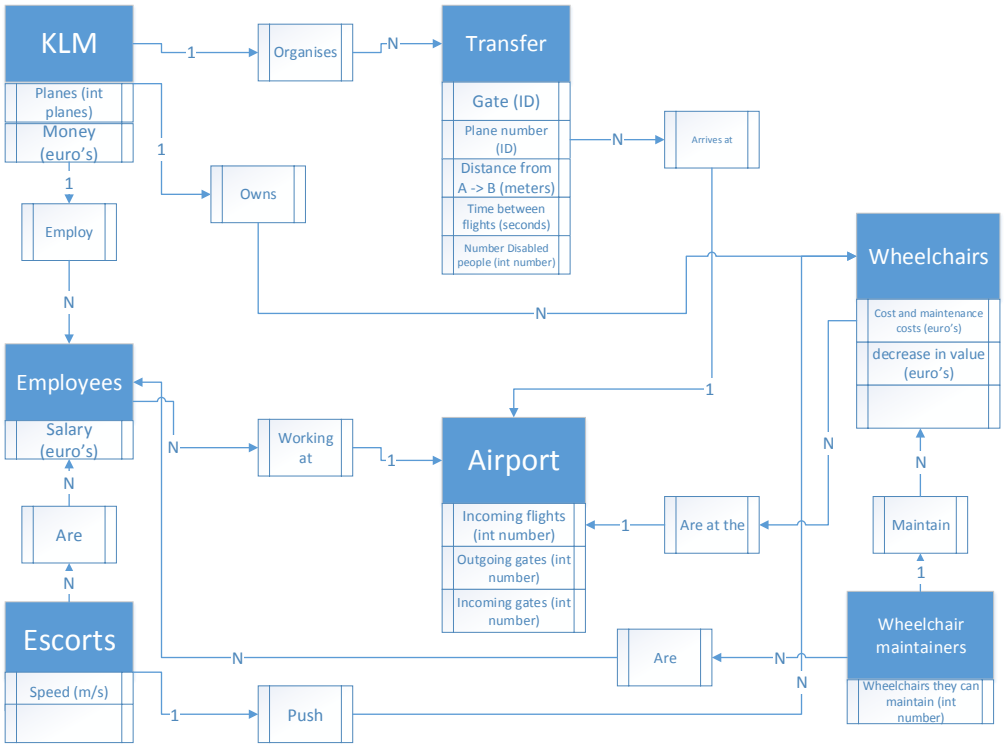
7. How does the cost depend on the time of travel between gates?

Chapter 2

Conceptualization phase

2.1 Concepts, properties,values and relations

2.1.1 The model



2.1.2 Explanation of

2.1.2.1 KLM

The "Money" property is the amount of money KLM has in this model.

2.1.2.2 N on N relations of employees, escorts and maintainers

These are very loose relations. In words this whould be: some employees are escorts and some employees are maintainers.

2.1.2.3 Time

There two values that are described in the unit "euro's/time". This time is not a predetermined value, because we do not yet know in what timeframe we whould like to pay them.

2.1.2.4 Money

As one can see, all of the quantities are eigher usable to determine the eventual amount of money or are already quantified in money.

Chapter 3

Formalization phase

3.1 Quantities and their relationships

3.1.1 KLM

Property: Money

Unit: Euro's

Role:

3.1.2 Employees

Property: Salary

Unit: Euro's / hour

Role:

3.1.3 Transfer

Property: Distance from gate A to B

Unit: Meters

Role:

Property: Time between flights

Unit: Seconds

Role: To be chosen

Property: Disabled people

Unit: An integer number

Role: To be chosen

3.1.4 Escorts

Property Speed

Unit m/s

Role Constant

3.1.5 Wheelchairs

Property Cost and maintenance cost

Unit Euros

Role Constant

Property Decrease in value

Unit Euros/time

Role Constant

3.1.6 Wheelchair maintainers

Property Wheelchairs they can maintain

Unit Integer

Role Constant

3.2 Approximations and assumptions

3.3 Derivations

3.4 Special cases

3.5 Estimates

Chapter 4

Execution phase

4.1 Rephrased problem in formal terms