# Management Science

# BM04BAM

# Group Assignment

# Group 20

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### Question 1.

* 1. Below is the mathematical notation for the integer program used to express the problem of maximizing profit for GWA.

, , , , 0

= Large size plane (200 people)

The objective is to maximize the profit. The revenue is expressed 0.1 multiplied by the distance (*r*) multiplied by the number of passengers (*x*) for each flight (*ij*). The costs depend on which type of aeroplanes (small; *sij*, medium; *mij*, large; *lij*) is used. Each mile flown costs $4.5, $8 and $20 relative to the small, medium and large aeroplanes.

To maximize this profit, some constraint are given. The first constraint is that the number of passengers can not exceed the demand in the given CSV file. In the description is given that not all the demand has to be satisfied. For that reason, the most profitable amount of passengers has to be calculated.   
The second constraint is set to ensure that the number of passengers in each plane for a specific flight may not exceed the total calculated number of passengers. The most profitable amount of passengers should fit in the different types of aeroplanes. Also with this constraint is the underlying constraint given for the maximum capacity for the different types of aeroplanes.

#### 1.2. Data preparation in GUROBI (Figure 1):

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Figure 1

#### Implementing the proposed model in GUROBI (Figure 2 & 3):

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Figure 2

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Figure 3

#### 1.4 Analysing the solution by using GUROBI:

1. *Figure 4* provides information on the daily profits of GWA (optimal value) which is at **$3,459325.6.**
2. Additionally, *figure 4* indicates the number of types of planes that are used. The optimal number of planes to use would thus be **614 small planes**, **833 medium sized planes**, and **313 large planes**.

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Figure 4

1. The daily revenue as well as daily cost can be seen below in *figure 5,* which indicates that the daily revenues of GWA stand at **$15,737833.1,** whereas the daily costs stand at **$12278507.5**
2. Calculating the profit margin of GWE (daily revenues–daily costs/daily revenues), further indicates that the profit margin of GWA stands at **22% (0.219).** The value is shown in *figure 5* respectively.

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Figure 5

1. The Utilization of the allocated capacity that GWA uses is calculated and indicated in *figure 6.* According to the calculations, GWA can allocate **97,8%** (0.977) of its capacity, when considering the capacity of small, medium, as well as large planes.

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Figure 6

1. Finally, the percentage of lost demand that GWA is seeing is indicated in the calculations in *Figure 7.* According to the calculations, the percentage of lost demand stands at around **9,9%** (0.0994).

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Figure 7

### Question 2