**Background information**

This report aims at the optimization of the establishment of a high-efficient delivery system in Edinburgh for China’s famous online shopping platform JD.com. JD.com, one of China's largest self-operating e-commerce platforms, is renowned for its efficient logistics system and exceptional customer service. Characterized by a comprehensive warehouse network and advanced logistics technology, JD.com efficiently and accurately processes and delivers orders, providing customers with a fast and reliable shopping experience.

The core objective of this project is to create an e-commerce platform that competes in logistical efficiency and customer satisfaction with market leaders like Amazon. To stay competitive, we first aim to achieve a rapid ‘next-day delivery’ service as efficient as Amazon Prime, without charging users for Prime membership fees. This approach will lead to high customer satisfaction while adopting a low-cost strategy to capture the market. Simultaneously, we plan to prioritize selling product categories where Amazon has limited presence in the UK market, such as mechanical keyboards and monitors. These categories are extremely popular and offer better value for money in JD.com’s Chinese market than Amazon UK, enabling us to implement a differentiation strategy. In this endeavor, the selection of an appropriate warehouse location is crucial, as it directly impacts order processing speed and delivery efficiency.

Our goal, through scientific site selection methods, is to establish an efficient warehouse network that gains an advantage in the highly competitive e-commerce field. This involves not only assessing the location's accessibility and cost-effectiveness but also how to maximize customer service levels and market responsiveness. Our objective is to resolve the facility location problem of establishing delivery stations in Edinburgh for JD.com, as addressed in Model 1, to minimize cost. Subsequently, based on the optimized solution of Model 1, we aim to solve the fleet size problem in Model 2, determining the optimal number of vehicles for the i-th delivery station, thereby minimizing the total delivery time.

By drawing on the successful experience of JD.com and combining it with operations research analysis methods, our online shopping platform will be able to achieve efficient inventory management and rapid market response in Edinburgh's e-commerce market, laying a solid foundation for successful operation.

**Variables and symbols:**

: The flow of goods from pick-up point i to demand area j (continuous variable).

: Binary variable indicating **whether** a pick-up point is established at location i.

: monthly demand for place j

: distance from i to j

: the investment for model 1

: the cost from i to j

: the fixed cost from of setting up a warehouse in at i

: the rent of a warehouse at i

-----------------------------------------MODEL2-----------------------------------------------

: The number of **trucks** purchased at the th delivery station.

: The number of motorcycles purchased at theth delivery station.

: The number of bicycles purchased at theth delivery station.

: the investment for model 2

Vol : the volume of product need to be delivered

|  |  |
| --- | --- |
| **Product** | **Volume** |
| **Phone** | **10** |

|  |  |
| --- | --- |
| **Box size type** | **Max Volume** |
| **S** | **25** |

**S-> 2 Phone**

# Model 1 - Cost Minimization Model (MILP)

**Objective:** Minimize the total cost, including fixed and transportation costs.

is the transportation cost from warehouse to demand area, and is the fixed cost of establishing a warehouse at location. Z is the total cost of setting up a warehouse.

时间尺度-> 月

# Constraints:

~~每个区的需求量不一样-> 根据人口~~ *~~NHS / POSTCODE~~*

*Z <= investment1*

Table: RENT*i*房租成本

Capacity Constraint:

Demand Satisfaction Constraint:

Pickup Point Number Limit:

Investment Constraint:

# Model 2 - Transportation Time Minimization Model (MIP) [Based on the optimized solution of Model 1]

**Objective:**

Minimize the total transportation time using different types of vehicles for goods delivery.

**时间尺度-> 天**

**Constraints:**

**Cargo Flow Constraint:**

**Cargo weight Constraint: (每种载具不同)**

~~A->B,K=1有3台,K=2有5台如何引入k代表货物类型,来约束Cap~~

**Cargo Max Volume Constraint: (每种载具不同)**

**????**

**Daily Max Departures for Each Vehicle Type:**

Trucks:

Motorcycles:

Bicycles:

**Vehicle Purchase Constraints:**

Trucks:

Motorcycles:

Bicycles:

Distance ij:

**Distance 考虑来回**

**每个产品的重量/体积, -> 每种载具能载多少这种产品**

**维护成本 -> 细分到月**

**? <=每种载具最大运货体积**

**? <=每种载具最大运货重量**

**Table 3 X 2 载具的最大运货体积, 最大运货重量**

**雇佣driver成本 -> 细分到月**

~~SONY, as a world-famous electronic device company, is trying to set up an online shopping platform at Edinburgh. Edinburgh is a city at Scotland, UK. This city is well-known as its rich history and developed economic, there are lots of young people work and study here. So, Edinburgh is an ideal city to launch SONY’s online shopping platform.~~

~~As the developing of the online shopping platform, efficient and safe delivery play an important role of successful. There are many elements in delivery, one of the most important elements is choosing the suitable location of warehouse. A good location of warehouse not only can make sure a short time of delivery to consumer, but also can reduce delivery cost and time, increase the overall efficiency.~~

~~However, choosing the suitable location warehouse should take account of many factors, such as the traffic convince, labor force, fixed cost of setting up a warehouse. Also we need to consider from SONY’s perspective, basically all the products are electronic devices, such as smart phone, camera, headphone and television…it has various type of products with different sizes.~~

~~So, this problem can be converted to a math programming issue, there are many variables need to take account such as whether set up a pick up point, also some constraints such as the total investment, the demand should be meet…~~

~~This problem should be solved by 2 models, the first model is the minimize the total cost of the delivery. The second model is the minimize the time of the delivery process.~~

1. 他说我们的问题框架需要修改,因为现在去修改亚马逊的delivery station不现实, 所以我跟他说修改为 start-up e-commerce company ,然后现在进驻爱丁堡市场, 选取市面上available的warehouse(通过zoopla等出售房产的网站获取数据[地点+价格])

2. 我们第二个问题, 他说要加入更多realistic的细节:

比如我们运的货物是什么?是smart phone吗?

那我们基于smart phone的重量数据, 我们可以得到每种vehicle的capacity, (比如货车一次运1000台手机).

因此我说我们可以是专门卖手机的e-commerce company.他说OK.

但是我们还需要加入更多细节到problem description里面

~~We are tasked with optimizing the setup of pick-up points to efficiently serve various demand areas. Our primary objectives are to minimize the costs associated with establishing and operating these pick-up points, and to minimize the transportation time for delivering goods to these areas. This dual focus aims to enhance operational efficiency while ensuring customer satisfaction by reliably meeting their demands in a timely manner.~~

~~Critical considerations in this endeavor include the costs of transporting goods from pick-up points to demand areas, the fixed costs of establishing these points, the capacity constraints of each location, and an overarching investment budget that must not be exceeded. Furthermore, we aim to balance these economic objectives with the operational goal of reducing delivery times, thereby maintaining a high level of customer satisfaction and reflecting the efficiency in fulfilling the demand.~~

~~The~~ **~~challenge~~** ~~lies in formulating an optimization model that effectively balances these dual objectives, possibly through multi-objective optimization techniques such as weighted objectives or hierarchical optimization. This model will inform the strategic decision-making process for determining the optimal number and locations of pick-up points, taking into account both cost-effectiveness and timeliness within the given constraints.~~