**TR-GY 7013: Urban Transport & Logistics Systems**

**Fall 2024, Prof. Joseph Chow**

**Assignment #1**

This assignment part is worth **10 points**.

1. **(2 pts)** Read the following paper:

Prencipe, L. P., Colovic, A., Binetti, M., & Ottomanelli, M. (2024). Zero-emission vehicle adoption towards sustainable e-grocery last-mile delivery. *Research in Transportation Economics*, *104*, 101429.

1. **What is the research contribution of this paper? i.e. what innovation does this paper add to the literature?**

The paper brought out a Mathematical model which measure the performance of the eco-friendly cargo shipping vehicles. The model considers that factors like capacity, time windows for delivery, and partial recharging. The model compared E-cargo bilks, e-mopeds and E-vans as the last mile delivery method, and finally interpreted the advantage of the each.

1. **Consider the system design problem they study (don’t worry about the model). If we were to adopt their proposed system in NYC, what would be the benchmark system to compare against? What are the parameters you would need to collect data for in the benchmark system? Be sure to reference your sources in supporting your points.**

When applying the model from Prencipe et al.'s study on zero-emission vehicles to New York City, a key parameter to consider is the pricing of traffic congestion in Midtown and Downtown areas during high-traffic periods. This pricing mechanism will influence the selection of vehicles used for deliveries, as the cost of entering these zones during peak times will add to operational costs. Parameters to gather would include the cost per vehicle entry during congestion pricing hours, the volume of traffic entering these zones, delivery time windows, and vehicle emissions data. These factors will directly impact the efficiency of adopting zero-emission vehicles for last-mile deliveries, as the model considers constraints like time windows and energy consumption, which would be affected by congestion pricing(

[Homepage - Streetsblog New York City](https://nyc.streetsblog.org/2021/12/09/revealed-early-congestion-pricing-study-shows-congestion-pricing-works" \t "_blank)).

1. **(2 pts)** Larry Edison is the director of the Computer Center for Buckly College. He now needs to schedule the staffing of the center. It is open from 8AM until midnight. Larry has monitored the usage of the center at various times of the day and determined that the following number of computer consultants are required in Table 1. Two types of computer consultants can be hired: full-time and part-time. The full-time consultants work for 8 consecutive hours in any of the following shifts: morning (8AM-4PM), afternoon (noon-8PM) and evening (4PM-midnight). Full-time consultants are paid $40 per hour. Part-time consultants can be hired to work any of the four shifts listed in the table. Part-time consultants are paid $50 per hour. An additional requirement is that during every time period, there must be at least 2 full-time consultants on duty for every part-time consultant on duty. Larry would like to determine how many full-time and how many part-time workers should work each shift to meet the above requirements at the minimum possible cost. Formulate the LP (make sure to start by defining your decision variables! And it is ok to treat them as continuous variables) and solve using Excel or any other LP solver tool you prefer.

Table 1.

|  |  |
| --- | --- |
| Time of Day | Minimum Number of Consultants Required to be on Duty |
| 8AM-noon | 3 |
| Noon-4PM | 9 |
| 4PM-8PM | 10 |
| 8PM-midnight | 6 |

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | X1 | X2 | X3 | X4 | X12 | X23 | X34 |  |  |  |  |
|  | 0 | 0 | 0 | 2 | 3 | 6 | 4 |  |  |  |  |
| C: | 200 | 200 | 200 | 200 | 320 | 320 | 320 |  | z |  |  |
| St. |  |  |  |  |  |  |  |  | 4560 |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 8-noon | 1 | 0 | 0 | 0 | 1 | 0 | 0 |  | 3 | >= | 3 |
| noon-4 | 0 | 1 | 0 | 0 | 1 | 1 | 0 |  | 9 |  | 9 |
| 4-8 | 0 | 0 | 1 | 0 | 0 | 1 | 1 |  | 10 |  | 10 |
| 8-midnight | 0 | 0 | 0 | 1 | 0 | 0 | 1 |  | 6 |  | 6 |

1. (**3 pts**) Do BHM77 Ch 2 Q4.

文本, 信件

描述已自动生成

1. Maximize z = x1

-x1+x2+x3 = 2

x1+x2+x4 = 8

-x1+x2-x5 = -4

x1, x2, x3, x4, x5>=0

图片包含 图表

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地图上有字

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d)

地图上的文字

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e)

图示

描述已自动生成

1. (**3 pts**) Do BHM77 Ch 3 Q3 (a) – (i).

文本, 信件

描述已自动生成

1. Export 8750 units of Machinery, 232500 units of truck, and produce 300000 unit of steel, 50000 units of Machinery and 262500 units truck will be the optimal mix for New France. Net dollar of exports will be 0.490625E+09 dollars.
2. **STEEL**:   
   To export 1 unit of steel, it will cost 1 unit of steel.

To export Machinery or Trucks, dose not cost steel.

To produce 1 unit of steel, 1 unit of steel will gain.

To produce 1 unit of Machinery, it will cost 0.75 unit of steel.

To produce 1 unit of truck, it will cost 1 unit of steel.

**MACHIN**:   
To export 1 unit of steel, it will cost 0 unit of machinery.

To export 1 unit of Machinery, it will cost 1 unit of machinery.

To export 1 unit of truck, it will not cost any machinery.

To produce 1 unit of steel, it will cost 0.05 unit of machinery.

To produce 1 unit of machinery, 1 unit of machinery will gain.

To produce 1 unit of truck, it will cost 0.1 unit of machinery.

**TRUCK**:   
To export 1 unit of steel, it will cost 0 unit of truck.

To export 1 unit of Machinery, it will cost 0 unit of truck.

To export 1 unit of truck, it will cost 1 unit of truck.

To produce 1 unit of steel, it will cost 0.08 unit of truck.

To produce 1 unit of machinery, it will cost 0.12 unit of truck.

To produce 1 unit of truck, 1 unit of truck will gain.

文本, 信件

描述已自动生成

手机屏幕截图

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表格

描述已自动生成

e)

Besides everything already mentioned on the above, I think the labor force should also be considered, but not only manpower.

文本, 信件

描述已自动生成

文本, 信件

描述已自动生成

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | X1 | X2 | X3 | X4 | x5 | x6 |  |  |  |  |
|  | 0 | 8750 | 232500 | 300000 | 50000 | 262500 |  |  |  |  |
| C: | 900 | 2500 | 3000 | -300 | -150 | -900 |  | z |  |  |
| St. |  |  |  |  |  |  |  | 403250000 |  |  |
|  | -1 | 0 | 0 | 1 | -0.75 | -1 |  | 0 | = | 0 |
|  | 0 | -1 | 0 | -0.5 | 1 | -1 |  | 0 | = | 0 |
|  | 0 | 0 | -1 | -0.8 | -1.2 | 1 |  | 0 | = | 0 |
|  | 0 | 0 | 0 | 1 | 0 | 0 |  | 0 | <= | 300000 |
|  | 0 | 0 | 0 | 0 | 1 | 0 |  | 0 | <= | 50000 |
|  | 0 | 0 | 0 | 0 | 0 | 1 |  | 0 | <= | 550000 |
|  | 0 | 0 | 0 | 0.5 | 5 | 3 |  | 0 | <= | 1200000 |

Export 0 unit of steel

Export 8750 unit of Machinery

Export 232500 unit of trucks

Produce 300000 unit of steel

Produce 50000 unit of machinery

Produce 262500 unit of trucks

The new max export is 4.03e+09

表格

描述已自动生成

文本, 信件

描述已自动生成

手机屏幕截图

描述已自动生成