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Some company name

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Maybe Member7

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ABSTRACT

Your abstract goes here... To start, you have many options to write in $\LaTeX$, I would recommend using Sublime Text. You can find the instructions to setup it in the first section. Alternatively, you can download MiKTeX from here. It might take some time to open, or you may not be able to launch TeXworks at all (might be grayed out), wait until you see the MiKTeX console, then just open the "documentation.tex" file that comes with this pdf. Press ctrl + T to compile this pdf, it will ask you before downloading the necessary packages, let it download.

Keywords: route planning, cross-dock operations, milkrun, genetic algorithm.

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Your report goes here, you can reference a section by referring to its label, in the TeX editor as: In section 1, in section 1.2. Note that these references are hyperlinked, so it adds to the enjoyability of your report when it is being read from a computer.

1 DHL's Tactical Route Planning Process

1.1 Setting up Sublime Text for L^AT_EX

Download Sublime Text from [here](#). After the installment, follow the instructions on [here](#), to install Package Control. Then follow the instructions [here](#) to install LaTeXTools using Package Control. To view the compiled pdf file, download Sumatra PDF from [here](#). Launch Sublime Text on some .tex file, then go to the tools → build system and select latex from the menu, and compile it by ctrl + b. It should show the compiled pdf on Sumatra PDF, from there, change language if necessary from the settings, which is accessed from the menu button located at the left top of the window. From Sumatra PDF, you can perform inverse search on the parts of your pdf, just by double clicking, which directs you to the part in .tex file that generates that part of the pdf, it enables much faster editing. The issue is that it will open the .tex file in the notepad (or notepad++) by default, so you'll need to change it to Sublime Text, which is done as follows: Find the installation directory of Sublime Text and locate the sublime_text.exe inside it, by default, it should be "C:\Program Files\Sublime Text 3\sublime_text.exe". Open the settings → options in Sumatra PDF, at the bottom, you'll see the "Set inverse search command-line" box, copy and replace this inside of the text box there:

```
"A:\directory\to\sublime_text.exe" "%f: %l".
```

```
e.g. "C:\Program Files\Sublime Text 3\sublime_text.exe" "%f: %l"
```

As you can see above, you may want to manually separate the text inside commands, as they can overflow the page margin limits if they have too much content inside.

1.2 Problem Definition and Characteristics

I would suggest you to read this document's .tex file, from either Sublime Text, TeXworks or one of your other favorite tex editors, as most of the important stuff is covered in the comments, throughout the file. You will mostly work with sections and subsections, you declare them as you can see above. One important thing in latex is the number of empty lines left between paragraphs. If you are looking this at the TeXworks, you will see that letters of this word, p a r a g r a p h is written in 9 separate lines. The remark here is that, you declare a new paragraph by leaving one empty line between the texts, otherwise you are just putting a space between words. Another thing is, as you can notice, putting more than one space between words results in only one space in the produced file.

Bullet points:

- i. (First level) You just need to list the points like this
 - (a) (Second level) and the points under points like this

★. (Third level) ...

- ii. Check this page for further information on lists
- iii. Replace the number of "i"s in the end of "theenumi" by the level of list and you can define a bullet symbol for that level specifically (e.g. "theenumii" for the second level ("and the points under points like this"))

Some words talking about the points mentioned above...

1.3 In-text mathematics

You can write in-text mathematical expressions like as follows: m^3 , m^3 , m_3 , m_3 . Just put two dollar signs and write the expression between them, in some cases, it looks better if you use mathematical expression on just one part of the text, like above. Below are some examples that you can use to express system variables or functions.

Word_{subscript word that is not in form of a mathematical expression}
Another Word^{superscript word that is not in form of a mathematical expression}

1.4 Bold, italic, underlined and emphasising text

You can make the text **bold**, *italic*, underlined or *emphasized* like this. Note that you can combine these ***for even better results***. Below, you can see an example of a function, centered.

$$S-CD\ cost = FTC_{S-CD} \times \frac{CW}{TCW} + Collection\ Cost$$

you can right align some text by hfill

or by flushright,

center, by center,

and left justify by flushleft. To calculate S-3PL cost, the chargeable weight is multiplied by the unit cost (UC) that is defined in the contract with the shipping company. However, if the cost is less than the threshold value (T) determined by the shipping company, the client is charged a fixed minimum cost. On the other hand, if the cost is more than Full Truck Cost (FTC_{S-3PL}), which is the cost of a truck dedicated only for a single supplier by 3PL company.

You can use `newpage` command to continue in a new page, there's nothing fancy about it.

Alternative to leaving an empty space between paragraphs, you can leave the command `newline` to start a new paragraph.

One advantage of it is that it can be put into the text and let your `.tex` file seem more compact. The curly brackets `"{"` and `"}"` should be used with `"\"`, otherwise it will, most likely, produce an error, since it is a special character. Same goes for the dollar sign `$`, `\` is similar too except you need to write `textbackslash` for it (you can use it like this: `\if` some text immediately follows after it), for the vertical bar, you can use `|`.

Using the dash sign for the variable names looks bad in mathematical expressions, check out the examples below for comparison and the way around.

$$S\text{-}3PL\ cost = \min\{FTC_{S\text{-}3PL}, \max\{CW \times UC, T\}\}$$

$$S - 3PL\ cost = \min\{FTC_{S\text{-}3PL}, \max\{CW \times UC, T\}\}$$

2 Writing a Mathematical Model

Writing your mathematical model in `LATEX` requires a little work but, in the end, it looks better than most of its alternatives. In the following sections, you can find the template I used. If you notice the styles of model and decision variables need some improvements, you would be right, it definitely needs it.

2.1 Parameters

Since `LATEX` does not automatically divide tabulars into pages, you should do it manually like this:

I :	set of suppliers
R :	set of trucks
K :	set of final destinations
μ :	number of stops allowed in a milkrun route
X :	threshold distance for milkrun truck
s_i :	cost of S-3PL to customer for supplier i
b_i :	cost of S-3PL to cross-dock for supplier i
m^k :	cost per km for milkrun trips
F :	full truck cost
γ_1 :	utilization of milkrun truck
γ_2 :	utilization of cross-dock truck
O :	final destination (either customer or cross-dock)
w_i :	weight of the order from supplier i
v_i :	volume of the order from supplier i

TCW :	weight capacity of a truck
TCV :	volume capacity of a truck
D_{ij} :	distance between nodes i and j
$earlyEnt_i$:	earliest entry time to supplier i
$lateEnt_i$:	latest entry time to supplier i
$servTime_i$:	service time in supplier i
$servComp$:	latest time to complete all orders
$mDist_{ij}$:	distance between nodes i and j , in terms of minutes

2.2 Decision Variables

L^AT_EX will divide the text written between { and }, into separate pages automatically, which you can see below:

$$u_i^k = \begin{cases} 1 & \text{if load from supplier } i \text{ to the destination...} \\ 0 & \text{otherwise.} \end{cases} \quad \forall i \in I, k \in K$$

$$y_i = \begin{cases} 1 & \text{if load from supplier } i \text{ to the customer...} \\ 0 & \text{otherwise.} \end{cases} \quad \forall i \in I$$

$$z_{ir}^k = \begin{cases} 1 & \text{if load from supplier } i \text{ to the destination is sent by} \\ & \text{milkrun truck } r, \\ 0 & \text{otherwise.} \end{cases} \quad \forall i \in I, r \in R$$

$$d_{ir}^k = \begin{cases} 1 & \text{if there is a milkrun trip that utilizes truck } r \text{ starting} \\ & \text{from supplier } i \text{ and terminating at the destination,} \\ 0 & \text{otherwise.} \end{cases} \quad \forall i \in I, r \in R, k \in K$$

n = number of cross-dock trucks utilized

DKM_r^k = total distance traveled by truck r in milkrun trip to destination, $\forall r \in R, k \in K$

$DKMF_r^k$ = total distance traveled by truck r in milkrun trip to destination if

DKM_r^k exceeds X , $\forall r \in R, k \in K$

$time_{ir}^k$ = total time elapsed by the time truck r on milkrun route to destination reaches node i ,

in unit time, $\forall i \in I, r \in R, k \in K$

2.3 Model

The following mathematical model was constructed and used on the problem:

$$\text{minimize} \quad \sum_{i \in I} u_i^1 \times s_i + \sum_{r \in R, k \in K} m^k \times DKMF_r^k + \sum_{i \in I, r \in R} d_{ir}^1 \times F + \sum_{i \in I} u_i^2 \times b_i + n \times F \quad (1)$$

$$\text{subject to} \quad u_i^1 + y_i + \sum_{r \in R} z_{ir}^1 = 1, \quad i \in I \quad (2)$$

$$u_i^2 + \sum_{r \in R} z_{ir}^2 = y_i, \quad i \in I \quad (3)$$

$$\sum_{i \in I} z_{ir}^k \times w_i \leq TCW \times \gamma_1, \quad r \in R, k \in K \quad (4)$$

$$DKM_r^k - X \leq T_r^k \times M, \quad r \in R, k \in K \quad (5)$$

$$DKMF_r \geq DKM_r^k - M \times (1 - T_r^k), \quad r \in R, k \in K \quad (6)$$

Then you can reference the equations of the model by using eqref to their labels, like this: The objective (1) of the mathematical model aims to minimize the total cost of shipment methods that is composed of milkrun collection cost, milkrun full truck cost, S-3PL costs for the orders from the suppliers to cross-dock and for the orders sent directly to the customer.

3 Pseudocodes

You can write a pseudocode to explain your algorithms in a better way as in the example:

Algorithm 1: Rassal veri oluşturulması

Input: $\alpha_d, H, W, T, q_t, c, D_t, D_q, D_s, D_n, P, p, P_o, P_t, P_d, P_{dt}, a$

Output: $G = (N, A), N_c, w, t, e, l, d$

```
1  $C = \{1, 2, \dots, c\};$  // Müşteri kümesi
2  $musteriEvKoord = 0_{c \times 1};$  // Müşterilerin ev koordinatları
3 for  $i = 1$  to  $c$  do // Ev atamaları
4    $kume = musteriVarKume(i);$ 
5    $musteriEvKoord(i) = f_c(\alpha_{h_{nw}}(kume), \alpha_{h_{se}}(kume));$ 
6 end
7 foreach  $i \in C, j \in J, k \in K$  do // Her bir müşteri, gün ve zaman
   aralığı için, konum atamaları
8   if  $P_t(profilKume(i), j * T + k) == 0$  then // Müşteri evinde ise
9      $DoSomething = \dots;$ 
10  end
11  else if  $P_t(profilKume(i), j * T + k) == 1$  then // Müşteri iş yerinde
    ise
12     $DoSomething = \dots;$ 
13  end
14  else // Müşteri boş zamanında ise
15    if  $k \leq 1$  then // Sabah saati ise, önceki konum bilinmiyor
      ise
16       $DoSomething = \dots;$ 
17    end
18    else // Önceki konum biliniyor ise
19       $DoSomething = \dots;$ 
20    end
21     $DoSomething = \dots;$ 
22  end
23 end
24 return  $f(musteriKonum, musteriVarKargo);$  // Oluşturulan  $musteriKonum$ 
    ve  $musteriVarKargo$  matrislerine göre oluşturulmuş
     $G = (N, A), N_c, w, t, e, l, d$  değerleri
```

4 Figures and Tables

4.1 Figures

You can put a figure and a text below like this:

Then you can reference it by its label as: In figure 1, the result of the analysis on MRGA is given. You may want to consult this page for more placement options for the figures and visuals.



Figure 1: the score* values for given crossover and mutation probabilities

*score= $2 \times \text{mean deviation} + \text{deviation variation}$

4.2 Tables

	3 stops		4 stops		5 stops	
Order Size (N)	<i>T</i> (sec)	<i>Red.</i>	<i>T</i> (sec)	<i>Red.</i>	<i>T</i> (sec)	<i>Red.</i>
≤ 12	1.6	7.51%	1.2	15.14%	1.4	15.98%
13 – 18	2.9	14.12%	2.8	16.65%	3	19.67%
19 – 24	3.9	15.32%	5.4	14.84%	16.5	15.99%
≥ 25	17.2	16.36%	68	23.05%	198.4	26.21%
<i>Average</i>	7	12.36%	22.2	18.69%	63.2	20.95%

Table 1: The CPU time in seconds (*T*) and reduction in total shipment costs (*Red.*) for varying order sizes (N) and allowed stops (μ)

It is easier to explain the column format by an example: |l |(lower case L) creates a column that allows one data entry per row, all of which are left justified, you can put "r" or "c" to make it right justified or centered, respectively. |c c | means that two data entry per row, vertical lines are drawn before the first and after the second entry, entries are centered. You separate the rows by \\, followed by an hline command to draw horizontal lines between rows. & is used to separate columns. As usual, you reference the table by its label and using ref command:

The mathematical model is solved using IBM CPLEX for the data provided by the company by taking the required order and supplier information as input. The problem size, average CPU time to obtain a solution, and reduction in total shipment cost is provided in table 1. It is shown that CPU time increases exponentially with the problem size and number of stops allowed in a milkrun route.

Finally, in the references, you can use hanging indent as you can see at the end. Alternatively, you can use BibTeX to automate the creation of your bibliography, but this tutorial does not show its use, you should search internet for its use, which is what I talk about in the following last section.

You can reference an appendix as follows: In Appendix A.1, the routing plan obtained from the mathematical model is shown.

5 Improving the quality of report

By using the information in this file, you should be able to create your reports in $\text{\LaTeX}$. Don't forget that all of the examples in this file are open for improvement, and if you decide to improve them, or need something completely different, google will be your best friend, good luck!

Serkan Turhan

References

DHL Supply Chain. *DHL*, www.dhl.com/content/dam/downloads/g0/logistics/brochures/llp/dhl_llp_brochure_0414.pdf.

A Appendices

A.1 The route obtained from mathematical model

:)

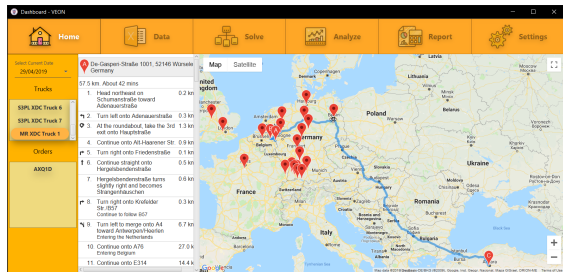
A.2 The route obtained from heuristic

:)

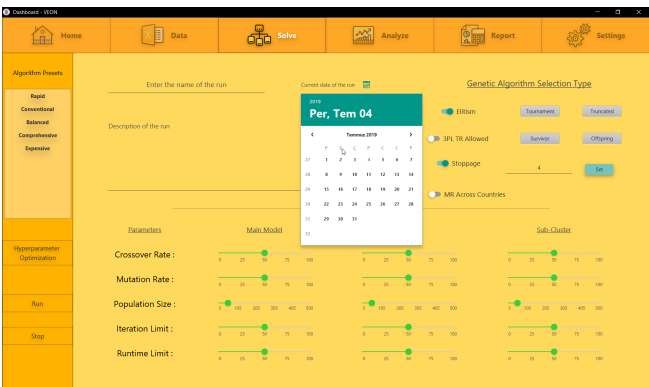
A.3 The route plan done by DHL

:)

A.4 Homepage of Veon



A.5 Parameter Settings Page in Veon



A.6 Visual Runtime Analyzer of Veon

