

ARMEK  
Team 10

# Design and Application of Inspection System for Mechanics Department

## Arçelik Dishwasher Factory

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4 May 2024

### Abstract

In the Arçelik Dishwasher Factory, lack of control system to calculate the performance of processes and the quality of products affects the productivity process negatively. The aim of this project is to prevent the data loss and to prepare the necessary infrastructure for the quality and improvement workers by designing and implementing a fast and user-friendly control system. The system is developed on Microsoft.NET platform using VisualBasic.NET programming language and Oracle 9.2 database. By the help of this system a sample efficiency improvement study was conducted and the efficiency is improved by 8% in terms of time and 3% in terms of productivity.

**Keywords:** GUI (Graphical User Interface), grid ergonomics, quality and performance improvement, process analysis.

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## 1 Introduction

Section 2 illustrates how to create tables, figures, refer to them, and cite others' work. Section 3 describes the report format. Follow it along with [LaTeX](#) code to learn how to produce the desired format.

## 2 LaTeX

To begin using LaTeX, one needs a LaTeX engine and a LaTeX editor. Download and install

- [MacTeX](#) for Mac,
- [MikTeX](#) for Windows

as your LaTeX engine. Both engines come with some LaTeX editors, but one popular cross-platform editor is [TeXstudio](#). We encourage you to use TeXstudio. Start by watching YouTube video [Write your first LaTeX document using TeXstudio](#) and reading four-page TeXstudio tutorial by [Kroonenberg \(2016\)](#).

## 2.1 Including Plots

You can include figures like Figure 1 along with its data in a table as in Table 1.

Table 1: The first six records of pressure versus temperature

temperature	pressure
0	2e-4
20	0.0012
40	0.006
60	0.03
80	0.09
100	0.27

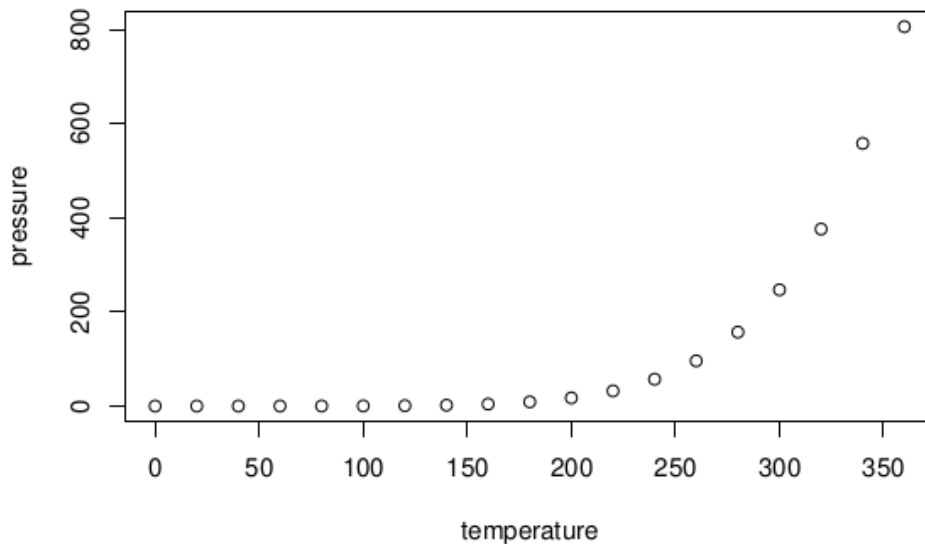


Figure 1: Pressure vs. temperature

If you expect to work with the underlying data closely; for example, if you are expecting to fit different models, then writing the report with [R Markdown](#) at the same time that you do your statistical analysis can be better.

## 2.2 Including Long Tables

For long tables resuming over more than a page, you can use `longtable` environment. You can assign labels to tables and refer them anywhere in the report. For example, Table 2 lists multiple solutions to a problem.

Table 2: Feasible triples for highly variable Grid, MLMMH.

Time (s)	Triple chosen	Other feasible triples
0	(1, 11, 13725)	(1, 12, 10980), (1, 13, 8235), (2, 2, 0), (3, 1, 0)
2745	(1, 12, 10980)	(1, 13, 8235), (2, 2, 0), (2, 3, 0), (3, 1, 0)
5490	(1, 12, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
8235	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
10980	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
13725	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
16470	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
19215	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
21960	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
24705	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
27450	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
30195	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
32940	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
35685	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
38430	(1, 13, 10980)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
41175	(1, 12, 13725)	(1, 13, 10980), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
43920	(1, 13, 10980)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
46665	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
49410	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
52155	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
54900	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
57645	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
60390	(1, 12, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
63135	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
65880	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
68625	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
71370	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
74115	(1, 12, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
76860	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
79605	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
82350	(1, 12, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
85095	(1, 12, 13725)	(1, 13, 10980), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
87840	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
90585	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
93330	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
96075	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
98820	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
101565	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)

Continued on next page

Table 2 – continued from previous page

Time (s)	Triple chosen	Other feasible triples
104310	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
107055	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
109800	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
112545	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
115290	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
118035	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
120780	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
123525	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
126270	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
129015	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
131760	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
134505	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
137250	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
139995	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
142740	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
145485	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0), (3, 1, 0)
148230	(2, 2, 2745)	(2, 3, 0), (3, 1, 0)
150975	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
153720	(1, 12, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
156465	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
159210	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
161955	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)
164700	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0), (3, 1, 0)

Table 3 is another longtable example, where we control the second column width, which forces long texts in the cells to wrap and continue on a new line. Table 3: Materials stored in Aselsan inventory. There are 23 critical materials and ...

Material	Description
MA	Devices, systems, software purchased from subcontractor
MB	Electronic modulers
MC	Capacitators
MD	...
ME	...
MF	...
MG	...
MI	Another very very very very very very long description
MH	...
MW	RF and microwave elements

## 2.3 Including Computer Code Listings

Use `lstlisting` environment to list codes.

Listing 1: An example C code to illustrate with `lstlisting` environment from Wikipedia

```
1      #include <stdio.h>
2      #define N 10
3      /* Block
4       * comment */
5
6      int main()
7      {
8          int i;
9
10         // Line comment.
11         puts("Hello_world!");
12
13         for (i = 0; i < N; i++)
14         {
15             puts("LaTeX_is_also_great_for_
16                programmers!");
17         }
18         return 0;
19     }
```

Anywhere in the report you can refer to a listing by using label assigned to that listing. For example, Listing 2 shows the pseudo code of Apriori algorithm while Listing 1 displays a C code.

### 2.3.1 An Example of Pseudo Code Listing

Listing 2: Pseudo code for Apriori algorithm

```
1 Pseudo code description:
2 //Find frequent 1 item set
3 L1 = find_frequent_1-itemsets (D);
4 For (k = 2; Lk-1! = Null; k++) {
5     //generate candidates and prunes
6     Ck = apriori_gen (Lk-1);
7     //Scan D to count candidates
8     For each transaction t in D {
9         Ct = subset (Ck, t); //get a subset of
10            t
11         For each candidate c belongs to Ct
12            c.count ++;
13     }
```

```

13 |         //Return the item set in the candidate set
14 |         that is not less than the minimum support
15 |         Lk = {c belongs to Ck | c.count >= min_sup}
16 |     }
17 | Return L = all frequent sets;
18 | The first step: join
19 | Procedure apriori_gen (Lk-1: frequent (k-1) -itemsets)
20 | For each item set l1 belongs to Lk-1
21 | For each item set l2 belongs to Lk-1
22 | If ((l1 [1] = l2 [1]) && (l1 [2] = l2 [2]) &&... && (
23 |     l1 [k-2] = l2 [k-2]) && (l1 [k-1] < l2 [k-1]))
24 | then {
25 |     c = l1 connect l2 //connect step: generate
26 |     candidate
27 |     //If the subset c already exists in the k-1
28 |     item set, pruning
29 |     if has_infrequent_subset (c, Lk-1) then
30 |     delete c; //pruning step: delete infrequent
31 |     candidates
32 |     else add c to Ck;
33 | }
34 | Return Ck;
35 | Step Two: Prune
36 | Procedure has_infrequent_sub (c: candidate k-itemset;
37 |     Lk-1: frequent (k-1) -itemsets)
38 | For each (k-1) -subset s of c
39 | If s does not belong to Lk-1 then
40 | Return true;
41 | Return false;

```

### 2.3.2 Another pseudocode example

You can specify the keywords that you want to be typeset bold; see Listing 3, with optional keywords argument to *lstlisting* environment.

Listing 3: Integer division

---

```

1 input: int N, int D
2 output: int
3
4 begin
5   res ← 0
6   while N ≥ D
7     N ← N - D
8     res ← res + 1
9   end
10  return respdfa
11 end

```

---



### 2.3.3 Include a Computer Code File

If the code is in a separate file, then you can it with `\lstinputlisting`.

Listing 4: Python program to find the area of triangle

```
1 a = 5
2 b = 6
3 c = 7
4
5 # Uncomment below to take inputs from the user
6 # a = float(input('Enter first side: '))
7 # b = float(input('Enter second side: '))
8 # c = float(input('Enter third side: '))
9
10 # calculate the semi-perimeter
11 s = (a + b + c) / 2
12
13 # calculate the area
14 area = (s*(s-a)*(s-b)*(s-c)) ** 0.5
15 print('The area of the triangle is %0.2f' %area)
```

## 2.4 Further Reading

[Oetiker et al. \(2015\)](#) wrote a short introduction to LaTeX which is a good place to start learning LaTeX. [Wickham and Grolemund \(2017\)](#) and [Xie et al. \(2018\)](#) describe with plenty examples how to use R Markdown. All three books are available online. Follow the links in the bibliography section.

**By the way, LaTeX is pronounced “Lay-tech” or “Lah-tech.”** If you do not want to sound like a business person in [rubber industry](#), then learn how to the pronounce LaTeX. As a matter of fact, the last letter in “TeX” is supposed to be not an “X”, but Greek letter “ $\chi$ ” as in  $\chi^2$  test of independence.

We are aware that there are online LaTeX services, but they do not strictly follow LaTeX standards. For the final project fair booklet, we will collect your LaTeX and BibTeX files. Therefore, it is crucial that you learn how to create acceptable LaTeX documents and share them with us—starting with your proposal report coming less than a month.

## 3 Report Format

The text must be written 12 pt and single spaced and justified. The first paragraphs in each section/subsection/... should not be indented. All others should be indented 1 cm. There must be no line blanking between paragraphs. LaTeX used with `buIE47x` document class will take care of all these and the remaining formatting requirements.

## 3.1 Margins

Top and bottom margins must be 3 cm, right and left margins must be 3.50 cm width. All headings, tables, figures, texts and appendices must be between the spacing limits that are determined by margins, there must no text outside of these limits. Please ensure that all tables and figures that you used in the text and appendix are between the margins.

## 3.2 Headings

The first character of each word must be a capital letter. In the headings of reports written in Turkish, conjunctions like ‘ve’, ‘ile’ must be written in lowercase. In the headings of reports written in English, auxiliary words like ‘the’, ‘on’, ‘for’ must be written in lowercase. All headings must be enumerated.

## 3.3 Subheading

The first character of a subheading must be uppercase, and other characters must be lowercase. There must be no dot after the last character of any headings or subheadings.

Headings should not be chained without any remarks in between. When a new section or sub section or sub sub section is created, greet the reader with the purpose of section and give a brief review of its content and the contents of its sub sections.

### 3.3.1 Sub sub heading

The same subheading rules apply. A fourth subheading should not be used like 3.2.2.1. Use `\subsubsection*{...}` to create unnumbered subsub sections, in which case the next text starts in a new paragraph. If you want to write a paragraph with a title, then use `\paragraph{...}` command. See the tex file for the code for the following effects:

**This is an unnumbered subsubsection title**

Following text goes into a new paragraph.

**This is a paragraph with a title.** Text follows the paragraph title.

**Headings and definitions:** If there is a heading, definition etc. that you do not want to enumerate, it must be written in italic and there must be “:.” (double dot) after that. *Example:*

**MDB:** Main distribution base.

**MDB network:** the network that is created by main distribution bases and their connection.

## 3.4 Bulleting and Indexing

### 3.4.1 Bulleting

Use `itemize` environment to create bullet lists. *Example:*

The objectives can be listed in more detail as follows:

- Measuring the performance of molds, operators and press machines where products are produced, in line with the expectations of the enterprise.
  - Measuring the molds in which the products are produced, in line with the expectations of the enterprise.
  - Measuring the molds in which the products are produced, in line with the citations of the enterprise.
- A system design that will allow the measurement of the quality of all kinds of raw materials, semi-finished products and especially the materials from the supplier companies that are processed in press machines.
- All performance analysis reports are designed to be available to senior management in an intranet environment and include multiple user levels (senior management, system management and operators), allowing all units to access the data in the fastest way.

### 3.4.2 Indexing

Numbering should be written in the same format as the bulleting, an example is as follows. *Example:*

The objectives can be listed in more detail as follows:

1. Measuring the performance of molds, operators and press machines where products are produced, in line with the expectations of the enterprise.
  - (a) Measuring the molds in which the products are produced, in line with the expectations of the enterprise.
  - (b) Measuring the molds in which the products are produced, in line with the expectations of the enterprise.
2. A system design that will allow the measurement of the quality of all kinds of raw materials, semi-finished products and especially the materials from the supplier companies that are processed in press machines.
3. All performance analysis reports are designed to be available to senior management in an intranet environment and include multiple user levels (senior management, system management and operators), allowing all units to access the data in the fastest way.
4. Establishing a database that will prepare the infrastructure for the total quality management activities that are being carried out in the enterprise, and providing the opportunity to obtain a healthy data for these studies.

### 3.4.3 Figures and Tables

#### Tables

Tables should be within the specified writing range and should not protrude in any way. The title of the table should be numbered; see Table 4 as an example, centered on the table and there should be one empty line before and after the table.

Table 4: Daily average intermediate stock levels in mechanical production.

Material Name	Material Level
Chasis	5,000
Side Wall	15,000-17,000
Door	15,000-17,000
TOTAL	35,000-39,000

## Figures

Figures should be within the specified writing range and should not protrude in any way. All graphics and photographs except tables should be presented as figures. Figures should be included in the text and should be legible. The title of the figure should be numbered, centered below the figure; see Figure 2 as an example, and an empty line should be left before and after the figure.

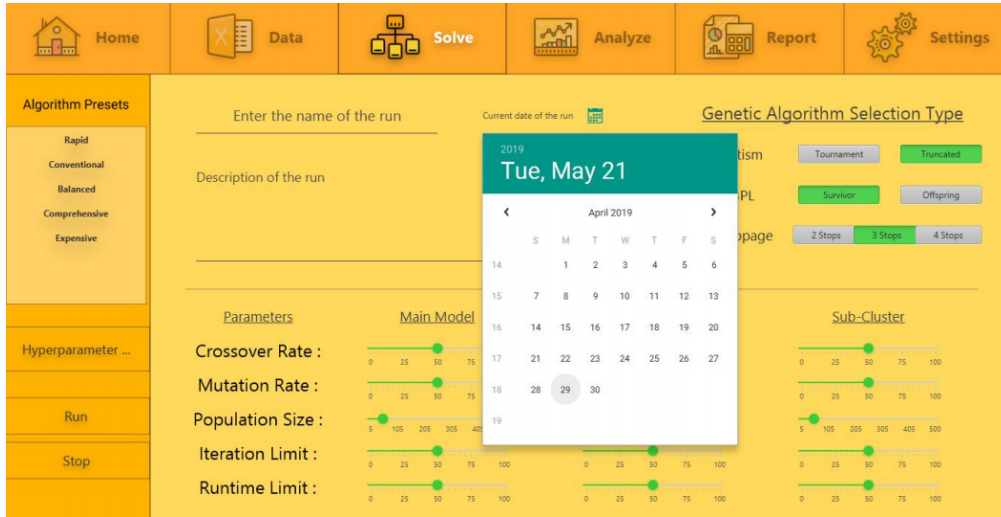


Figure 2: User interface example

## Referencing the tables and figures

When referring to the figures and tables, the name of the figure and the table can be written in parentheses (Table 4), or in the sentence “as shown in Figure 1”. All the other uses (see table-4, figure: 1) are not correct.

### 3.4.4 Numbers and punctuation marks

In Turkish spelling, “,” (comma) is used as the fractional number separator and “.” (dot) is used as the separator for thousands of digits (three zeros). *Examples:* 2.23; 12356.2.

In English spelling, “.” (dot) is used as a fractional number separator and “,” (comma) is used as a separator for thousands of digits (three zeros). *Examples:* 2.23; 12,356.2.

In Turkish writing, the percent sign (%) is before the number (*Example:* %15). In the English spelling, the percentage (%) sign is located after the number (*Example:* 15%). Numbers from one to nine are written in text and numbers greater than or equal to 10 are written as numbers.

The letters and symbols in mathematical expressions are as inline or displayed math environments [Oetiker et al. \(2015\)](#). Inline and displayed math example Wikipedia ([2019b](#)):

The standard newswender profit function is  $f(p) = E[p \min(p, D)] - cp$ , where  $D$  is the random demand with cdf  $F$ , each unit is sold for price  $p$  and purchased for price  $c$ , the number of units stocked (decision variable) is  $q$ . The stocking quantity of the newsvendor that maximizes expected profit is given by

$$q^* = F^{-1} \left( \frac{p - c}{p} \right).$$

Fertilizer linear programming example ([Wikipedia Contributors, 2019a](#)):

$$\begin{aligned} & \text{Maximize} && S_1x_1 + S_2x_2 && \text{(maximize the revenue)} \\ & \text{s.t} && && \\ & && x_1 + x_2 \leq L && \text{(limit on total area)} \\ & && F_1x_1 + F_2x_2 \leq F && \text{(limit on fertilize)} \\ & && P_1x_1 + P_2x_2 \leq P && \text{(limit on pesticide)} \\ & && x_1 \geq 0, x_2 \geq 0 && \text{(cannot plant a negative area).} \end{aligned}$$

Another example. This time objective function and constraints are numbered and labeled, so they can be referred in the text without having to remember the equation numbers:

The decision variables are

$$x_{ij} = \begin{cases} 1, & \text{if task } i \text{ is assigned agent } j, \\ 0, & \text{otherwise,} \end{cases}$$

for every  $i \in I$ ,  $j \in J$ , and the model is

$$\min \sum_{i \in I} \sum_{j \in J} c_{ij} x_{ij}, \tag{1}$$

s.t.

$$\sum_{j \in J} x_{ij} = 1 \quad \forall i \in I \tag{2}$$

$$\sum_{i \in I} a_{ijk} x_{ij} \leq b_{jk} \quad \forall k \in K \quad \forall j \in J, \tag{3}$$

$$x_{ij} \in \{0, 1\} \quad \forall i \in I, j \in J, \tag{4}$$

where  $I$  is the index set of tasks,  $J$  is the index set of agents, and  $K$  is the index set of resources used by agents to perform these tasks.  $a_{ijk}$  is the amount of resource  $k$  used by agent  $j$  in performing task  $i$ ,  $b_{jk}$  is the amount of resource  $k$  available to agent  $j$ , and  $c_{ij}$  is the cost of assigning task  $i$  to agent  $j$ . Constraint (2) is assigned to exactly one agent, whereas (3) is the budget constraint.

You can use `eqnarray`, `multline`, `gather`, `gathered`, `cases`, `aligned`, `split` environments and their `*`-versions for numbered and unnumbered displayed equations, respectively. You may consult user's guide for the `amsmath` package (Freimer, 2002) for examples.

### 3.4.5 Common mistakes

The English word 'data' is plural (singular form is 'datum'), so there is no 'datas' in English, 'veriler' is the corresponding Turkish word. In Turkish, 'veri' or 'veriler' words should be preferred.

The word "heuristic" in English can be used as both a noun and an adjective. The Turkish equivalent of the word, 'sezgisel' is an adjective. Therefore, whether or not the word 'heuristic' is used as a noun or adjective in an English text or speech, for the Turkish equivalents, 'sezgisel algoritma' or 'sezgisel yöntem' should be used.

"Agenda" or "Outline" titles may be used in English to indicate the content of the presentation at the beginning of a presentation. Some of the Turkish words that correspond to these words may be 'gündem' or 'içerik'. The use of the word 'Ajanda' in this sense is incorrect.

GAMS, CPLEX, AMPL, EXPRESS, EXCEL have different functions for modeling and solution of developed mathematical models. These functions must be correctly expressed in the text. Software such as GAMS and AMPL are interface software where mathematical models can be algebraically expressed with their own syntax and can communicate with a solver. The mathematical models encoded with these software are optimized by a decoder program such as CPLEX and EXPRESS.

Similarly, mathematical models can be expressed in Excel worksheets with Excel software. These models can be optimized with Solver, an Excel add-on. Therefore, in Turkish (English) texts, statements such as

"Matematiksel modelimizi GAMS'de çözdürdük" ("We solved our mathematical model by GAMS"),

"Bir GAMS modeli geliştirdik" ("We developed a GAMS model"),

"Problemimizi GAMS'de modelledik" ("We formulated our problem in GAMS")

are false. Correct expressions in the Turkish (English) text as follows:

"Problemimiz için bir matematiksel model geliştirdik." ("We developed a mathematical model for our problem"),

"Matematiksel modelimizi GAMS ile kodladık ve CPLEX ile çözdürdük." ("We coded our mathematical model in GAMS and optimized with CPLEX"),

"EXPRESS programı ile modelimizi kodladık ve optimal değerleri bulduk." ("We coded our model and optimized in EXPRESS."),

"AMPL arayüzünü kullanarak modellediğimiz problemimizin optimal çözümünü bulabilmek için CPLEX çözücüsünü kullandık."

(“We used AMPL interface to optimize our model by CPLEX solver.”)

### 3.4.6 Bibliography

Bibliography should be included at the end of the report before the appendices. The title of the bibliography should not be numbered and should be written in bold and 12-point. LaTeX will again take care of these requirements.

All articles, books, internet pages etc. citations should be included in the text and listed in the bibliography. **Studies not referred to in the text should not be included in the bibliography.**

In the bibliography, the authors should be mentioned primarily using their last name, followed by the first letters of their names. The bibliography should be prepared alphabetically by the last name of the authors and chronologically for each author.

Turkish texts should not contain any English words except the title of the source in the bibliography. (E.g. and, volume (vol.), number (no.), page (p.) do not use words such as.)

One way to avoid the hassle of formatting bibliographic entries is this:

1. find BibTeX entries for books from Google Books, [BibSonomy](#) and for articles from journal web sites (try googling the article title and “bibtex” together),
2. save them in a .bib file,
3. give the .bib file name across `bibliography` field in the R Markdown file if you are using R Markdown or inside `\bibfilename{}` command in your LaTeX (inspect report.bib file), and cite the work with its bibtex identifier.

File `report.bib` included with this package contains examples. Include an in-text citation when you refer to, summarize, paraphrase, or quote from another source. For every in-text citation in your report, there must be a corresponding entry in your bibliography.

APA in-text citation style uses the author’s last name and the year of publication, for example: [Porteus \(2002\)](#). This is the case if the source is single authored. If it has two authors, write two authors’ last names using “and”, and the year of publication again, for example: [Clark and Scarf \(2004\)](#). If it is more than two authors, write as, for example: [İçöz et al. \(2006\)](#). If you use `\cite{}` command of LaTeX, you do not need to worry.

When referring to a source in a sentence, the structure of the sentence must be established as if it does not refer to the source itself but to its authors. A *correct* example in Turkish text:

“Özellikle, [Ambler \(2000\)](#) ve [Hoc \(2000\)](#) form ergonomileri üzerine yapılan çalışmaların gerekliliğini göstermiştir.”

An *incorrect* example in Turkish text:

“Form ergonomileri üzerine yapılan çalışmaların gerekliliği [Ambler \(2000\)](#) ve [Hoc \(2000\)](#)’da gösterilmiştir.”

A *correct* example in English text:

“[Clark and Scarf \(2004\)](#) characterize optimal ordering policies for an uncapacitated serial inventory system.”

An **incorrect** example in English text:

“Optimal ordering policies for an uncapacitated serial inventory system is characterized in [Clark and Scarf \(2004\)](#).”

For multiple works of an author that have appeared in the same year, the distinction is made with letters after the year, respectively. Example: [Wikipedia Contributors \(2019a,b\)](#). A similar path is followed for internet addresses.

*Example:* the internet addresses given in the bibliography below should be referred to as [Beckers and Siermann \(2005\)](#) and Turkish Statistical Institute [\(2006\)](#).

For direct quotations, include the page number as well, for example: ([Clark and Scarf, 2004](#), pg. 14). For sources such as websites and e-books that have no page numbers, use a paragraph number. More information on citing sources without pagination is given on the [APA Style web page](#). *Example paragraph with in-text citation:*

A few researchers in the linguistics field have developed training programs designed to improve native speakers’ ability to understand accented speech ([Derwing et al., 2002](#); [Thomas, 2004](#)). Their training techniques are based on the research described above indicating that comprehension improves with exposure to non-native speech. [Derwing et al. \(2002\)](#) conducted their training with students preparing to be social workers, but note that other professionals who work with non-native speakers could benefit from a similar program. See the examples in the bibliography section at the end.

## Bibliography

Ambler, S. W. (2000). *User Interface Design: Tips and Techniques*. Cambridge University Press.

Beckers, I. and C. Siermann (2005). Over one third of jobholders are regularly working overtime. Web Magazine, Statistics Netherlands, <https://www.cbs.nl/en-gb/news/2005/33/over-one-third-of-jobholders-are-regularly-working-overtime> [Online; accessed September 13, 2021].

Clark, A. J. and H. E. Scarf (2004). Optimal Policies for a Multi-Echelon Inventory Problem. *Management Science* 50(12-Supplement), 1782–1790.



- Derwing, T. M., M. J. Rossiter, and M. J. Munro (2002). Teaching Native Speakers to Listen to Foreign-accented Speech. *Journal of Multilingual and Multicultural Development* 23(4), 245–259.
- Freimer, M. (2002). User’s Guide for the amsmath Package.
- Hoc, J.-M. (2000). From human – machine interaction to human – machine cooperation. *Ergonomics* 43(7), 833–843. PMID: 10929820.
- Kroonenberg, S. (2016). Texstudio: Especially for latex newbies. 37(1), 41–44. <https://www.tug.org/TUGboat/tb37-1/tb115kroonenberg.pdf>.
- Oetiker, T., H. Partl, I. Hyna, and E. Schlegl (2015). *The Not So Short Introduction to LaTeX2e*. <http://mirrors.ctan.org/info/lshort/english/lshort.pdf>.
- Porteus, E. (2002). *Foundations of Stochastic Inventory Theory*. Business/Marketing. Stanford University Press.
- Thomas, H. K. (2004). *Training Strategies for Improving Listeners’ Comprehension of Foreign-Accented Speech*. Ph. D. thesis, University of Colorado Boulder, University Libraries Digitized Theses.
- Türkiye İstatistik Kurumu (2006). Over one third of jobholders are regularly working overtime. İş Gücü Anketi June 2006, <http://www.turkstat.gov.tr> [Online; accessed June 10, 2007].
- Wickham, H. and G. Grolemund (2017). *R for Data Science*. O’Reilly Media. <https://r4ds.had.co.nz/r-markdown.html>.
- Wikipedia Contributors (2019a). Linear programming — Wikipedia, The Free Encyclopedia. [https://en.wikipedia.org/w/index.php?title=Linear\\_programming&oldid=920481845](https://en.wikipedia.org/w/index.php?title=Linear_programming&oldid=920481845) [Online; accessed 17-October-2019].
- Wikipedia Contributors (2019b). Newsvendor model — Wikipedia, The Free Encyclopedia. [https://en.wikipedia.org/wiki/Newsvendor\\_model](https://en.wikipedia.org/wiki/Newsvendor_model) [Online; accessed 17-October-2019].
- Xie, Y., J. Allaire, and G. Grolemund (2018). *R Markdown: The Definitive Guide*. Chapman and Hall/CRC the R Series. Taylor & Francis Limited. <https://bookdown.org/yihui/rmarkdown/>.
- İçöz, O., H. Başer, G. Bulut, and I. Altınel (2006). Sınırlı sığalı yerleştirme-paylaştırma problemlerinin eniyi amaç fonksiyon değeri için bir güven aralığı bulma yöntemi. *Endüstri Mühendisliği* 17(3), 31–40.

# Appendices

Each appendix starts on a separate page. The title should be written in bold and capital letters.

All appendices should be labeled consecutively and each one must have a title. If an appendix has subheadings, they should be numbered as well (e.g., Appendix A.1). Appendix can be referenced just as an ordinary section; for example, Figure 3 in Appendix A, consult Appendix A.1, A.2. For example, “organization chart of the company can be seen in Appendix B.”

Appendices should be included in the same file as the continuation of the report. Appendices should not have a landscape layout. (However, pictures and tables can be positioned horizontally as shown in Appendix B.) The appendices must not exceed the specified document margins.

## A Raw Material Flow Chart

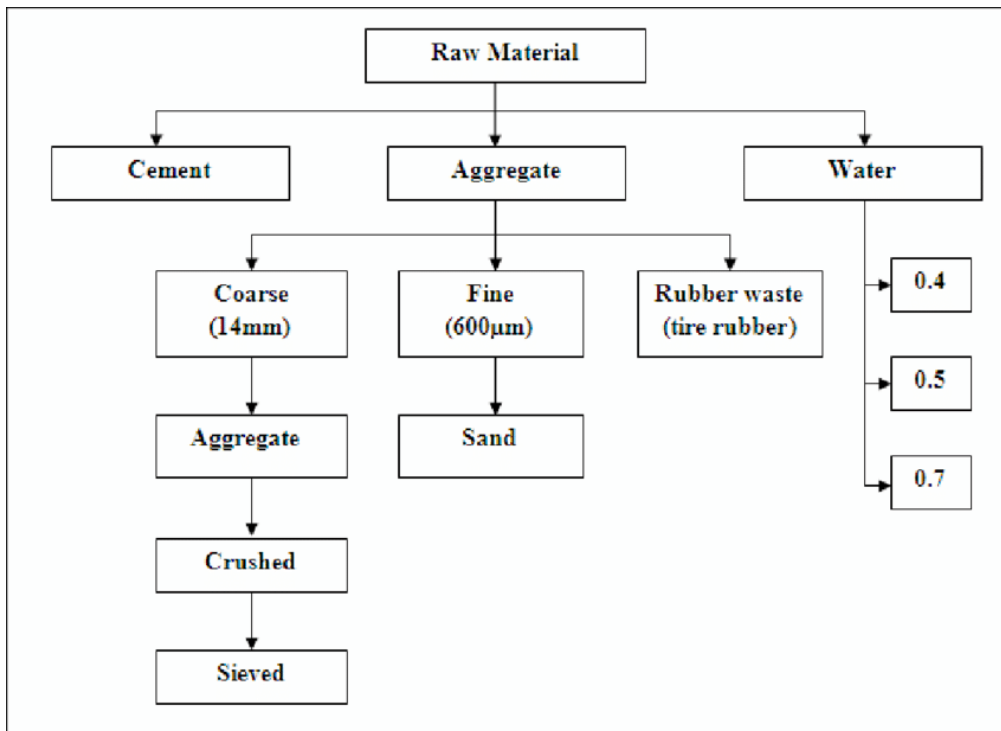


Figure 3: Raw Material Flow Chart shows that ...

## A.1 Routing Plan Obtained From the Heuristic Method

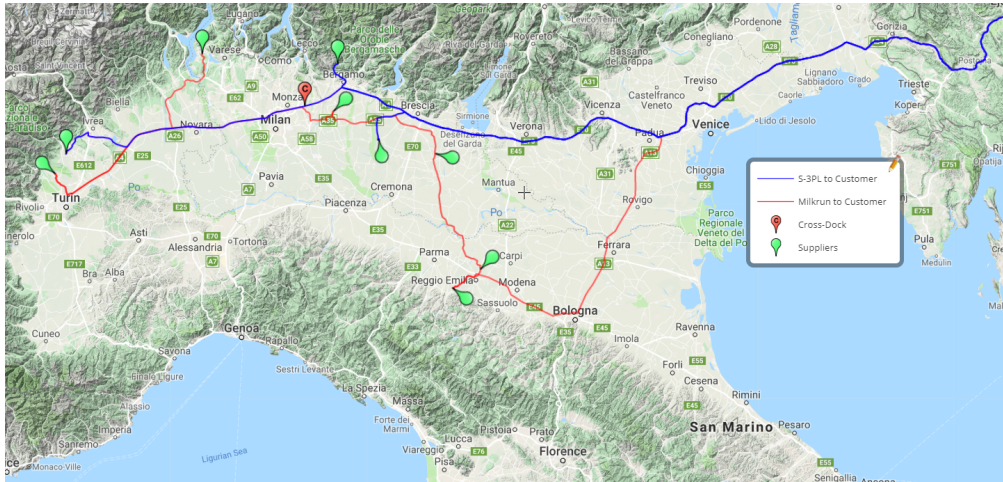


Figure 4: Routing Plan was obtained with the heuristic method developed in Section 3)

## A.2 Sample Report in the User Interface

	A	B	C	D	E	
1	<b>Supplier Code</b>	<b>Chargeable Weight</b>	<b>Shipment Type</b>	<b>Cumulative Distance if Milkrun (km)</b>	<b>Collection Cost</b>	
2	R151A	134.2656	S-3PL to XDC to TR		234.27	175.1
3	CFNOA	159.84	S-3PL to XDC to TR		167.22	209.4
4	AXQ1D	319.68	S-3PL to XDC to TR		341.955	418.
5	MQPSA	1478.9943199999998	MR from XDC to TR	252.0		462.
6	MEQ3A	1185.0	MR from XDC to TR	332.7		405.
7	G944A	3551.6448	MR from XDC to TR	411.2	1202.76	691.
8	C97GA	174.0	S-3PL to XDC to TR		241.56	227.1
9	E622D	1150.0	S-3PL to XDC to TR		459.09	1506
10	<b>Supplier Code</b>	<b>Chargeable Weight</b>	<b>Shipment Type</b>	<b>Cumulative Distance if Milkrun (km)</b>	<b>Collection Cost</b>	
11	R151A	134.2656	S-3PL to XDC to TR		234.27	175.1
12	CFNOA	159.84	S-3PL to XDC to TR		167.22	209.4
13	E622D	1150.0	S-3PL to XDC to TR		459.09	1506
14	AXQ1D	319.68	S-3PL to XDC to TR		341.955	418.
15	MQPSA	1478.9943199999998	MR from XDC to TR	252.0		462.
16	MEQ3A	1185.0	MR from XDC to TR	332.7		405.3
17	G944A	3551.6448	MR from XDC to TR	411.2	1202.76	691.
18	C97GA	174.0	S-3PL to XDC to TR		241.56	227.1
19	<b>Supplier Code</b>	<b>Chargeable Weight</b>	<b>Shipment Type</b>	<b>Cumulative Distance if Milkrun (km)</b>	<b>Collection Cost</b>	
20	C97GA	174.0	S-3PL to XDC to TR		241.56	227.1
21	AXQ1D	319.68	S-3PL to XDC to TR		341.955	418.
22	MQPSA	1478.9943199999998	MR from XDC to TR	252.0		462.4
23	MEQ3A	1185.0	MR from XDC to TR	332.7		405.3

Figure 5: This report shows that ...

Dashboard - VEGN
Home Data Solve Analyze Report Settings

**Date & Time**

Current Date : 23.05.2019

Current Time : 2:07 AM

**Options**

Chart Nodes

Axis Animations

**Visuals**

Color Theme : #FFFFFF

Return To Default Color Theme

**Configurations**

GMaps ID : Atz5yA6dU30C.6X3680XE6dgrIRZpk8jw

Save Preferences

Current Language  
English

Connected Username / Contact / IP Address / Available Processor Count / Available Free Memory  
This Computer / - / 172.20.10.3 / 8 / 72441040

Figure 6: Connecting with other computers

## B Locations of the Distribution Centers

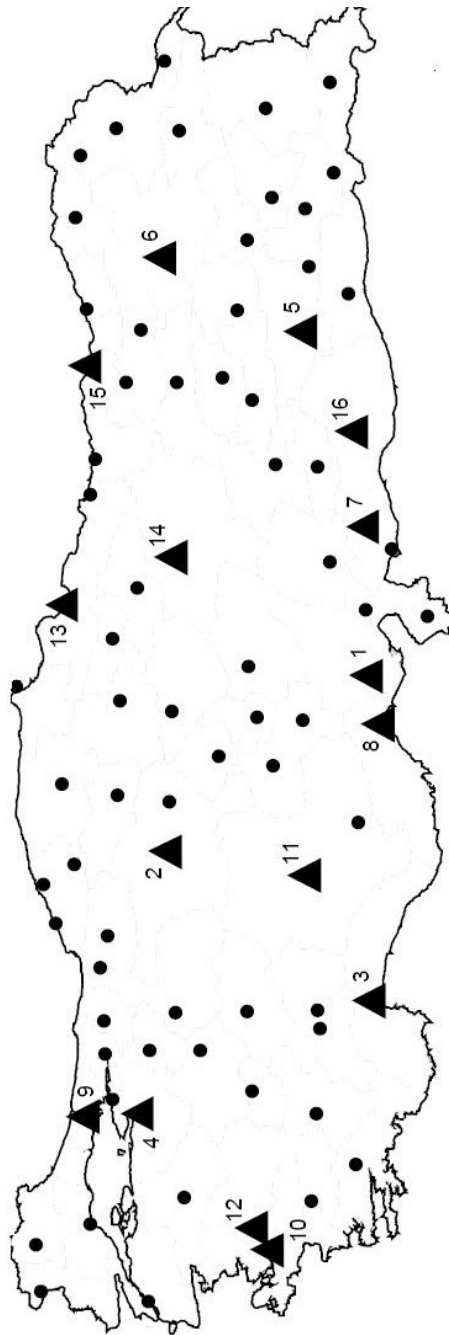


Figure 7: Solid triangles show the hubs whereas solid circles are the demand points