

Design and Application of Inspection System for Mechanics Department

Arçelik Dishwasher Factory

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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.

Contents

1	Introduction	2
2	LaTeX	2
2.1	Including Plots	3
2.2	Further Reading	3
3	Report Format	4
3.1	Margins	4
3.2	Headings	4
3.3	Subheading	4
3.3.1	Sub sub heading	5
3.4	Bulleting and Indexing	5
3.4.1	Bulleting	5
3.4.2	Indexing	5
3.4.3	Figures and Tables	6
3.4.4	Numbers and punctuation marks	7
3.4.5	Common mistakes	8
3.4.6	Bibliography	9
A	Raw Material Flow Chart	11
A.1	Routing Plan Obtained From the Heuristic Method	12
A.2	Sample Report in the User Interface	13
B	Locations of the Distribution Centers	14
	Bibliography	15

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

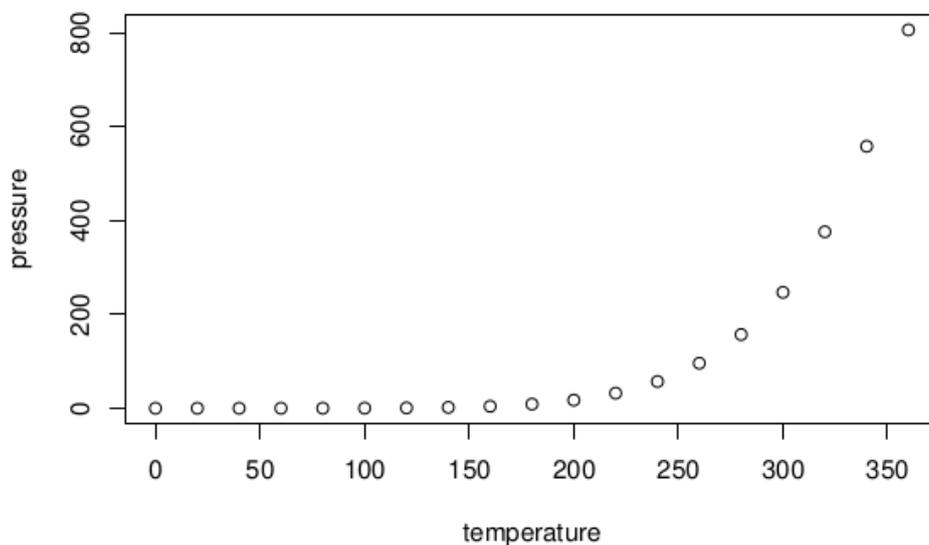


Figure 1: Pressure vs. temperature

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 Further Reading

[Oetiker et al. \(2015\)](#) wrote a short introduction to LaTeX which is a good place to start learning LaTeX. [Wickham and Golemund \(2017\)](#) 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.

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. 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 2 as an example, centered on the table and there should be one empty line before and after the table.

Table 2: 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.

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 2), or in the sentence “as shown in Figure 1”. All the other uses (see table-2, figure: 1) are not correct.

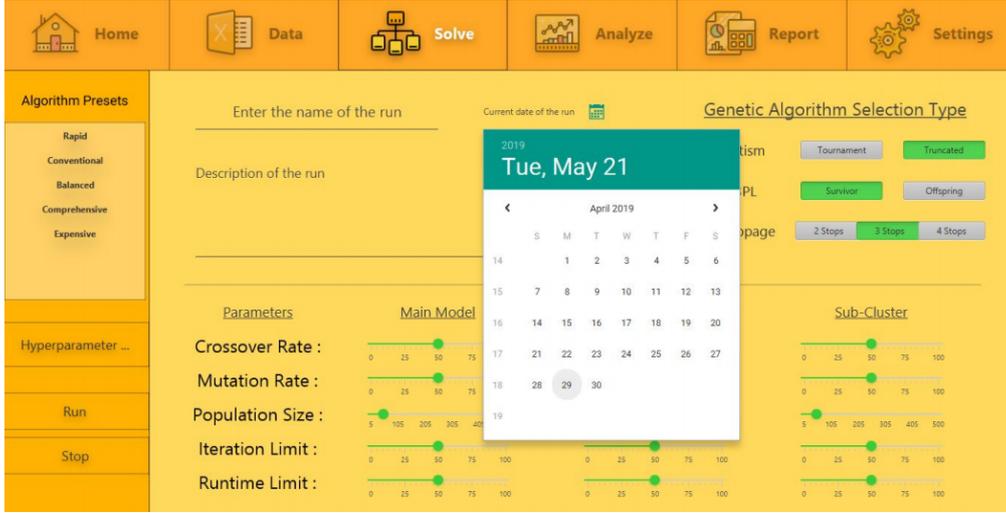


Figure 2: User interface example

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 newsvendor 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):

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

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, starting on a separate page. 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.

Appendices

The Appendix should start 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

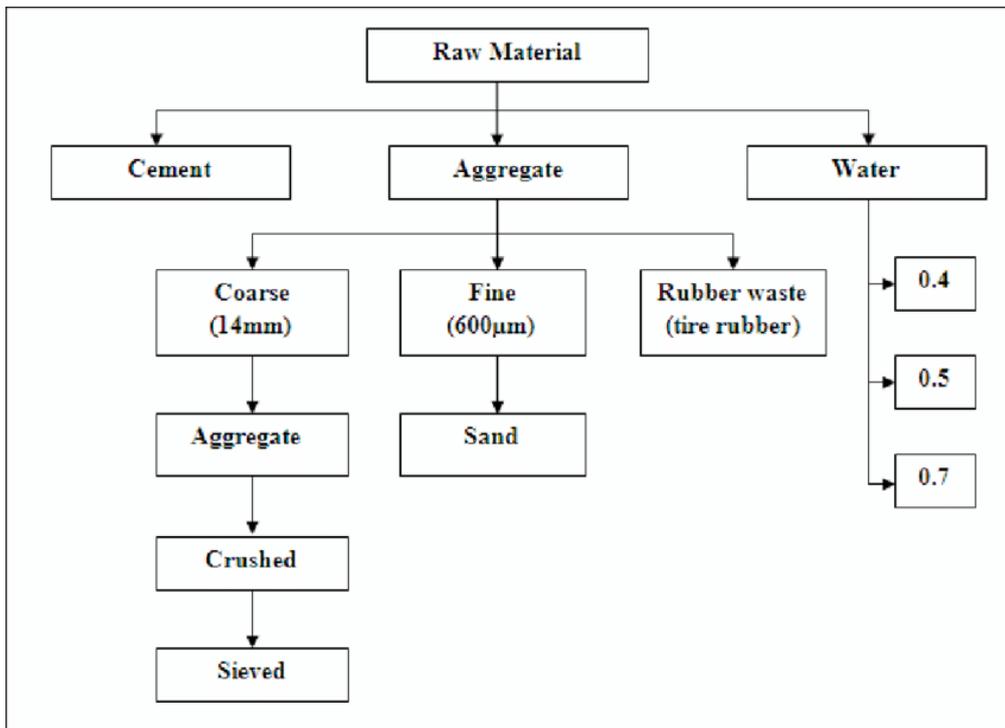


Figure 3: Raw Material Flow Chart shows that ...

A.1 Routing Plan Obtained From the Heuristic Method

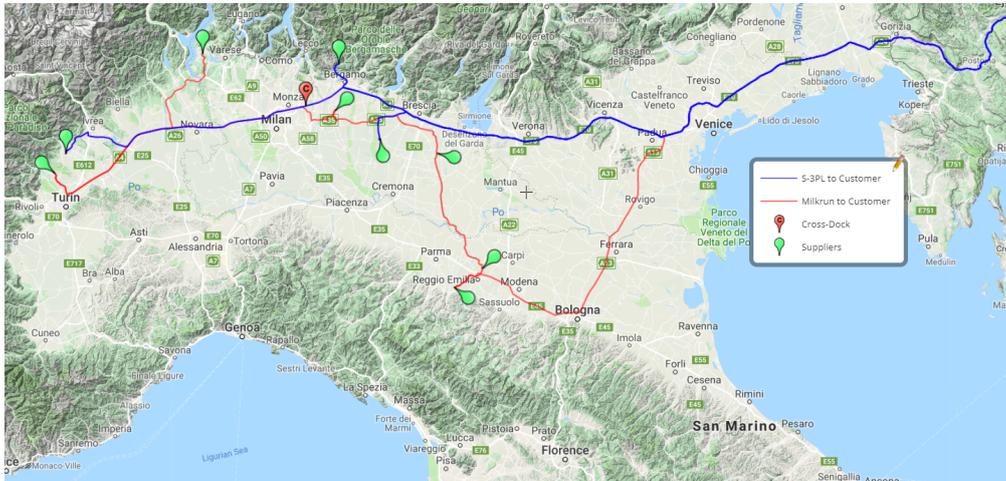


Figure 4: Routing Plan was obtained with the heuristic method developed in Section 3)

A.2 Sample Report in the User Interface

	A	B	C	D	E	
	Supplier Code	Chargeable Weight	Shipment Type	Cumulative Distance if Milkrun (km)	Collection Cost	
1	R151A	134.2656	S-3PL to XDC to TR		234.27	175.6
2	CFNOA	159.84	S-3PL to XDC to TR		167.22	209.4
3	AXQ1D	319.68	S-3PL to XDC to TR		341.955	418.
4	MEQ3A	1478.9943199999998	MR from XDC to TR	252.0		462.4
5	MEQ3A	1185.0	MR from XDC to TR	332.7		405.3
6	G944A	3551.6448	MR from XDC to TR	411.2	1202.76	691.1
7	C97GA	174.0	S-3PL to XDC to TR		241.56	227.6
8	E622D	1150.0	S-3PL to XDC to TR		459.09	1506.
9	Supplier Code	Chargeable Weight	Shipment Type	Cumulative Distance if Milkrun (km)	Collection Cost	
10	R151A	134.2656	S-3PL to XDC to TR		234.27	175.6
11	CFNOA	159.84	S-3PL to XDC to TR		167.22	209.4
12	E622D	1150.0	S-3PL to XDC to TR		459.09	1506.
13	AXQ1D	319.68	S-3PL to XDC to TR		341.955	418.
14	MEQ3A	1478.9943199999998	MR from XDC to TR	252.0		462.4
15	MEQ3A	1185.0	MR from XDC to TR	332.7		405.3
16	G944A	3551.6448	MR from XDC to TR	411.2	1202.76	691.1
17	C97GA	174.0	S-3PL to XDC to TR		241.56	227.6
18	Supplier Code	Chargeable Weight	Shipment Type	Cumulative Distance if Milkrun (km)	Collection Cost	
19	C97GA	174.0	S-3PL to XDC to TR		241.56	227.6
20	AXQ1D	319.68	S-3PL to XDC to TR		341.955	418.
21	MEQ3A	1478.9943199999998	MR from XDC to TR	252.0		462.4
22	MEQ3A	1185.0	MR from XDC to TR	332.7		405.3

Figure 5: This report shows that ...

Figure 6: Connecting with other computers

B Locations of the Distribution Centers

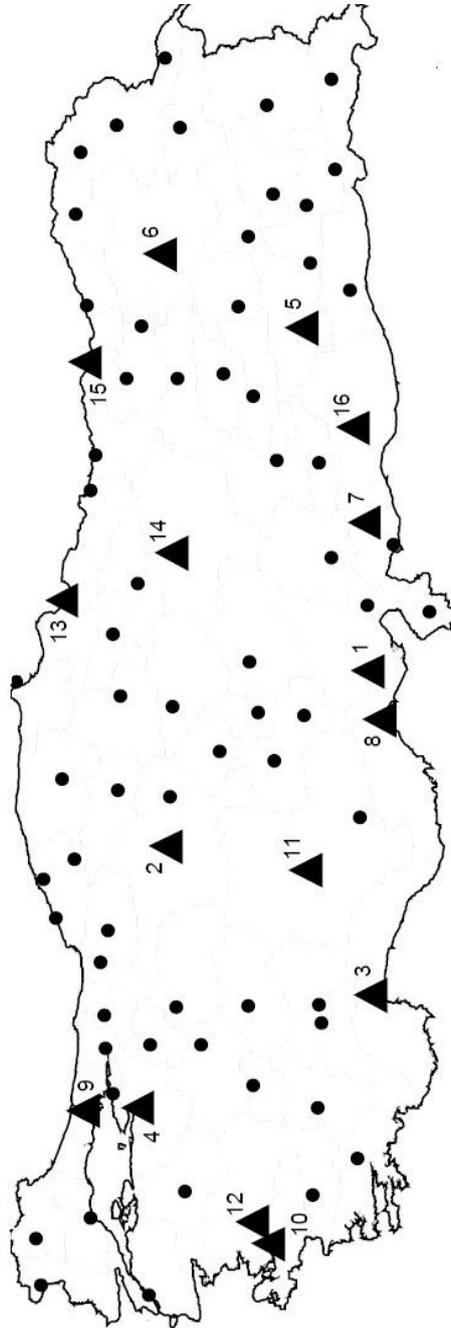


Figure 7: Solid triangles show the hubs whereas solid circles are the demand points

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