ARMEK
Team 10

Mekanik Bölümü için Muayene Sistemi Tasarımı ve Uygulaması

10

Arçelik Bulaşık Makinesi İşletmesi

Proje Ekibi

Kudret Arman, Alper Ayhan, A. Burcu Çolak,
Ali Hüseyin Demirci, Fatih Ergen, Dilek Ölez

Şirket Danışmanları
N. Tanzer Tunçalp
Otomasyon ve Bilgi Sistemleri
Yöneticisi

Akademik Danışman
Dr. Öğr. Üyesi M. Murat Fadıloğlu
Endüstri Mühendisliği Bölümü

ÖZET

Arçelik Bulaşık Makinesi İşletmesi'nde, süreçlerini başarımlarını ve ürünlerin kalitesini ölçen bir sistemin olmayışı, işletmenin üretkenliğini olumsuz etkilemektedir. Projemizin amacı veri kaybını önlemek ve ürün kalitesini ve üretkenliği arttırmak için gerekli kullanılması kolay sistemleri kurulmuştur. Bunun için Microsoft.NET üzerinde VisualBasic.NET programlama dili ve Oracle 9.2 veritabanı beraber kullanılmıştır. Yaptığımız pilot verimlilik çalışmasına göre, kurduğumuz sistem sayesinde üretim zamanından %8 tasarruf edildiği, verimliliğin %3 arttığı görülmüştür.

Anahtar Sözcükler: Arayüz, örgü ergonomi, kalite ve başarım geliştirme, süreç analizi

Design and Application of Inspection System for Mechanics Department

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.

1 Introduction

This document shows how to create tables, figures, refer to them, and cite others' work. Read it along with LaTeX code to learn how to produce the desired format.

1.1 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

1.2 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.
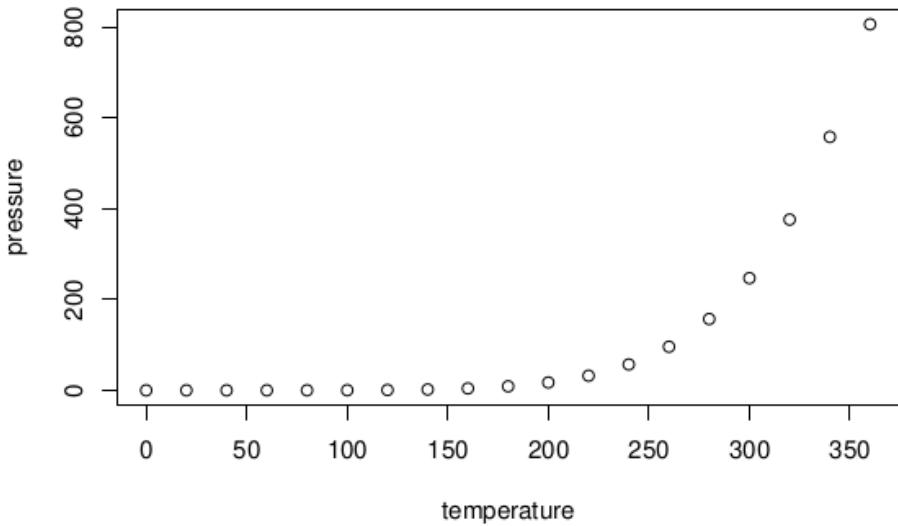
Figure 1: Pressure vs. temperature

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)
2745	(1, 12, 10980)	(1, 13, 8235), (2, 2, 0), (2, 3, 0)
5490	(1, 12, 13725)	(2, 2, 2745), (2, 3, 0)
8235	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0)
10980	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0)
13725	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0)
16470	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0)
19215	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0)
21960	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0)
24705	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0)
27450	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0)
30195	(2, 2, 2745)	(2, 3, 0)
32940	(1, 13, 16470)	(2, 2, 2745), (2, 3, 0)
35685	(1, 13, 13725)	(2, 2, 2745), (2, 3, 0)
38430	(1, 13, 10980)	(2, 2, 2745), (2, 3, 0)
41175	(1, 12, 13725)	(1, 13, 10980), (2, 2, 2745), (2, 3, 0)
43920	(1, 13, 10980)	(2, 2, 2745), (2, 3, 0)
46665	(2, 2, 2745)	(2, 3, 0)
49410	(2, 2, 2745)	(2, 3, 0)
52155	(1, 12, 16470)	(1, 13, 13725), (2, 2, 2745), (2, 3, 0)

Table 2 – continued from previous page

Time (s)	Triple chosen	Other feasible triples
54900	(1, 13, 13725)	(2, 2, 2745), (2, 3, 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

1.3   Including Computer Code Listings

Use lstlisting environment to list codes.

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

```c
#include <stdio.h>
#define N 10
/* Block
 * comment */

int main()
{
        int i;

        // Line comment.
```

```
11                    puts("Hello world!");
12
13                    for (i = 0; i < N; i++)
14                    {
15                            puts("LaTeX is also great
                                  for programmers!");
16                    }
17
18                    return 0;
19            }
```

Anywhere in the report you can refer to a listing by using label assigned to that listing.

1.3.1 A pseudocode example

You can specify the keywords that you want to be typeset bold; see Listing 2, with optional keywords argument to *lstlisting* environment.

Listing 2: 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 respdfla
11 end
```

2   Report Format

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 buIE47xbooklet document class will take care of all these and the remaining formatting requirements.

2.1   Margins

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.

2.2 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.

2.3 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.

2.3.1 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.

2.4 Bulleting and Indexing

2.4.1 Bulleting

Use `itemize` and `enumerate` environments to create bullet and enumerated lists, respectively. *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.

  1. Measuring the molds in which the products are produced, in line with the expectations of the enterprise.

2. 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.

2.4.2   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.

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.
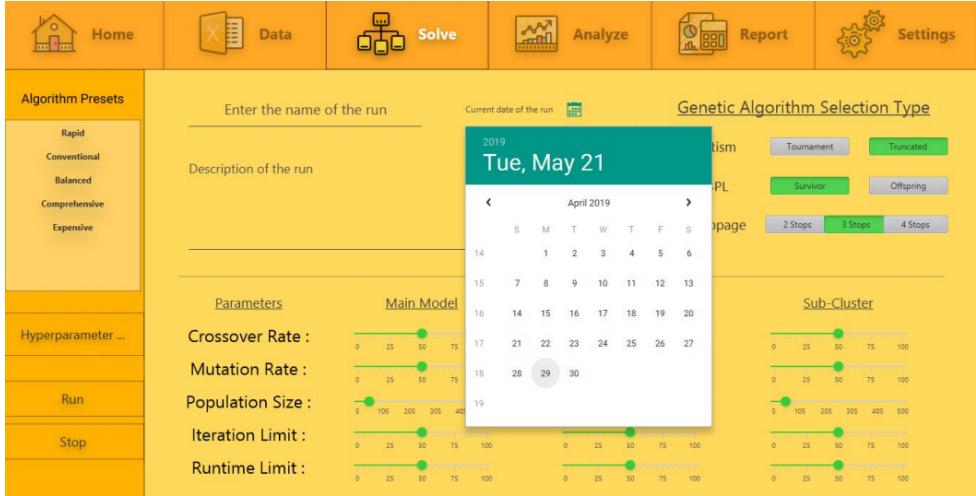
Figure 2: User interface example

2.4.3 Mathematical expressions

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):

$$
\begin{aligned}
\text{Maximize} \quad & S_1 x_1 + S_2 x_2 && \text{(maximize the revenue)} \\
\text{s.t} \quad & \\
& x_1 + \quad x_2 \le L && \text{(limit on total area)} \\
& F_1 x_1 + F_2 x_2 \le F && \text{(limit on fertilize)} \\
& P_1 x_1 + P_2 x_2 \le P && \text{(limit on pesticide)} \\
& x_1 \ge 0, x_2 \ge 0 && \text{(cannot plant a negative area)}.
\end{aligned}
$$

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

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

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

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

$$\text{s.t.}$$

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

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

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

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.

2.4.4 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.**

2.4.5 Index

At the end of the booklet, there will be an index of **concepts, terms, algorithms, software**, etc. used by the projects along with page numbers

for the readers to easily reach to the places where they are presented. Do not forget to contribute to the index.

To add a term and page number to the index, all you have to do is to insert `\index{<index-key>}` into your document near the place where the `<index-key>` is mentioned, defined, or discussed. Check the last page of this report for examples.

If you have used *minimum spanning tree algorithm*, for example, in your project, then add `\index{algorithm!minimum spanning tree}` near the place where you describe the algorithm and/or how you have used it. The key *minimum spanning tree* and page number will appear under key *algorithm* in the index (check the last page of this report).

If you used *Excel, Python, R, Stan, SQL*, etc to implement your solutions, then near the place where you describe your implementations add `\index{software!Excel}`, `\index{software!Python}`, and so on.

If you have used forecasting methods *arima, ETS, Holt, Holt-Winters*, add `\index{forecasting!arima}`, `\index{forecasting!ETS}`, etc.

For database systems *MS Access, SQLite* add `\index{database!MS Access}`, `\index{database!SQLite}`; .

Some other key term examples (not exhaustive):

- information systems: *MRP, SAP*,

- programming: linear, mixed integer, nonlinear, dynamic, goal, conic quadratic mixed-integer program

- algorithms: shortest path, Wagner-Whitin, genetic, apriori, analytical hiearchy processes (AHP)

- model: stochastic, mathematical

- optimization: CPLEX, Gurobi, GAMS, Xpress, open-solver

- data analysis: linear regression, anova, logistic regression, kNN, SVM, Naive Bayes, clustering, deep learning, neural network, apiori algorithm

- quality control: Shewart chart

- problem: line balancing, assignment, vehicle routing, scheduling, team formation, p-median

- system: inventory management, supply chain, transportation, FMCG,

- inventory: safety stock, kardex,

- forecasting: sarima, intermittent demand, Croston, seasonality, MASE, MAPE, MAE, MSE

- scheduling: annual leave,

- production planning

- supply chain: milk run, network optimization

- management: disaster

- constraint: subtour elimination, annual leave

- terms: cycle time, , milk run, bill of materials, configuration change, omni-channel retailing, distribution network design, fashion industry

Bibliography

Freimer, M. (2002). User's Guide for the amsmath Package.

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.

Wikipedia Contributors (2019a). Linear programming — Wikipedia, The Free Encyclopedia. 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 [Online; accessed 17-October-2019].

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

Appendices 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.

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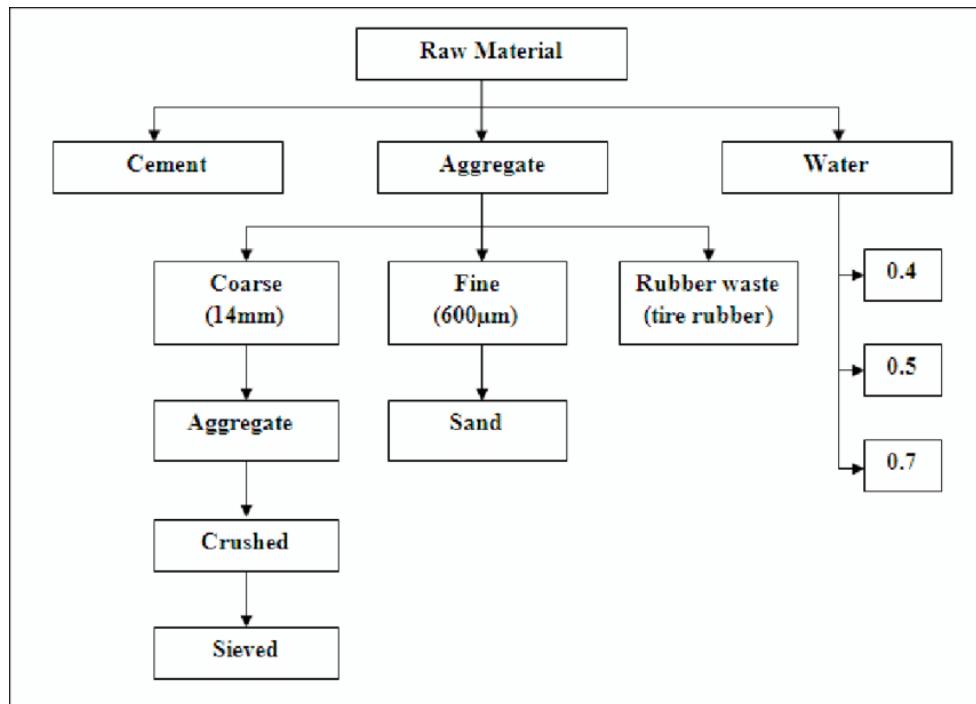
Figure 3: Raw Material Flow Chart shows that ...

B   Locations of the Distribution Centers
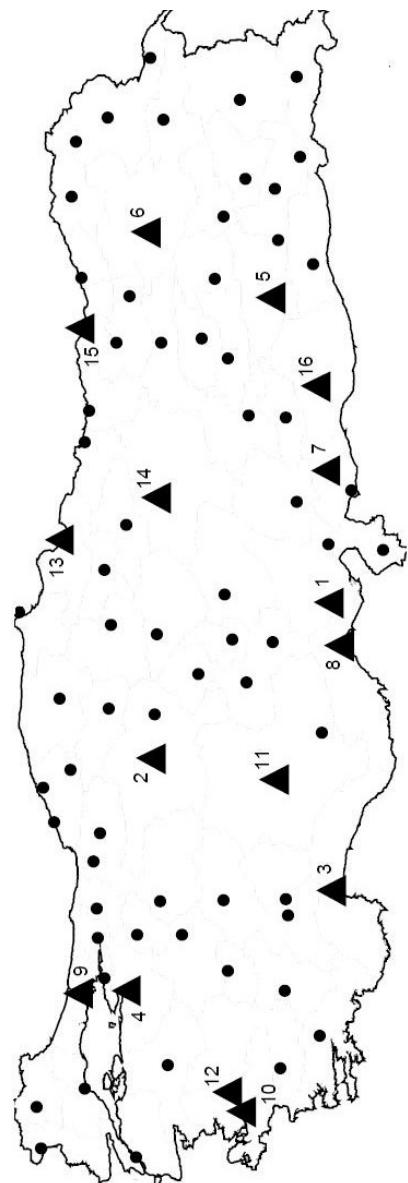
Figure 4: Solid triangles show the hubs whereas solid circles are the demand points

See İçöz et al. (2006).

Index