AIN SHAMS UNIVERSITY FACULTY OF ENGINEERING COMPUTERS AND SYSTEMS ENGINEERING DEPARTMENT

SIMULATION IN INDUSTRY

Y Line

BY

MAYSSA ABDEL FATTAH BL KAFAFI
(B.Sc. Electrical engineering - electronics and communications)
(Cairo University)

A Thesis
Submitted in partial fulfillment
of the requirements for the degree of
MASTER OF SCIENCE
IN COMPUTERS AND SYSTEMS ENGINEERING

621.392

M.A

Supervised by

Prof.Dr. OSMAN ABDEL LATTIF BADR
Professor in Computers and Systems Engineering Department
Faculty of Engineering, Ain Shams University, Cairo.

Dr. EL SAYED ALI EL SAYED EL SAKKA Doctor engineer consultant

> Cairo, Egypt 1994

91971



بسم الله الرحمن الرحيم



صحق الله العظيم

Examiners Committee

1- Prof. Dr. Mohamed Zaki Abdel Meguid

Professor in computers and systems Eng. Dept. Faculty of Engineering, El Azhar University, Cairo.

2- Prof. Dr. Abdel Monem Abdel Zaher Wahdan

Professor in computers and systems Eng. Dept. Faculty of Engineering,
Ain Shams University, Cairo.

3- Prof. Dr. Osman Abdel Lattif Badr

Professor in computers and systems Eng. Dept. Faculty of Engineering,
Ain Shams University, Cairo.

4- Dr. El-Sayed Aly El-Sayed El-Sakka

Associate Professor

Higher Technological Institute, 10th of Ramadan,

Dept. of Electronicis & Computer Tech.

Signature

f. Al

Dushale

Andrew Joseph ...

Date: 2/11/1994

AKNOWLEDGEMENT

I would like to take this opportunity to thank every one help or advise me during my work in this thesis.

I am deeply indebted to Prof.Dr. Osman Badr, Computers and Systems Engineering department, Faculty of Engineering, Ein Shams University, for his encouragement, unwearied efforts, and his generous devoting of time and effort throughout all the stages of this thesis.

I would like also to express my thanks to Dr. El Sayed El Sakka, Part-time Dr., for his kind assistance and generous help during this work.

I owe my greatest debt of gratitude to Prof.Dr. Mohamed Adeeb Ghoneimy, Computers and Systems Engineering department, Faculty of Engineering, Ein Shams University, for his generous help, interest, beneficial advices, encouragement at various stages in the preparation of the thesis.

Without them, it is doubtful whether this thesis would have seen the light of day.

Much gratitudes are due to the Computers and Systems Engineering faculty staff for their cooperation during the work.

I am deeply thankful to all technical and administration staff of Computers and Systems engineering department, Faculty of Engineering, Ein Shams University for their help during this work.

STATEMENT

This dissertation is submitted to Ain Shams University for the degree of master of Science

in Computer and Systems engineering.

The work included in this thesis was carried out by the author in the Department of

Computers and Systems Engineering, Ein Shams University, from October 1992 to October

1994.

No part of this Thesis has been submitted for a degree or a qualification at any other

University or Institution .

Reprints from this Thesis may be made on conditions that the full title of the Thesis,

name of author, page reference, and date of publication are given.

Date : 2/11/1994

Name : Mayssa A. Fattah El Kafafi

Signature: Mayson Abdel Fatter El Refahi

VIIA

Name

: Mayssa Abdel Fattah El Kafafi

Nationality

: Egyptian

Present position

: Outside researcher

Degrees awarded

: B.Sc. in Electrical Engineering,

Electronics & Communications section,

Faculty of Engineering,

Cairo University.

Date

: 2/11/1994

Name

: Mayssa A. Fattah El Kafafi

Signature: May Sa. Abolel Fattah El Kafah

TABLE OF CONTENTS

ABSTRACT		1
INTRODUCTIO	ON	3
CHAPTER I	: LITERATURE REVIEW, TECHNIQUES AND TOOLS	7
1.1 GOO	DONESS OF FIT STATISTICAL HYPOTHESIS TEST	7
1.	.1.1 CHI-SQUARE TESTS	7
1.	1.2 KOLMOGOROV SIMOGOROV TESTS	l0
1.2 RAN	DOM NUMBER GENERATORS (RNG)	11
1.	2.1 PROPERTIES OF A GOOD ARITHMETIC RNG	12
1.3 SELI	ECTING INPUT PROBABILITY DISTRIBUTIONS	13
1.	.3.1 SELECTING A DISTRIBUTION IN THE ABSENCE OF DATA	13
1	.3.2 MAXIMUM LIKELIHOOD ESTIMATOR (MLE)	16
	1.3.2.1 PROPERTIES OF MLE	16
	1.3.2.2 REASONS FOR CONSIDERING MLE	17
1	.3.3 GENERAL PROPERTIES OF A DISTRIBUTION FUNCTION	18
1.4 CON	VITIOENCE INTERVAL & GENERATION OF RANDOM VARIATES	19
1	.4.1 CORRECT INTERPRETATION OF CONFIDENCE INTERVAL	21
1	.4.2 INVERSE TRANSFORM METHOD	21
1.5 STA	TISTICAL VALIDATION TEST	22
1	.5.1 INSPECTION APPROACH	23
1	.5.2 CONFIDENCE INTERVAL APPROACH	23
1	.5.3 TIME SERIES APPROACH	23
1	.5.4 SPECTRAL ANALYSIS APPROACH	24