

**SOME CONTRIBUTIONS TO RANKING AND SELECTION  
PROCEDURES IN RELIABILITY AND PAIRED COMPARISON  
DESIGNS**

**VINAY MAITRI**

**DEPARTMENT OF MATHEMATICS  
INDIAN INSTITUTE OF TECHNOLOGY, DELHI**

A THESIS ON  
SOME CONTRIBUTIONS TO RANKING AND SELECTION PROCEDURES  
IN RELIABILITY AND PAIRED COMPARISON DESIGNS

By  
VINAY MAITRI  
Department of Mathematics  
Indian Institute of Technology  
New Delhi

Submitted to the Indian Institute of  
Technology, New Delhi for the award  
of the Degree of Doctor of Philosophy  
in Mathematics

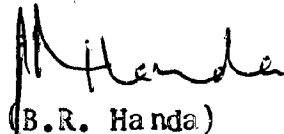
JANUARY, 1982

DEDICATED  
TO  
ALMIGHTY SHIVA

C E R T I F I C A T E

This is to certify that the thesis entitled 'Some Contributions To Ranking And Selection Procedures In Reliability And Paired Comparison Designs' which is being submitted by Mr. Vinay Maitri for the award of Degree of Doctor of Philosophy to the Indian Institute of Technology, Delhi, is a record of bonafide research work carried out by him under my guidance and supervision.

The thesis has reached the standard fulfilling the requirement of the regulations relating to the degree. The results obtained in this thesis have not been submitted to any other University or Institute for the award of any degree or diploma.



(B.R. Handa)

Assistant Professor  
Department of Mathematics  
Indian Institute of Technology  
Hauz Khas, New Delhi-110016

## A C K N O W L E D G E M E N T S

It gives me great pleasure to express my deep sense of gratitude to Dr. B.R. Handa, Assistant Professor, Department of Mathematics, Indian Institute of Technology, Delhi for suggesting me the subject of this thesis and for his constructive guidance and supervision throughout the preparation of this thesis.

I express my regards to Professor M.K. Jain, Head, Computer Centre, for providing me facility of using computer.

I am thankful to Professor H.L. Manocha, Head, Department of Mathematics, Professor C.P. Jain, Director, Indian Institute of Technology, Delhi for providing me necessary research facilities and financial help to complete this work.

I will be failing in my duty if I don't gratefully acknowledge the inspiration from my parents and brother during the period of this work.

A word of thanks are also due to my friends K.S. Scariah and V.K. Jain for extending their cooperation.

Finally I thank Mr. D.R. Joshi for his neat and clean typing.

*Vinay Maitri*  
(Vinay Maitri)

# C O N T E N T S

CHAPTER		Page
	SYNOPSIS	
I	INTRODUCTION	1
	1.1	1
	1.2	6
	1.3	11
	1.4	14
	1.5	19
	1.6	33
	1.7	37
	1.8	43
	1.9	44
	<u>PART - I</u>	
II	SELECTION PROCEDURE FOR EXPONENTIAL FAILURE DISTRIBUTION USING DIFFERENT SAMPLING SCHEMES	46
	2.1	46
	2.2	47
	2.3	73
III	SELECTION PROCEDURE FOR THE POINT AVAILABILITY IN AN ALTERNATING POISSON PROCESS	98
	3.1	98
	3.2	99
	3.3	107
	3.4	116

IV	SELECTION PROCEDURE FOR IFR POPULATIONS USING DIFFERENT SAMPLING SCHEMES	123
4.1	Introduction	123
4.2	A Subset Selection Procedure Using SSI	124
4.3	A Subset Selection Procedure Using SSII	134
4.4	A Subset Selection Procedure Using SSIII	138
4.5	Comparison And Conclusion	143

V	SELECTION PROCEDURE FOR t-BEST OUT OF k POPULATIONS	146
5.1	Introduction	146
5.2	A Subset Selection Procedure For Scale Type Parameter	146
5.3	The Probability of Correct Selection	147
5.4	A Subset Selection Procedure For Location Type Parameters	159
5.5	The Probability of Correct Selection	166
5.6	Applications In Selecting the IFR Populations	167

PART - II

VI	SELECTION PROCEDURE USING KNOCKOUT PAIRED COMPARISON DESIGN	172
6.1	Introduction	172
6.2	The Paired Comparison Tournament Design And The Selection Rule	172
6.3	The Probability of Correct Selection	175
6.4	Special Case - $T_2(2)$ Tournament of 4 players	188
6.5	Expected Number of Games	196
6.6	Numerical Comparison	201

VII	SELECTION PROCEDURE USING STANDARD PAIRED COMPARISON DESIGN	210
7.1	Introduction	210
7.2	The Standard Paired Comparison Design	210
7.3	A Subset Selection Rule For Goal I	213
7.4	A Subset Selection Rule For Goal V	227
	BIBLIOGRAPHY	230
	BIG-DATA	254