



# **Empirical Evaluation of Modified Dynamic Time Quantum Round Robin Scheduling**

**Dissertation**

**Submitted To:**

Central Department of Computer Science & Information Technology

**Tribhuvan University**

Kirtipur, Kathmandu

Nepal

In partial Fulfillment of the requirements for the Degree of Master of Science in  
Computer Science & Information Technology

Submitted by:

**Shiv Shankar Pant**

September, 2015

Supervisor

**Mr. Arjun Singh Saud**



**Tribhuvan University**

**Institute of Science and Technology**

**Central Department of Computer Science and Information Technology**

### **Student's Declaration**

I hereby declare that I am the only author of this work and that no sources other than the listed here have been used in this work.

.....

**Shiv Shankar Pant**

**Date: 10 September, 2015**



**Tribhuvan University**

**Institute of Science and Technology**

**Central Department of Computer Science and Information Technology**

### **Supervisor's Recommendation**

I hereby recommend that the dissertation prepared under my supervision by **Mr. Shiv Shankar Pant** entitled “**Empirical Evaluation of Modified Dynamic Time Quantum Round Robin Scheduling**” be accepted as in fulfilling partial requirement for the completion of Masters Degree of Science in Computer Science & Information Technology.

-----  
**Mr. Arjun Singh Saud**

Lecturer,  
Central Department of Computer Science and Information Technology,  
Institute of Science and Technology,  
Kirtipur, Kathmandu, Nepal

**Date: 10 September, 2015**



**Tribhuvan University**

**Institute of Science and Technology**

**Central Department of Computer Science and Information Technology**

**LETTER OF APPROVAL**

We certify that we have read this dissertation work and in our opinion it is appreciable for the scope and quality as a dissertation in the partial fulfillment of the requirements of Masters Degree of Science in Computer Science & Information Technology.

**Evaluation Committee**

---

**Asst. Prof. Nawaraj Paudel**  
**Head of Department**  
Central Department of Computer Science  
& Information Technology  
Tribhuvan University  
Kirtipur

---

**Mr. Arjun Singh Saud**  
**Lecturer**  
Central Department of Computer Science  
and Information Technology  
(Supervisor)

---

---

---

---

**(External Examiner)**

**(Internal Examiner)**

**Date:**

## **Acknowledgement**

First and foremost, I would like to express my gratitude to my supervisor, Mr. Arjun Singh Saud faculty member of Central Department of Computer Science and Information Technology who have helped me from beginning of my master degree up to this point and I hope it will continue up to my academic life. This thesis would not have been possible without his guidance, support, and endless patience.

Most importantly I would like to thank all my respected teachers of CDCSIT (TU) Asst. Prof. Nawaraj Paudel (HOD), Prof. Dr.Shashidharram Joshi, Prof. Dr.Subarna Sakya, Prof.Dr.Arun Timilshina, Mr.Dheeraj Kedar Pandey, Mr.Jagdish Bhatta, Mr.Min Bahadur Khati, Mr.Sarbin Sayami, Mrs.Lalita Sthapit, Mr.Bikash Balami, Mr.Bishnu Gautam and Mr.Tej Bhadur Shahi for providing me such a broad knowledge and inspirations.

My special thanks goes to my seniors Mr.Dipak Prasad Bhatt for his valuable support and guidance and my friends Mr. Harisharan Bhatt, Mr.Panch Dev Bhatt, Mr. Pukar Shakya, Mr.Yub Raj Dahal, Mr.Top Bahadur Pun, Mr.Santosh Ghimere, and Mr.Rajesh Pandey for their endless help during my master's study period. I am also thankful to all the peoples who have helped me directly or indirectly in completion of this work.

I am grateful toward my department (CDCSIT) of TU for providing this opportunity because it is beneficial for every student to being mature in his/ her field of study.

I have completed this work as I can do. All the future recommendations and suggestions are always welcomed.

Finally, I would like to thank my parents who always support me in every stage of my life, my brothers GD Pant, Krishnanand Pant, Pankaj Pant, Kishor Joshi and sisters Sunita, and Usha for their help, love and care.

.

## **Abstract**

There are number of scheduling algorithms used in computer system today. They all have their own characteristics. Thus selection of the particular scheduling algorithm depends upon the need of the system. One of the most widely used scheduling algorithms in multiprogramming operating system is round robin. Round robin scheduling algorithm is most widely used scheduling algorithm in multitasking and real time environment. In RR scheduling the time quantum play a very important role, because if time quantum is very large then RR scheduling algorithm is same as the FCFS scheduling. If the time quantum is extremely too small then the number of context switches is very high. In recent days there is more research in dynamic quantum scheduling policies that can adopt automatically according to nature of incoming jobs. "Dynamic time quantum RR scheduling algorithm" is based on 'Q' which is the quantum for one complete round and 'n' number of jobs in ready queue. This research work modifies the quantum selection strategy in case of fraction (f) of jobs finished in previous round of round robin scheduling algorithm and the value of f is checked with 6.25%. If f is greater than or equal to 6.25% then the quantum value is decreased and if f is less than 6.25% then the quantum value is increased. And at last, experimentally verifies that modified algorithm policy gives better performance than dynamic time quantum RR scheduling policy by reducing number of context switches, average waiting time and average turnaround time.

Keywords: RR scheduling, CPU scheduler, Dynamic quantum, Static quantum, context switches, AWT, ATT

## **Table of Contents**

### **CHAPTER 1 INTRODUCTION**

<b>Details</b>	<b>Page No.</b>
1.1 Introduction	1
1.2 Motivation	1-2
1.2.1 Dynamic Quantum Approaches	2-3
1.3 Performance Metrics	3-5
1.4 Problem Statement	5
1.5 Objective	6
1.6 Thesis Organization	6

### **CHAPTER 2 BACKGROUND AND LITERATURE REVIEW**

2.1 Background	7
2.1.1 Multiprogramming	7-8
2.1.2 The Process Model	9
2.1.3 Process State	9-8
2.1.4 CPU and I/O-bound processes	10-11
2.1.5 CPU Scheduling Algorithm	11
2.1.6 Categories of Scheduling Algorithms	11-12
2.1.7 Stages of Scheduler	13-14
2.2 Literature Review	15
2.2.1 FCFS Scheduling Algorithm	15
2.2.2 RR Scheduling Algorithm	15
2.2.3 WRR Scheduling Algorithm	15-16
2.2.4 VRR Scheduling Algorithm	16
2.2.5 VTRR Scheduling Algorithm	16
2.2.6 SARR Scheduling Algorithm	16

2.2.7 DQRR Scheduling Algorithm	17
2.2.8 IRR Scheduling Algorithm	17
2.2.9 TPBCS Algorithm	17-18
2.2.10 AMRR Scheduling Algorithm	18
2.2.11 MMRR Scheduling Algorithm	18
2.2.12 MDTQRR Scheduling Algorithm	18
2.2.13 Finding Time Quantum of RR CPU Scheduling Algorithm using Integer programming	18

### **CHAPTER 3**

#### **ALGORITHM STUDIED**

3.1 Algorithm Study Framework	19
3.2 Studied Algorithm	19
3.2.1 Dynamic Time Quantum RR Scheduling	19-20
3.2.2 MDTRR Scheduling Algorithm	20-21
3.3 Illustration	21-22

### **CHAPTER 4**

#### **IMPLEMENTATION**

4.1 Tools Used	23
4.1.1 Programming Language	23
4.2 Data Structure Used	23
4.2.1 List	23
4.3 Algorithms and Flowchart taken in this dissertation	24
4.3.1 Pseudo code for DTRR Scheduling Algorithm	24-25
4.3.2 Flowchart for DTRR Scheduling Algorithm	26



4.3.3 Pseudo code for MDTRR Scheduling Algorithm	27-28
4.3.4 Flowchart for MDTRR Scheduling Algorithm	29

## CHAPTER 5

### DATA COLLECTION AND ANALYSIS

5.1 Test Case Design	30
5.1.1 Test Case 1	30
5.1.2 Test Case 2	30
5.1.3 Test Case 3	30
5.2 Data Collection and Analysis	31
5.2.1 For Test Case 1	31-34
5.2.2 For Test Case 2	34-37
5.2.3 For Test Case 3	38-41

## CHAPTER 6

### CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion	42
6.2 Recommendation	43
<b>References</b>	<b>44-45</b>

#### List of figures

Fig. no.	caption	page no.
Fig. 2.1	Memory Layout for a multiprogramming system	8
Fig. 2.2	Process execution in Pseudo-parallelism	9
Fig. 2.3	Process state diagram	10
Fig. 2.4	Queuing diagram for scheduling	14
Fig. 3.1	Gantt chart for DTRR	22
Fig. 3.2	Gantt chart for MDTRR	22

Fig. 4.1 Structure of list	23
Fig. 4.2 Flowchart of DTRR	26
Fig. 4.2 Flowchart of MDTRR	29
Fig. 5.1 Graph for Table 5.1	32
Fig. 5.2 Graph for Table 5.2	33
Fig. 5.3 Graph for Table 5.3	33
Fig. 5.4 Graph for Table 5.4	36
Fig. 5.5 Graph for Table 5.5	36
Fig. 5.6 Graph for Table 5.6	37
Fig. 5.7 Graph for Table 5.7	39
Fig. 5.8 Graph for Table 5.8	40
Fig. 5.9 Graph for Table 5.9	40

### List of Tables

<b>Table no.</b>	<b>caption</b>	<b>page no.</b>
Table 3.1	Data in random order	21
Table 3.2	Comparison table DTRR and MDTRR	22
Table 5.1	Input processes are taken in 20 to 200 and their burst time ranges in between 25 to 200	31
Table 5.2	Input processes are taken in 20 to 200 and their burst time ranges in between 200 to 500	31
Table 5.3	Input processes are taken in 20 to 200 and their burst time ranges in between 500 to 1000	32
Table 5.4	Input processes are taken in 50 to 500 and their burst time ranges in between 200 to 500	34
Table 5.5	Input processes are taken in 50 to 500 and their burst time ranges in between 500 to 700	35
Table 5.6	Input processes are taken in 50 to 500 and their burst time ranges in between 700 to 1000	35

Table 5.7 Input processes are taken in 100 to 1000 and their burst time ranges in between 200 to 500	38
Table 5.8 Input processes are taken in 100 to 1000 and their burst time ranges in between 500 to 700	38
Table 5.9 Input processes are taken in 100 to 1000 and their burst time ranges in between 700 to 1000	39

## List of Abbreviations

AMRR	-	Average Max Round Robin
ATT	-	Average Turnaround Time
AWT	-	Average Waiting Time
CPU	-	Central Processing Unit
CS	-	Context Switch
CTQ	-	Changeable Time Quantum
DQRR	-	Dynamic Quantum with Re-Adjusted Round Robin
DTRR	-	Dynamic Time Quantum Round Robin
EMP	-	Empty
FCFS	-	First Come First Service
IRR	-	Improved Round Robin
I/O	-	Input and Output
MDTQRR	-	Multi-Dynamic Time Quantum Round Robin
MDTRR	-	Modified Dynamic Time Quantum Round Robin
MOS	-	Multiprogramming Operating System
RR	-	Round Robin
SARR	-	Self Adjusted Round Robin
SJF	-	Shortest Job First
TPBCS	-	Two Processor Based CPU Scheduling
VRR	-	Virtual Round Robin
VTRR	-	Virtual Time Round Robin
WRR	-	Weighted Round Robin