Practical Workbook
CS-428
Parallel and Distributed Computing

Name   : _____

Year   : _____

Batch   : _____

Roll No   : _____

Department: _____

Department of Computer & Information Systems Engineering
NED University of Engineering & Technology

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Parallel and Distributed Computing

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INTRODUCTION

This workbook has been compiled to assist the conduct of practical classes for CS-428 Parallel and Distributed Computing. Practical work relevant to this course aims at providing students a chance to write parallel algorithms and their programming on shared and distributed memory environments. Parallel and distributed computing is considered to be one of the most exciting technologies to achieve prominence since the invention of computers. The pervasiveness of computing devices containing multicore CPUs and GPUs, including home and office PCs, laptops, and mobile devices, is making even common users dependent on parallel processing. Certainly, it is no longer sufficient for even basic programmers to acquire only the traditional sequential programming skills. The preceding trends point to the need for imparting a broad-based skill set in parallel and distributed computing technology. However, the rapid changes in computing hardware platforms and devices, languages, supporting programming environments, and research advances, poses a challenge both for newcomers and seasoned computer scientists. Programming a parallel and distributed system is not as easy as programming single processor systems. There are many considerations like details of the underlying parallel system, processors interconnection, concurrency, transparency, heterogeneity and selection of appropriate platform which makes the programming of parallel and distributed systems more difficult.

The Course Profile of CS-428 Parallel and Distributed Computing lays down the following Course Learning Outcome:
"Examine existing techniques for parallel & distributed computing (C3, PLO-2)"
"Analyze parallel and distributed computing solutions for their pros and cons (C4, PLO-4)"
Lab sessions 1, 2, 3, 7, 8, 9, 11, 12, 13, and 14 of this workbook have been designed to assist the achievement of the CLO-1. While lab sessions 4, 5, 6, and 10 have been designed for CLO-2. A rubric to evaluate student performance has been provided at the end of the workbook.

Part one of this lab manual is based on shared memory programming. It deals with the programming of both the SIMD and multicore systems respectively. The shared memory programming is done by using openmp programming model. The first lab gives a basic introduction to openmp API. Lab session 2, 3 and 4 deals with openmp work sharing constructs and performance analysis of real world applications. Lab session 5 and 6 enables the exploitation of vector processing units present in General Purpose Processors (GPPs) by

performing SIMD programming using openmp. Part two of this workbook deals with distributed programming. Lab session 7 gives an introduction to MPI programming model. It is followed by lab session 8 which introduces the MPI communication operations. In lab session 9 MPI collective operations are explored whereas lab session 10 discusses the programming of real world applications using MPI. Apart from covering MPI for distributed memory programming, this workbook also covers some other paradigms. Lab session 11 and 12 deal with socket programming in Linux. Java RMI is covered in lab session 13 and implementation of web service using Restful API is discussed in lab session 14.

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