Practical Workbook
CS-437
Parallel Programming

Name : _____

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Roll No : _____

Department: _____

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

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February 2023

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INTRODUCTION

This workbook has been compiled to assist the conduct of practical classes for CS-437 Parallel Programming. It aims at providing students a chance to write parallel algorithms and their programming on shared and distributed memory environments. The pervasiveness of computing devices containing multicore central processing units (CPUs) and graphical processing units (GPUs), including home and office personal computers, 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, 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. Considerations like details of the underlying parallel system, processors interconnection, concurrency, transparency, heterogeneity and selection of appropriate platform which makes parallel programming more challenging as well as exciting.

The Course Profile of CS-437 Parallel Programming lays down the following Course Learning Outcome: **"Practice** programs for parallel computing systems (C3, PLO-5)"
All lab sessions of this workbook have been designed to assist the achievement of the above CLO. 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 single instruction multiple data (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 application programming interface (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 message passing interface (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.

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