Adoptions and Outcomes of NSF/IEEE TCPP PDC Curriculum at College of Staten Island

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Abstract

The Department of Computer Science at College of Staten Island, City University of New York, has been offering three different levels of PDC courses: lower undergraduate level, upper undergraduate level, and graduate level. After examining all our Parallel and Distributed Computing (PDC) courses and comparing them with NSF/IEEE TCPP Curriculum initiatives, we proposed some modifications to our current curriculum. We have gradually experimented and implemented those ideas in our PDC related curriculum. The modifications on some courses have been introduced. In this poster, we will mainly focus on the new developed PDC course Shared Memory Programming and some results we have achieved.

HPC Facilities

System	Type	Job Mix	Nodes	Cores /node	Memory /node	Memory /core	Chip type
ANDY	Cluster	64 or fewer cores	93	8	24 Gbytes	3 Gbytes	Nehalem (2.93 GHz)
APPEL	SMP		1	384	12 Tbytes	NA	Ivy Bridge (3.0 GHz)
BOB	Cluster	Gaussian	28	8	16 Gbytes	2 Gbytes	AMD Barcelona
KARLE	SMP	Interactive and batch for some applications	1	24	96 Gbytes	NA	Penryn (2.4 GHz)
PENZIAS	Cluster	128 or fewer cores	60	12	48 Gbytes	4 Gbytes	Sandy Bridge (2.2 GHz)
		4 cores/GPU	60	4 cores and 2 GPUs	16 Gbytes		NVIDIA K20 GPUs
SALK	Cluster	1024 or fewer cores	176	16	32 Gbytes	2 Gbytes	AMD Magny-cour (2.3 GHz)

CSC 4XX Shared Memory Programming

1.Goals and Assessment

GOALS	ASSESSMENT
Understanding shared memory parallel computer architecture	The part I of each homework assignment will be focused on the fundamental concepts.
Learning how to program OpenMP	Programming assignment 1 on parallel computers
Learn GPU programming	Programming assignment 2 on parallel computers
Effectively modify or extend the classic algorithms to solve variants of problems	Corresponding homework problems will be served on assessing students' such ability.
Able to analyze the correctness and performance of an OpenMP or GPU program	Corresponding homework problems will be served on assessing students' such ability
Apply algorithmic techniques to research – tasks partitioning, data partitioning, etc.	Demonstrate practical skills by completing the programming assignment 1&2

2. Tentative Schedule

Week	Topic
1	1. Discussion of the syllabus, requirements, topics to be covered, etc. 2. Introduction to shared memory parallel computer architecture
2-3	1. Overview of OpenMP: ◦ multithreading ◦ OpenMP programming styles ◦ correctness and performance consideration ◦ Writing a first OpenMP program
4-5	1. OpenMP language features ◦ Sharing the work among threads in an OpenMP program ◦ Clauses to control parallel and work-sharing constructs ◦ OpenMP synchronization constructs
6	1. How to get good performance by using OpenMP
8	1. Midterm exam (in class) 2. Presentation for programming assignment 1
9	1. GPU introduction
10-12	1. Parallel programming in CUDA C
13	1. GPU programming performance evaluation
14	1. Using GPU in the real world
15	1. Review 2. Presentation for programming assignment 2
16	Final Exam (in class)

Student Activities and Results:

- ❖ Two undergraduates were hired as interns by CUNY HPC Center.
- ❖ Other students are interested in intern positions and in the process of applying.
- ❖ Many students gain interest in HPC and participate in faculty's research.
- ❖ Coauthor the papers: PCO2016, 2015 SummerSim and 2016 SpringSim.

Background

- ➢ One of twenty-three institutions of The City University of New York (CUNY).
- ➢ Offers B.S. program, M.S. program, and Ph.D. program in computer science.
- ➢ The CUNY HPC Center (http://www.csi.cuny.edu/cunyhpc) is housed on the campus of CSI, and financially supported by several NSF grants and from state and local funds.