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Toward High Performance Computing Education

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Toward High Performance Computing Education

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ABSTRACT
High Performance Computing (HPC) is the ability to process data and perform complex calculations at extremely high speeds. Current HPC platforms can achieve calculations on the order of quadrillions of calculations per second with quintillions on the horizon. The past three decades witnessed a vast increase in the use of HPC across different scientific, engineering and business communities, for example, sequencing the genome, predicting climate changes, designing modern aerodynamics, or establishing customer preferences. Although HPC has been well incorporated into science curricula such as bioinformatics, the same cannot be said for most computing programs. This working group will explore how HPC can make inroads into computer science education, from the undergraduate to postgraduate levels. The group will address research questions designed to investigate topics such as identifying and handling barriers that inhibit the adoption of HPC in educational environments, how to incorporate HPC into various curricula, and how HPC can be leveraged to enhance applied critical thinking and problem solving skills. Four deliverables include: (1) a catalog of core HPC educational concepts, (2) HPC curricula for contemporary computing needs, such as in artificial intelligence, cyberanalytics, data science and engineering, or internet of things, (3) possible infrastructures for implementing HPC coursework, and (4) HPC-related feedback to the CC2020 project.

CCS CONCEPTS
• Social and professional topics → Computer science education; Computing education;

KEYWORDS
ITiCSE working group; high performance computing; HPC; high-performance computing curricula; contemporary computing education; computer science education.

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1 MOTIVATION
Current High Performance Computing (HPC) resources provide the ability to process data and perform complex calculations at quadrillions of calculations per second, orders of magnitude faster than ordinary high-speed computers [9]. HPC can be performed on dedicated supercomputers typically containing thousands of compute nodes working together to complete one or more tasks in parallel, or in recent years, large numbers of inexpensive commodity computers configured in parallel or distributed settings, with
There have been prior efforts in bringing HPC into computing education. This working group seeks to:

(1) Catalog HPC elements such as multi- and many-core programming; distributed memory, shared memory, and hybrid models; accelerators including graphical processing units, FPGAs, Xeon Phi and Quantum processing units; parallel and distributed file systems, and supercomputers.

(2) For each of the contemporary application areas (such as AI, DSE or IoT), catalog best practices and examples of how educators can incorporate HPC.

(3) Explore infrastructures for implementing HPC coursework with a focus on simple and low-cost solutions.

(4) Develop HPC recommendations for modern computing curricula and provide feedback to the CC2020 project.

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REFERENCES