Xi'an Jiaotong-Liverpool University
西交利物浦大学

DTS205TC

High performance computing
School of AI and Advanced Computing Stage 3 | Level 2

SECTION A: Basic Information

Brief Introduction to the Module

High-performance computing courses typically cover parallel computing, distributed systems, numerical algorithms, performance optimization, and application development for supercomputing environments. Students learn about HPC architectures, parallel programming models (MPI, OpenMP, CUDA), performance analysis tools, and scaling algorithms to large-scale systems. The courses also explore the applications of HPC in scientific computing, data analytics, and machine learning. Students gain hands-on experience in developing and optimizing HPC applications to solve complex problems efficiently.

Key Module Information

Module name	Module code	Credit value	Semester in which the module is taught	Pre-requisites needed for the module
High performance computing	DTS205TC	2.5	SEM2	DTS102TC AND MTH007 AND DTS202TC
Programmes on which the module is shared	BEng Data Science and Big Data Technology with Contemporary Entrepreneurialism			

Module Leader and Contact Details

Module Leader:

Name	Email address	Office telephone number	Room number	Office hours	Preferred means of contact
DI ZHANG	Di.Zhang@xjtlu.edu.cn			Office Tel.: 89167604, Room: D5026, Office Time: Thursday 10-12 am	Email
Brief Biography	PhD of Computer Science from Communication University of China and B.Sc and M.Sc of Computer Science from BUAA. 15 years of working experience in Institute of Software (CAS), Nokia Research Centre, and Noah's Ark Lab. Huawei. Research Domain: probabilistic graphical models, parallel algorithm library, reinforcement learning.				

Additional Teaching Staff and Contact Details:

Role	Name	Email address	Office telephone number	Room number	Office hours	Preferred means of contact
TA	ZIXUAN CHU	zixuan.chu23@student.xjtlu.edu.cn	/	/	/	/
TA	BIWEN MENG	biwen.meng22@student.xjtlu.edu.cn	/	/	/	/

SECTION B: What You Can Expect from the Module

Educational Aims of the Module

The module aims to provide an introduction to High Performance Computing (HPC) and its role in data sciences. In this course you will learn how to write faster code that is optimized for modern multi-core processors and clusters, using modern software development tools, parallelization strategies, and advanced parallel programming constructs in OpenMP and MPI.

Learning Outcomes

A. Demonstrate understanding of the concepts used in modern processors for increasing the performance.
B. Demonstrate optimization techniques for serial code
C. Understand and apply parallel computing paradigms
D. Write optimized programs designed for high-performance computing systems.

Methods of Learning and Teaching

Students will be expected to attend formal lectures, seminars, tutorials and labs . Students will be introduced to the academic content and have a understanding of lecture materials. In addition, students are expected to devote unsupervised time to private study. Private study will provide time for reflection and consideration of lecture material and background reading.

Syllabus & Teaching Plan

Week Number	Mode of Delivery(Lecture/Tutorial/Seminar/Field Trip/Other)	Topic	Pre-reading and others
W2	Comp.Lab/Lecture/Tutorial	Infrastructure	Foundations of Computer Science, Third Edition, Chapter 1,5
W3	Comp.Lab/Lecture/Tutorial	Network	Foundations of Computer Science, Third Edition, Chapter 6
W4	Comp.Lab/Lecture/Tutorial	Design	Introduction to Parallel Computing, Second Edition, Chapter 3
W5	Comp.Lab/Lecture/Tutorial	Analysis	Introduction to Parallel Computing, Second Edition, Chapter 5
W6	Comp.Lab/Lecture/Tutorial	Applications	Introduction to Parallel Computing, Second Edition, Chapter 8 Parallel Computing for Data Science: With Examples in R, C++ and CUDA, Chapter 9
W7	Comp.Lab/Seminar/Tutorial	Frontier in HPC	-

Assessment Details

Initial Assessment

Assignment(Groupwork) (50% of the module mark)

Assessment Type: *CW*
Learning outcomes assessed: *AB*
Duration: *N/A*
Resit opportunity: *S*

Assessment Task	Learning Outcomes	Weighting	Release Date	Due Date	Need Submission?
Assignment(GROUPWORK)	AB	50%	/	15/Apr/2024	YES
Generative AI Permissions	No				
Brief Description of the Assessment Task	/				
Requirement Details(to download from e-Bridge)	/				

Lab Report (50% of the module mark)

Assessment Type: *CW*
Learning outcomes assessed: *CD*
Duration: *N/A*
Resit opportunity: *S*

Assessment Task	Learning Outcomes	Weighting	Release Date	Due Date	Need Submission?
Lab Report	CD	50%	/	22/Apr/2024	YES
Generative AI Permissions	No				
Brief Description of the Assessment Task	/				
Requirement Details(to download from e-Bridge)	/				

Resit Assessment

Coursework (100% of the module mark)

Assessment Type: *CW*
Learning outcomes assessed: *ALL*
Duration: *N/A*

Assessment Task	Learning Outcomes	Weighting	Release Date	Due Date	Need Submission?
Coursework	ALL	100%	/	/	YES
Generative AI Permissions	No				
Brief Description of the Assessment Task	/				
Requirement Details(to download from e-Bridge)	/				

Reading Materials

Type	Title	Author	ISBN/Publisher
Mandatory Textbooks	N/A		
Optional Textbooks	N/A		
Reference Textbooks	N/A		
Additional Materials	Kumar V, Grama A, Gupta A, et al. Introduction to parallel computing[M]. Redwood City, CA: Benjamin/Cummings, 1994. Forouzan B A, Mosharraf F. Foundations of computer science[M]. Thomson, 2008. Matloff N. Parallel computing for data science: with examples in R, C++ and CUDA[M]. CRC Press, 2015.		

SECTION C: Additional Information

This section provides students with essential information and resources pertaining to their academic studies to ensure a successful academic journey and engagement with the module.

Student Feedback:

The University is committed to receiving and responding to student feedback in order to improve the quality of the student experience within the institution. It is University policy that the preferred way of doing this is by using the Online Student Module Feedback Questionnaire Survey. Students are encouraged to complete the questionnaire survey for this module at the end of the semester.

Attendance:

The University expects students to attend all timetabled learning sessions associated with this module, and to engage with the relevant learning and

support resources. Student attendance will be recorded using the Attendance Management System (AMS). Please follow your teacher's instructions for recording your attendance at each session. Students are responsible for managing their attendance, and should take prompt action to inform the Module Leader in case circumstances beyond their control affect their class attendance. You are advised to read the University's 'Student Attendance Policy' for more information.

Rules of Submission for Assessed Coursework:

The University has detailed rules and procedures governing the submission of assessed coursework. You need to be familiar with the rules and procedures as detailed in the University's 'Code of Practice on Assessment'.

Late Submission of Assessed Coursework:

The University attaches penalties to the late submission of assessed coursework. You need to be familiar with the rules as detailed in the University's 'Code of Practice on Assessment'.

Mitigating Circumstances:

The University is able to take into account mitigating circumstances, such as illness or personal circumstances, that may have adversely affected student performance on a module. Students who believe that their performance on an examination or item of assessed coursework may have been impaired by illness or other exceptional circumstances should follow the procedures set out in the University's 'Mitigating Circumstances Policy'. Such students are also advised to contact their Development Advisor for further guidance and support.

Academic Integrity:

Offences of plagiarism, collusion, copying, submission of commissioned or procured work, and/or the falsification and fabrication of data can result in investigations and penalties being imposed. You need to be familiar with the University's 'Academic Integrity Policy'. For more information on Academic Integrity, please refer to the Understanding Academic Integrity page of the Learning Mall Core. To learn about XJTLU Referencing, please refer to the XJTLU Referencing LibGuides.

Examination Misconduct:

The University values academic integrity in both coursework submission and examination conduct. Any examination misconduct will not be tolerated and will result in penalties in accordance with University procedures and regulations as detailed in the 'Regulations for Conduct of Examinations' policy.

Generative AI:

Information on whether the use of Generative AI is permitted or not for each assessed coursework is indicated in the Assessment Details section of this module handbook.

For more information and resources on Generative AI and your learning and assessment, please consult the 'XJTLU AI for Learning' pages of the Learning Mall Core.

Learning Mall Core:

Copies of lecture notes and other materials are available electronically through the Learning Mall Core, the University's virtual learning environment, at learningmall@xjtlu.edu.cn.

Communication:

All official communication concerning module-related matters will be conducted via e-mail and/or as Learning Mall Core announcements. Other modes of electronic communication are treated as informal.

Further Support:

You are advised to contact your Module Leader in the first instance if you experience any issues with your learning on this module. You may also contact your Academic Advisor or Programme Director. Further information on the kinds of support that the University provides to students can be found in the XJTLU Student Handbook.

You are strongly advised to read the policies mentioned above very carefully, because this will help you perform better in your academic studies. You can find all the policies and regulations related to your academic study on the e-Bridge → 'Quick Reference' → 'Policies and Regulations' page.