



Parallel Programming

National Tsing Hua University
2020, Fall Semester

Instructor & TA Information

■ Instructor: 周志遠教授 (Jerry)

- Email: jchou@lsalab.cs.nthu.edu.tw
- Office/phone: 台達602 / 42801
- Office hour: email for appointment

■ TA: 周裕閔、林恩德

- Email: pp@lsalab.cs.nthu.edu.tw
- Office/phone: 資電836 / 33538
- Office hour: email for appointment
- Lecture & Demo for Homework

COVID-19 Regulation



■ School policy

- 上課時應注意教室通風良好，並維持社交距離；如無法維持社交距離（室內應保持 1.5公尺、室外保持 1公尺），即應佩戴口罩。
- 上課時，請落實課堂點名及妥善保管課堂點名資料

■ We have prepared an online sign-in sheet

- <https://forms.gle/EAswSvd25vAioMq18>
- Please fill-in the for each class you attend
- It will not be used for grading, so please make sure the information is correct to avoid troubles

Additional Enrollment ...



- Fill in the form below **TODAY**

➤ <https://forms.gle/TyxqJVd7MJYiqvw2A>

- You will receive my decision Wednesday night
- If your request is approved, bring the sign-up sheet to my office (台達602) this Thursday between 2:50-3:30pm

No Class this Thursday!!!

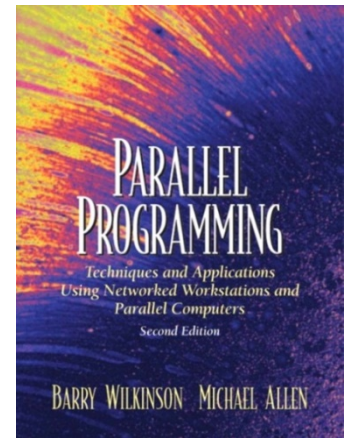
Course Material

■ Textbook:

- “Parallel Programming– Techniques and applications Using Networked Workstations and Parallel Computers”, 2nd Edition. Barry Wilkinson and Michael Allen, Prentice Hall.

■ Reference:

- “Parallel Programming in C with MPI and OpenMP”.
Michael J. Quinn, McGraw Hill.
- **LLNL** High-Performance Computing Training
<https://computing.llnl.gov/?set=training&page=index>
- **Nvidia Tutorial Slides**
- **Google It!!!!**



Course Website

■ Website: <http://lms.nthu.edu.tw/course/46274>

- Announcement
- Materials (lecture/project slides)
- Discussion forums

The screenshot shows the NTHU iLMS interface. At the top, there's a header with the NTHU logo and the text "國立清華大學 iLMS數位學習平台". On the right, there are links for "LMS", "知識社群", "我的首頁", and "登出(b14732)", along with "English", "Q&A", and a login field showing "線上人數:26".

The main content area is titled "課程: 平行程式Parallel Programming" and "位置: 平行程式Parallel Programming > 課程說明". It features a sidebar on the left with "瀏覽模式 (切換)" and "課程功能 (管理)" sections. The "課程功能" section includes links for "課程活動(公告)", "上課教材", "課堂整理", "課程說明", "課程行事曆", "討論區", "小組專區", "隨堂筆記 (共享的筆記)", "作業", "問卷", "線上測驗", "出缺勤 (統計)", "成員 (60)", "成績計算", and "設定".

The main content area displays "課程資訊" with a table of course details:

項目	內容
課程名稱	平行程式Parallel Programming (1021, 10210CS542200, 資工系, 碩士班)
閱讀權限	開放旁聽
課堂整理權限	不開放
老師	周志遠
助教	無
學分	3
課程大綱	<p>一、課程說明(Course Description)</p> <p>熟悉平行程式語言及平行程式設計</p> <p>二、指定用書(Text Books)</p> <p>1. Parallel Programming – Techniques and applications Using Networked Workstations and Parallel Computers, Barry Wilkinson and Michael Allen, Prentice Hall, 1999.</p> <p>2. Parallel Programming in C with MPI and OpenMP, Michael J. Quinn, McGraw-Hill, 2003.</p> <p>3. Intel Multi-Core Programming</p> <p>三、參考書籍(References)</p> <p>1. Documentation (PVM, MPI, Cilk, Pthread, TreadMark, SAM).</p>

Course Contents

■ Part I: Parallel Programming

- Intro. to Parallel Computing
- MPI Programming
- Pthread Programming
- OpenMP Programming

■ Part III: GPU Programming

- Heterogeneous Computing
- CUDA Programming
- GPU Architecture & Multi-GPU
- Optimization

■ Part II: Computation Model

- Embarrassingly Parallel
- Divide-and-Conquer
Pipelined Computations
- Synchronous Computations

■ Part IV: Distributed Computing Frameworks

- Hadoop
- Spark
- TensorFlow

Course Expectations

“Parallel/Multi-thread Programming is Essential Programming Skill in Today’s World”

■ Lecture & textbook

- Fundamental knowledge, algorithm and theory

■ Homework & Project

- Coding
- Performance optimization

■ Report & Presentation

- Performance Analysis
- Writing & Presenting

Grading Information

■ Programming homework (75%)---Individual

➤ 4 Assignments

- ◆ Parallel Odd-Even Transposition Sort (MPI) 9/30-10/26: 20%
- ◆ Mandelbort Set (MPI & OpenMP) 10/22-11/16: 20%
- ◆ All-Pairs Shortest Path on CPU(Pthread) 11/12-11/30: 15%
- ◆ All-Pairs Shortest Path on GPU(CUDA) 11/26-1/4: 20%

➤ Grading Items:

- ◆ Code correctness
- ◆ Report (Performance analysis & evaluations)
- ◆ **Code Performance**

➤ **Late submission is NOT accepted!**

- ◆ **No exception**

Grading Information

■ Labs (10%) ---Individual

➤ Chances to boost & practice your skills

- ◆ Lab1: System & MPI (9/24 7-9pm)
- ◆ Lab2: Pthread (10/22 7-9pm)
- ◆ Lab3: CUDA-Basic (11/12 7-9pm)
- ◆ Lab4: CUDA-Advanced (11/26 7-9pm)
- ◆ Lab5: Hadoop (12/14 lecture time)
- ◆ Lab6: Distributed TensorFlow (1/4 lecture time)

➤ Might be scheduled on Thursday night 7-9pm

➤ Attendance is not mandatory, but the tasks given in the labs must be completed in a week

Grading Information

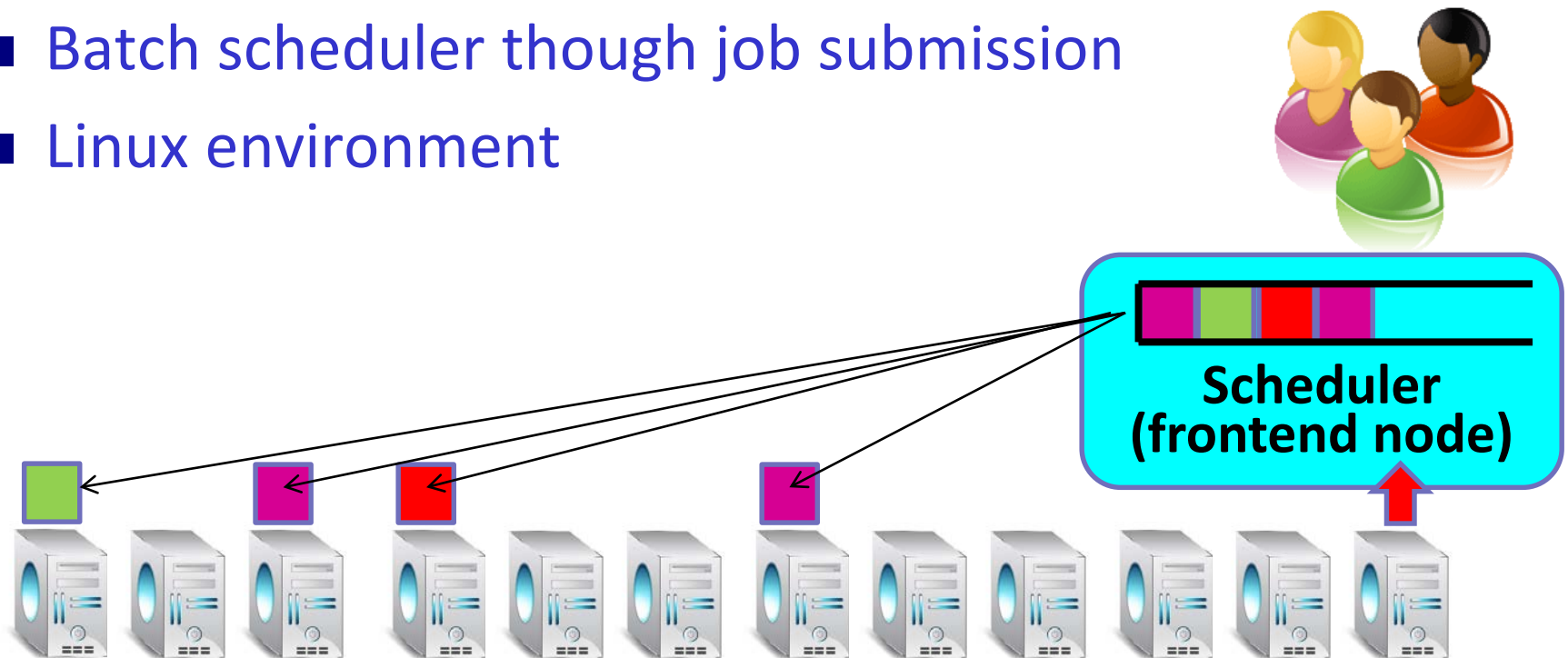
- Final Project(15%) ---Team of 1 or 2 persons
 - Select a topic on your own
 - Implement a solution & show how parallel programming is useful
 - 10min. presentation will be scheduled (1/11)
 - Demo will be scheduled after presentation

Clarification of Plagiarism

- Homework assignments are **individual**
 - You may discuss with each other
 - But **NEVER SHOW YOUR CODE** to others & you must write your code by yourself
 - If the codes are similar to other people and you can't questions properly during demo, you will be identified as plagiarism
- **0 points will be given to Plagiarism**

Coding Environment

- Batch scheduler though job submission
- Linux environment



*Don't wait until the **LAST** day, or you may suffer from **LONG** queuing delay