|  |  |  |
| --- | --- | --- |
| **Identification** | **Department**  | Computer Science |
| **Program** | Graduate |
| **Subject** | **Parallel Computer Architecture (3 credits)** |
| **Term** | Fall 2017 |
| **Instructor** | **PhD, Associate Professor Leyla Muradkhanli** |
| **Classroom/hours** |  |
| **Prerequisites** | Computer Architecture |
| **Language**  | English |
| **Compulsory/Elective** | Major |
| **Text books and course materials** | **Textbooks**1. Parallel Computer Architecture, Culler, Singh and Gupta, Morgan Kaufmann Publishers.
2. Introduction to Parallel Architecture Andy Pimentel
3. Computer Architecture: A Quantitative Approach, JohnHennessy and David Patterson, 4th edition, Morgan Kaufmann Publishers, 2007
 |
| **Teaching methods** | **Case analysis** |  |
| **Group discussion** | **x** |
| **Lab** | **x** |
| **Lecture** | **x** |
| **Course paper** | **x** |
| **Others** |  |
| **Evaluation Criteria** | **Methods** | **Date/deadlines** | **Percentage (%)** |
| **Midterm Exam** |  | **30%** |
| **Case studies** |  |  |
| **Class Participation**  |  |  |
| **Quizzes** |  |  |
| **Project** |  | **10%** |
| **Presentation** |  |  |
| **Assignments** |  | **20%** |
| **Final Exam** |  | **40%** |
| **Other** |  |  |
| **Total** |  | **100%** |
| **Course objectives**  | The course will focus on fundamental parallel computer architectures, their evaluation and the tradeoffs made in their design. The goal of this course is to help students develop competence in analysis, design, and evaluation of new technologies in computer architecture. |
| **Learning outcomes** | At the end of this course, students will be able to: • Obtain understanding of fundamental architectural principles • Measure the performance of modern microprocessor designs • Analyze simulation data to evaluate designs • Construct alternative computer architecture designs  |
| **Course outline** | Introduction to Parallel Computing. Parallel Programs. Workload-Driven Performance Evaluation. Shared Memory Multiprocessors. Snoop-based Multiprocessor Design. Scalable Multiprocessors. Snoop-based Multiprocessor Design. Directory-based Cache Coherence. Interconnection Network Design.  |
| **Tentative Schedule** |
| **Week** | **Date** | **Topics** | **Textbook/Assignments**  |
| 1 | 16.09.17 | **Course Overview and Introduction** | PresentationChapter 1 |
| 2 | 23.09.17 | **Why Parallelism?****Modern Multi-Core Processor** | Chapter 1 |
| 3 | 30.09.17 | **Parallel Programs** | Chapter 2 |
| 4 | 07.10.17 | **Programming for Performance** | Chapter 3 |
| 5 | 14.10.17 | **Workload-Driven Performance Evaluation**Scaling Workloads and MachinesEvaluating a Real Machine | Chapter 4  |
| 6 | 21.10.17 | **Workload-Driven Performance Evaluation**Multiprocessor Simulation Workload Characteristics | Chapter 4 |
| 7 | 28.10.17 | **Shared Memory Multiprocessors**Cache CoherenceMemory ConsistencyDesign Space for Snooping ProtocolsAssessing Protocol Design TradeoffsSynchronization | Chapter 5 |
| 8 | 04.11.17 | **Midterm exam** |  |
| 9 | 11.11.17 | **Snoop-based Multiprocessor Design**Correctness RequirementsBase Design: Single-level Caches with an Atomic BusMulti-level Cache Hierarchies | Chapter 6 |
| 10 | 18.11.17 | **Scalable Multiprocessors**ScalabilityRealizing Programming Models | Chapter 7 |
| 11 | 25.11.17 | **Directory-based Cache Coherence**Scalable Cache CoherenceOverview of Directory-Based Approaches | Chapter 8 |
| 12 | 02.12.17 | **Directory-based Cache Coherence**Assessing Directory Protocols and TradeoffsMemory-based Directory Protocols | Chapter 8 |
| 13 | 09.12.17 | **Interconnection Network Design**IntroductionInterconnection TopologiesEvaluating Design Trade-offs in Network Topology | Chapter 10 |
| 14 | 16.12.17 | **Interconnection Network Design**RoutingSwitch DesignFlow Control | Chapter 10  |
| 15 | 23.12.17 | **Large-Scale Multiprocessors and Scientific Applications** | Presentation |
|  |  | **Final exam** |  |