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| **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** | | | | Presentation  Chapter 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 Machines  Evaluating 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 Coherence  Memory Consistency  Design Space for Snooping Protocols  Assessing Protocol Design Tradeoffs  Synchronization | | | | Chapter 5 |
| 8 | 04.11.17 | **Midterm exam** | | | |  |
| 9 | 11.11.17 | **Snoop-based Multiprocessor Design**  Correctness Requirements  Base Design: Single-level Caches with an Atomic Bus  Multi-level Cache Hierarchies | | | | Chapter 6 |
| 10 | 18.11.17 | **Scalable Multiprocessors**  Scalability  Realizing Programming Models | | | | Chapter 7 |
| 11 | 25.11.17 | **Directory-based Cache Coherence**  Scalable Cache Coherence  Overview of Directory-Based Approaches | | | | Chapter 8 |
| 12 | 02.12.17 | **Directory-based Cache Coherence**  Assessing Directory Protocols and Tradeoffs  Memory-based Directory Protocols | | | | Chapter 8 |
| 13 | 09.12.17 | **Interconnection Network Design**  Introduction  Interconnection Topologies  Evaluating Design Trade-offs in Network Topology | | | | Chapter 10 |
| 14 | 16.12.17 | **Interconnection Network Design**  Routing  Switch Design  Flow Control | | | | Chapter 10 |
| 15 | 23.12.17 | **Large-Scale Multiprocessors and Scientific Applications** | | | | Presentation |
|  |  | **Final exam** | | | |  |