**University of Jordan**

**King Abdullah II School for Information Technology (KASIT)**

**Department of Computer Science**

**Course:** **Distributed Systems (1901466). Sections: STR 10-11 PM.**

**Semester:** **Fall 2013.**

**Prerequisite:** **Computer Networks 1(1901361).**

**Instructor:** **Maen M. Al Assaf, Ph.D. (m\_alassaf @ju.edu.jo).**

**Office Hours: 12-1 STR.**

**Course Description**

Distributed system basic concepts: hardware, software, design issues; communication in distributed systems; layered protocols; synchronous vs. asynchronous communication mechanisms; client-server model vs. peer-to-peer model; Remote Method Invocation (RMI) and Remote Procedure Call (RPC); group communication; processes vs. threads; synchronization: physical vs. logical clocks, Lamport clocks, distributed mutual exclusion, election algorithms; distributed transactions; case studies.

**Textbook**

George Coulouris, Jean Dollimore, and Tim Kindberg, Gordom Blair, Distributed Systems Concepts and Design, 5th edition, Addison-Wesley, 2011.

**Additional References**

1. A. Tanenbaum, and M. Van Steen, Distributed Systems: Principles and Paradigms, 2nd Edition Prentice-Hall 2006.

2. A. Rubini et al, Linux Device Drivers, 3rd edition, O'Reilly.

3. J. Bacon, Concurrent Systems, 3rd edition, Harlow, England: Addison-Wesley.

4. Kris Jamsa, Cloud Computing , Jones & Bartlett Learning; 2012.

**Course Contents**

|  |  |  |
| --- | --- | --- |
| **Topic** | **Hours** | **ILO** |
| 1. Characterization of Distributed Systems  Introduction  Examples  Resource sharing  Challenges | 3 | A1  A1-A3  A1-A3  A1 |
| 2. Networking Revision  Types of networks  Networking principles  Internet protocols | 1 | A1-A2 |
| 3. System Models  Architectural model  Fundamental model | 3 | B1 |
| 4. Inter-process Communication  External data representation and marshalling  Client/server communication  Group communication  Practical section: experimenting with marshalling and unmarshalling | 3+3 | A1, B1  A1-A3  A1-A3  D1-D3 |
| 5. Distributed Objects and Remote Method Invocation (RMI)  Communications between distributed objects  RMI and RPC  Events and notifications  Practical section: Java's RMI | 6+3 | A1-A3, C1  A1-A2,B1,C1  C1,D1-D3 |
| 6. Operating Systems support  The OS layer  Protection  Processes and threads  Communication and invocation | 3 | A2,B2 |
| 7. Timing and clocking  Clocks, events, and process state  Synchronizing physical clocks  Logical time and logical clocks  Practical section: experimenting with timing and clocks | 6+3 | B3,C2  B3,C2  B3,C2  C2-C3 |
| 8. Coordination and agreement  Mutual Exclusions(ME) vs. Distributed Mutual eXclusion(DMX)  Ricart-Agrawala's distributed mutual exclusion algorithm  Maekawa's distributed mutual exclusion algorithm  The token-ring election algorithm  Practical section: experimenting with concurrent programming | 6+3 | B3,C2  B3,C2  B3,C2  B3,C2  C2-C3 |
| 9. Transactions and concurrency control  Transactions  Locks  Timestamp ordering | 5 | B2,C2-C3 |
| 10. Cloud Computing Paradigm  IaaS  PaaS  SaaS  Case Study: CloudAV | 3 | A2,A3 |

**Evaluation**

Midterm Exam 30%

Assignments and quizzes 20%

Final Exam 50%

**Course policy**

**No makeup exams will be offered**

Students are expected to adhere to assignment strict deadlines and to behave responsibly

**Students' acts of cheating and/or plagiarism will be penalized according to the regulations of the University of Jordan**

**Tentative Grading Scale**

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| --- | --- |
| **0 - 40** | **F** |
| **41-49** | **D-** |
| **50-53** | **D** |
| **54-57** | **D+** |
| **58-61** | **C-** |
| **62-66** | **C** |
| **67-70** | **C+** |
| **71-75** | **B-** |
| **76-79** | **B** |
| **80-84** | **B+** |
| **85-89** | **A-** |
| **90-100** | **A** |

**Intended Learning Outcomes**

The successful completion of this course is expected to lead to the following outcomes:

**A. Knowledge and Understanding (students should be able to understand):**

A1) the basic concepts associated with distributed systems

A2) the inter-process communication mechanism (message-passing)

A3) the advantages of deploying distributed systems

**B. Intellectual skills (students should be able to):**

B1) distinguish between the distributed systems models described in class

B2) distinguish between processes and threads

B3) distinguish between different distributed synchronization algorithms

**C. Subject specific skills (students should be able to):**

C1) write programs that address Java RMI

C2) write programs that address inter-process synchronization

C3) write programs that address timing

**D. Transferable skills (students should be able to):**

D1) work in a group in order to write the specification of a designated distributed system component

D2) work in a group in order to implement the component described in D1

D3) demonstrate the component implemented in D2

**Teaching / Learning Methodologies**

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| --- | --- | --- | --- |
| **Method** | Lecturing | Demo | Laboratory |
| **Learning outcome** | A1-A3 & B1-B3 | D1-D3 | C1-C3 & D1-D3 |
| **Assessment** | Exams & quizzes | Assignments | Assignments&quizzes |