**Course title: INFSCI 2750 Cloud Computing**

**Description:** This course covers the fundamental concepts in Cloud Computing and provides hands-on experience in working with cloud systems. We will cover the introductory concepts of cloud software systems and provide an understanding of the design principles behind various existing cloud solutions. We will first cover the concepts of large scale parallel data processing in the cloud including the MapReduce programming model and Hadoop and its related ecosystem. We then focus on various existing virtualized commercial cloud models including the fundamental concepts of system virtualization, hypervisors and virtualized platforms. The next part of the course will focus on cloud storage systems including key-value stores and geographically distributed clouds. The last part of the course provides an introduction to security and privacy issues in cloud computing covering the issues of data and execution privacy and legal issues in modern commercial cloud services.

**Pre-requisites:**

- TEL2000 OR Equivalent Background
- INFSCI 2500

## Tentative Schedule

| Date | Lecture topic | Objectives | Testing |
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| Week 1 | Course Introduction<br>Introduction to Cloud Computing | *Describe/explain* the importance of elasticity, pay-per-use and the key distinctions between software-as-a-service, platform-as-a-service and infrastructure-as-a-service models.<br>Required reading: Reference [1] | |
| Week 2 | Introduction to Datacenters and Datacenter Systems<br>Google Filesystem (GFS) Case study | *Recognize/explain* the basic challenges in datacenter filessytems<br>*Identify* the key principles underlying | Quiz1 (based on required reading in week 1) |

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| | | the design of large scale distributed filesystems<br>Required reading:[7] | |
| Week 3 | MapReduce Programming Model<br>MapReduce programming examples | *Recognize/explain* MapReduce programming model<br>*Explain and use* Piglatin and Hive commands for writing high-level language queries in Hadoop<br>Required reading: [9] | Mini Project 1 |
| Week 4 | Hadoop, Piglatin, Hive case studies<br>Overview of MapReduce optimization Techniques | *Recognize, explain* the inefficiencies in original Hadoop schedulers<br>*Understand, explain* various optimization techniques for in-memory MapReduce<br>Required Reading: [42] | Quiz 2 (based on required reading in weeks 2 and 3) |
| Week 5 | Introduction to virtualization and virtualized cloud platforms<br>Overview of Virtual Machine placement and live Virtual Machine Migration techniques | *Understand, explain* basic virtualization techniques in Cloud systems<br>*Recognize and analyze* various virtual machine placement and migration techniques<br>Required reading: [16] | |
| Week 6 | Cloud Storage systems and key | *Recognize/explain* the basic challenges in large scale storage | Quiz 3 |

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| | value stores<br>Overview of Bigtable and Dynamo systems<br>Amazon Web Services | systems<br>*Identify* the key principles underlying the design of Bigtable and Dynamo systems<br>Required Reading:[8] | (based on required reading in weeks 4 and 5)<br>Mini Project 2 |
| Week7 | MapReduce in a Cloud: Challenges, Architectures and Techniques<br>Overview of Elastic MapReduce, Purlieus and Cura systems | *Explain and Recognize* basic challenges in dedicated MapReduce clouds<br>*Understand* the key design principles in existing MapReduce Cloud systems<br>Required Reading: [43] | |
| Week 8 | Mid term | | |
| Week 9 | Geographically distributed Clouds and overview of Spanner system | *Recognize, compare/contrast,* challenges of geographically distributed datacenter management with conventional datacenter resource management problem<br>*Recognize, identify* the design features of Spanner system | Quiz 4<br>(based on required reading in weeks 6 and 7) |

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| | | Required reading: [20] | |
| Week 10 | Introduction to Blockchains and distributed consensus and ledger management . | *Recognize, identify* challenges of distributed consensus in blockchains<br>*Recognize, identify* the design features of Blockchain-based systems<br>Required reading: [46] | Mini Project 3 |
| Week 11 | Introduction to Security issues in Cloud Computing | *Understand, explain* security challenges in cloud computing<br>*Recognize, explain* the design principles of CryptDB system<br>Required reading: [45] | Quiz 5<br>(based on required reading in weeks 9 and 10) |
| Week 12 | Data Privacy in Cloud computing | *Recognize, explain* the basic privacy and legal issues in cloud systems<br>*Understand, explain* k- anonymity and differential privacy models and techniques | |

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| | | Required reading: [19] | |
| Week 13 | Final Exam | | |

## Grading Policy

Reading Assignment-based Quiz (10%)

Three mini projects (40%)

Midterm (20%)

Final Exam (20%)

Mini presentation (10%)

Class participation & Discussion (3% extra credit)

## References

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