

Các môn học ở kì 3 - UIT

I. Mathematics for Computer Science (Toán cho KHMT - CS115)

1. Assessment Components

Progress	End-term	Final Project
0.3	0.4	0.3

2. Contents

- **Week 1-3: Introducing and Revising**
 - Introduction to Math for Computer Science.
 - Revising Calculus.
 - Revising Linear Algebra.
 - Revising Probability & Statistics.
- **Week 4-6: Regression Analysis.**
 - Maximum Likelihood Estimation - MLE.
 - Linear Regression.
 - Logistic Regression.
 - Loss Function.
- **Week 7-9: Optimization**
 - Introduction about Convex Optimization.
 - Newton's method and Gradient descent.
 - L1, L2, Regularization.
 - Stochastic gradient descent.
 - Momentum, Nesterov.
 - Adagrad, RMSprop, Adadelta, Adam.
- **Week 10-12: Introduction to Neural Network**
 - Multi-layer Perceptron.
 - Computational Graph.
 - Chain rule & Backpropagation.
 - Cross-validation.
 - Batch normalization.
 - Modifying Hyperparameters.
- **Week 13-15: About Final Project and Seminar about other topics**
 - Linear discriminant Analysis(LDA).
 - Singular Value Decomposition (SVD) & Principal Component Analysis (PCA).
 - Support Vector Machine (SVM) & Kernels.
 - Expectation Maximization.
 - Hierarchical Clustering, Spectral Clustering.
 - ...

3. References & Materials

- Gilbert Strang. Linear Algebra and Learning from Data. Wellesley-Cambridge University Press (2019).
- Mykel Korchenderfer & Tim Wheeler. Algorithms for Optimization. MIT Press(2019).
- Zhang, Lipton, Li & Smola. Dive into Deep Learning.

- Marc Peter Deisenroth, A. Aldo Faisal & Cheng Soon Ong. Mathematics for Machine Learning, Cambridge University Press(2020).
- Kevin Patrick Murphy. Probabilistic Machine Learning: An Introduction. MIT Press (2021).

II. Database (Cơ sở dữ liệu - IT004)

1. Assessment Components

Coursework + Practice	Mid-term	End-term
30%	20%	50%

2. Contents

- **Chapter 1: Overview of Databases**
 - 1.1. Introduction
 - 1.2. File System
 - 1.3. Defining a Database
 - 1.4. Database Users
 - 1.5. Database Management System (DBMS)
 - 1.6. Components of a Database System
 - 1.7. Data Models
 - Network Data Model (Introduction)
 - ER Model (Entity-Relationship Model)
- **Chapter 2: Relational Data Model**
 - 2.1. Introduction
 - 2.2. Basic Concepts of the Relational Model
 - Relation
 - Attribute
 - Schema
 - Tuple
 - Domain
 - 2.3. Integrity Constraints
 - Super Key
 - Key
 - Primary Key
 - Foreign Key
 - Referential Integrity
 - 2.4. Properties of Relations
 - 2.5. Mapping E/R Diagrams to Relational Model
- **Chapter 3: Relational Algebra**
 - 3.1. Introduction
 - 3.2. Relational Algebra
 - 3.3. Set Operations
 - 3.4. Selection

- 3.5. Projection
- 3.6. Cartesian Product
- 3.7. Rename
 - Natural Join
 - Theta Join
 - Equi Join
- 3.8. Division
- 3.9. Other Operations
 - Aggregation Functions
 - Grouping
 - Outer Join
- **Chapter 4: SQL**
 - 4.1. Introduction
 - 4.2. Data Definition Language (DDL)
 - Create Table
 - Declare Constraints (Primary, Foreign Keys)
 - Alter Table (Add, Drop, Modify Columns and Constraints)
 - Drop Table
 - 4.3. Data Manipulation Language (DML)
 - Insert (Manually, from other tables, or complete copies)
 - Update
 - Delete
 - 4.4. SQL Queries
 - General Structure
 - Select From Where
 - WHERE Clause
 - ORDER BY
 - 4.5. Multi-Table Queries
 - GROUP BY
 - HAVING
 - 4.6. Subqueries
 - Aggregate Functions over Groups
 - String, Date, Numeric Functions
- **Chapter 5: Integrity Constraints**
 - 5.1. Definition
 - 5.2. Components of Integrity Constraints
 - Content
 - Syntax, Example
 - Context
 - Affected Scope
 - Classification
 - 5.3. Integrity Constraints over One Relation
 - Value Dependencies, Attribute Dependencies, Tuple Dependencies
 - 5.4. Integrity Constraints over Multiple Relations
 - Foreign Key (Referential Integrity), Join Dependencies, Aggregate Dependencies
- **Chapter 6: Functional Dependencies and Normal Forms**
 - 6.1. Functional Dependencies

- Basic Concepts
- Armstrong’s Axioms & Closure
- ▶ 6.2. Normal Forms
 - First Normal Form (1NF)
 - Second Normal Form (2NF)
 - Third Normal Form (3NF)
 - Boyce-Codd Normal Form (BCNF)
- **Chapter 7: Review and Practice**

3. Coursework

Session	Content
1	Introduction to tools in Microsoft SQL Server and implementation of data definition language (DDL) in DBMS <ul style="list-style-type: none"> • Understand data types • Learn how to manipulate databases, tables, primary keys, and foreign keys using built-in tools in SQL Server Management Studio • Commands for creating databases, tables, primary keys, and foreign keys • Introduction to system stored procedures: sp_help, sp_tables, sp_columns, sp_pkeys, sp_fkeys, sp_helpconstraint, sp_helpsql, etc. • DROP, ALTER commands
2, 3	Implementing data manipulation language (DML) and simple SQL queries in SQL Server <ul style="list-style-type: none"> • Data manipulation commands: INSERT, DELETE, UPDATE • Query syntax: SELECT ... FROM ... WHERE • Introduction to SELECT ... INTO ..., VIEW
4, 5	Performing basic query types in SQL Server <ul style="list-style-type: none"> • Subqueries • Set operations: UNION, INTERSECT, EXCEPT
5, 6	Performing advanced queries in SQL Server <ul style="list-style-type: none"> • Division operator • Aggregate functions, grouping data
7, 8	Understand how to declare integrity constraints (ICs) <ul style="list-style-type: none"> • NULL, NOT NULL, RULE, CHECK • Using constraints across multiple relations (foreign keys, triggers)

4. Textbooks

- 1. Slides môn Cơ sở dữ liệu, Khoa hệ thống thông tin, Đại học Công nghệ Thông tin, ĐHQG, HCM.
- 2. Hector Garcia-Molina, Jeffrey D. Ullman, and Jennifer Widom, Database Systems - The Complete Book, Prentice Hall, ISBN: 0-13-031995-32002.
- 3. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, Third Edition, McGraw Hill, 2003. ISBN: 0-07-246563-8.
- 4. C. J. Date, An Introduction to Database Systems, Eighth Edition, Addison Wesley, 2003. ISBN 0- 321-19784-4
- 5. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems (SIXTH EDITION).

5. Coursework Apps

- 1. Microsoft SQL Server

III. Introduction to Computer Networks (Nhập môn Mạng máy tính - IT005)

1. Assessment Components

Progress	Mid-term	Coursework	End-term
15%	20%	25%	40%

2. Contents

- **Chapter 1: Introduction to Computer Networks and Internet.**

- History of Computer Networks and Internet.
- Network Edge.
- Network Core.
- Network latency, Packet loss, Network throughput.
- Protocols Layers & Service Models.

- **Chapter 2: Application Layer**

- Basic Principles of Network Applications.
- Web/HTTP Services.
- Email/SMTP Services.
- DNS Services.
- Socket Programming with TCP and UDP Protocols.

- **Chapter 3: Transport Layer**

- Transport Layer Services.
- Multiplexing and Demultiplexing.
- UDP Protocol.
- Principles of Reliable Data Transfer.
- TCP Protocol.
- Principles of Congestion Control.
- Congestion Control in TCP.

- **Chapter 4: Network Layer**

- Introduction.
- Virtual-Circuit and Datagram Networks.
- Router Internal Structure.
- IP Protocol.
- Routing Algorithms.
- Routing in the Internet.

- **Chapter 5: Data Link Layer**

- Introduction.
- Error Detection and Correction.
- Multiple Access Protocols.
- LANs: ARP, Ethernet, Switches, VLANs.
- A General Scenario of a Web Query.

3. Coursework

- **Lab 1: Introduction to Wireshark**

- **Lab 2: HTTP Protocols**
- **Lab 3: TCP & UDP Protocols**
- **Lab 4: Crimping Ethernet cables**
- **Lab 5: Simulating with Packet Tracker**
- **Lab 6: Combined Coursework**

4. Textbooks

- Jim Kurose, Keith Ross, Computer Networking: A Top Down Approach Featuring the Internet, 8th edition Pearson.

5. Coursework Apps

- Wireshark.
- Packet Tracker.
- Crimping tool, Network cable (Ethernet cable), RJ-45 connector.

IV. Operating Systems (Hệ Điều Hành - IT007)

1. Assessment Components

Progress	Mid-term	Coursework	End-term
15%	15%	20%	50%

2. Contents

- **Chapter 1: Introduction to Operating Systems**
 - 1.1 Definition of Operating System
 - 1.2 Components of a Computer System
 - 1.3 Operating System Types
 - 1.4 Interaction with the Operating System
- **Chapter 2: System Structure**
 - 2.1 Types of System Calls
 - 2.2 Types of Operating Systems
 - 2.3 System Call Errors
 - 2.4 System Software
 - 2.5 System Structure
- **Chapter 3: Process Management**
 - 3.1 Basic Concepts
 - 3.2 Process Control Block (PCB)
 - 3.3 Process States
 - 3.4 Process Scheduling
 - 3.5 Context Switching
 - 3.6 Process Communication
 - 3.7 Process Creation
 - 3.8 Threads
- **Chapter 4: CPU Scheduling**
 - 4.1 Basic Concepts
 - 4.2 Scheduling Criteria
 - 4.3 Scheduling Algorithms
 - FCFS

- SJF
- SRTF
- Priority
- Round Robin (RR)
- HRRN
- Multilevel Queue
- Multilevel Feedback Queue

- **Chapter 5: Process Synchronization**

- 5.1 Introduction to Race Condition
- 5.2 Critical Section Problem
- 5.3 Solutions
- 5.4 Synchronization Tools
 - Mutex
 - Semaphore
 - Monitor
 - Liveness
- 5.5 Classical Problems
 - Producer-Consumer
 - Readers-Writers
 - Dining Philosophers

- **Chapter 6: Deadlock**

- 6.1 Definition
- 6.2 Models
- 6.3 Deadlock Handling
 - Prevention
 - Avoidance
 - Detection
 - Recovery

- **Chapter 7: Memory Management**

- 7.1 Basic Concepts
- 7.2 Types of Memory Addresses
- 7.3 Address Translation
- 7.4 Memory Allocation Models with Contiguous Allocation
 - 7.4.1 Static Partitioning
 - 7.4.2 Dynamic Partitioning
- 7.5 Paging Mechanism
- 7.6 Swapping Mechanism
- 7.7 Exercises

- **Chapter 8: Virtual Memory**

- 8.1 Overview of Virtual Memory
- 8.2 Virtual Memory Implementation
 - 8.2.1 Demand Paging
 - 8.2.2 Page Replacement
- 8.3 Page Replacement Algorithms
- 8.4 Frame Allocation Problem
- 8.5 Thrashing Problem
- 8.6 Exercises

- **Chapter 9: Linux and Windows OS**

- 9.1 Linux
 - Components
 - Process Management
 - Memory Management
 - Scheduling
 - Interprocess Communication
- 9.2 Windows
 - Components
 - Process Management
 - Memory Management
 - Scheduling
 - Interprocess Communication

3. Coursework

- Lab 1: Guide to installing VirtualBox, installing Ubuntu OS, and practicing basic commands in the Linux shell.
- Lab 2: Programming in the Ubuntu shell environment.
- Lab 3: Practicing operations related to processes in the Ubuntu operating system.
- Lab 4: Programming to simulate CPU scheduling algorithms learned in theory, such as: First Come First Served (FCFS), Round Robin (RR), Shortest Job First (SJF) , Shortest Remaining Time (SRT).
- Lab 5: Working with threads. Using semaphore and mutex libraries to perform synchronization between processes and threads.
- Lab 6: Summary exercises.

4. Textbooks

- Textbook:
 - Trần Hạnh Nhi, Lê Khắc Nhiên Ân (2005). Operating Systems Textbook. Publisher: Vietnam National University - Ho Chi Minh City.
- Reference Materials:
 - Silberschatz, Galvin, Gagne. Operating System Concepts, 10th edition, John Wiley & Sons, 2018.
 - Nguyễn Phú Trường. Operating Systems Textbook. Can Tho University, 2005.

5. Coursework Apps

- Oracle (October 10th, 2022/VirtualBox 7.0.0 released). VirtualBox.
- Ubuntu 22.04 LTS.

V. Political Economics of Marxism and Leninism (Kinh Tế Chính Trị Marx - Lenin - SS008); History of Vietnamese Communist Party (Lịch Sử ĐCS VN - SS010)

Progress	Mid-term	End-term
30%	20%	50%