Lecture Plan for CO 71511: Database Engineering
2022-2023

Total Number of Lectures: 40(Approx.)
Name of Instructors: Dr. Vandan Tewari and Ms Neha Mehra
Pre Requisite of this course is good understanding of data structures and good programming skills

UNIT I: (No of Lectures: 15) < Introduction & Data Models, Integrity Constraints, Normalization & Storage Structure>

Lect 1: Basic Concept, View of data- Data abstraction. Data Integrity, universe of discourse, Instances and schemas, Data Independence.
Lect 2: DBMS Architecture, The 3 – schema design, various type of data models, various DBMS Architectures. Database languages & database administrator, overall system architecture, Database design..
Lect 3-4: Requirement analysis, design issues, ER Model: Basic Concepts, ER Diagram, ER Diagram, Design issues..
Lect 5-6: Relational Algebra. Relational Calculus
Lect 7-8: SQL Queries, Introduction to PL / SQL, Assertions.
Lect 9: Fds, Closure of set of F.Ds, Armstrong's axioms, closure of attribute sets.
Lect 10: Canonical cover and computation of key, equality of set of FDs.
Lect 11-12: 1 NF, 2 NF, and 3 NF, vrs BCNF, Loss less join decomposition, Denormalization.
Lect 13: Dependency Preservation.
Lect 14: Introduction to Hashing, Types of Hashing, Physical DB Design, RAID.
Lect 15: Type of file Organizations, Indexing, Techniques primary indexes, Clustering Indexes, Secondary Index & Multilevel Index.

UNIT II (No. of Lectures: 07) < Query Processing>

Lect 16-17: Query Processing, Implementation of Select.
Lect 18-19: Implementation of join operation, Query Optimization.
Lect 20-22: Selectivity Estimation, Improving query performance with variants indices, Cost Estimation

UNIT III (No. of Lectures: 11) <Transaction Processing >

Lect 23-24: Transaction, Operations, Properties (ACID) of transaction, Major actions oftransactions.
Concurrent Execution of Transaction; various types of anomalies arising out of them.
Lect 25-26: Logging & Schedule, recoverability of schedule, serial schedule, serializable schedule.
Result equivalence & Conflict equivalence.
Lect 27-28: Recovery Procedure, Structures for recovery procedures. Log with deferred updates & logging
with immediate updates.
Lect 29-30: Check pointing, Concurrency control, conflict serialisability, serialization graph.

Lock based concurrency control, 2PL protocol, strict 2PL & conservative 2PL, Multiversion.

Lect 31-32: Deadlocks, Prevention & detection with & without time stamps, wait for graphs. Transaction Support in SQL.

Lect 33: Triggers, cursors, Assertions

UNIT IV (No. of Lectures: 04) < Distributed & Parallel Databases >

Lect 34-35: Distibuted Database architecture and design its methods

Lect 36-37: Parallel Database architecture and design and its methods

UNIT V (No of Lectures 03) < Advanced Topics >

Lect 38: Review of Data Mining

Lect 39: Introduction to Data warehousing

Lect 40: Xml databases & Introduction to Web mining

Lecture Plan

CO71764 Data Science and Engineering

S. No.	Topic	Number of Lectures (Hours)
1.	Introduction of subject	1
2.	Motivation and Challenges	1
3.	Evolution of Data Mining	1
4.	Introduction to R Programming Language	1
5.	Variables and Data types	1
6.	Data frames, Recasting and Joining of Data frames	1
7.	Arithmetic, Logical and Matrix Operations	1
8.	Functions, Control Structures	1
9.	Data Visualization in R	1
		Total **9**
10.	Types of Data	1
11.	Quality of Data	1
12.	Data Preprocessing	2
13.	Measurement of Similarity and Dissimilarity	2
14.	Data Exploration- Summary Statistics	1
15.	Visualization	1
16.	OLAP and Multidimensional Data set	1
		Total **9**
17.	Linear Algebra for Data Science	2
18.	Predictive Modeling	1
19.	Linear Regression	1
20.	Model Assessment and improving linear model fit	1
21.	Cross validation	1
22.	Logistic Regression	1
23.	Performance measure	1
		Total **8**
24.	Classification	1
25.	Decision Tree	1
26.	Rule Based Classifier	1
27.	K-Nearest Neighbour Classsifier	1
28.	Model over fitting	1
29.	Performance evaluation of Classifier	1
30.	Class imbalance problem	1
		Total **7**
31.	Clustering, Different types of clusters	1
32.	K- Means Clustering	2
		Total **3**
		TOTAL 35

Dr. Urjita Thakar

SUMMARY LECTURE PLAN:

CO71720: Deep and Reinforcement Learning

S.No.	Topic	Lectures
1.	Introduction to Deep Learning	9
2.	Autoencoders & Regularization	8
3.	Convolutional Neural Network & Recurrent Neural Networks	
4.	Reinforcement Learning	
5.	Reinforcement Learning & Adveserial Networks	

DETAILED LECTURE PLAN:

Lecture No.	Topics
1.	CO's, Assessment policies, Scope of subject, What is covered? And whatis not covered?
2.	Introduction to Deep Learning, Difference between deep learning &machine learning, tools and libraries used
3.	McCulloch Pitts Neuron, Thresholding Logic
4.	Perceptron neurons, perceptron algorithm
5.	Activation functions- identity, step, binary, sigmoid, tanh, ReLU, leakyReLU, parametric ReLU, exponential ReLU, softmax, swish etc.
6.	Gradient Descent (GD), Momentum Based GD
7.	Nesterov Accelerated GD, Stochastic GD, mini batch GD
8.	AdaGrad, RMSProp, Adam, comparison between all variants of GD
9.	Eigen value, Eigenvalue Decomposition, PCA.
10.	Autoencoders and relation to PCA, different types of autoencoders
	Class Test -1
11.	Under complete autoencoder, over complete autoencoder, Regularizationin autoencoders
12.	Denoising auto encoders, Sparse autoencoders
13.	Contractive autoencoders
14.	Regularization: Bias Variance Tradeoff, L2 regularization
15.	Early stopping, Dataset augmentation, Parameter sharing and tying,
16.	Injecting noise at input, Ensemble methods, Dropout
17.	Batch Normalization, Instance Normalization, Group Normalization.
	MST-1
18.	Greedy Layerwise Pre-training, Better activation functions, Better weight initialization methods
19.	Learning Vectorial Representations Of Words- n-grams, TF-IDF, BOWetc
20.	Convolutional Neural Networks- convolution operation, padding, pooling,types of pooling, stride
21.	LeNet, AlexNet, ZF-Net,
22.	VGGNet, GoogLeNet, ResNet
23.	Visualizing Convolutional Neural Networks, Comparison between all theabove networks
24.	Guided Backpropagation

25.	Deep Dream, Deep Art
26.	Recent Trends in Deep Learning Architectures.
27.	Recurrent Neural Networks, motivation, types of RNN, applications ofRNN
28.	Backpropagation through time (BPTT)
29.	Limitation of BPTT, Solution to it
	Quiz -1
30.	Vanishing and Exploding Gradients,Truncated BPTT
31.	GRU, LSTMs
32.	Encoder Decoder Models, BLEU score
33.	Attention Mechanism, Attention over images.
34.	Introduction to reinforcement learning(RL), elements of RL
35.	Bandit algorithms – UCB, PAC,
36.	Thompson Sampling
37.	Median Elimination, Policy Gradient, Full RL & MDPs, BellmanOptimality
	MST-2
38.	Dynamic Programming - Value iteration, Policy iteration, and Q-learning
39.	Temporal Difference Methods, Temporal-Difference Learning, EligibilityTraces
40.	Temporal Difference Methods, Temporal-Difference Learning, EligibilityTraces, Function Approximation, Least Squares Methods

Ms. Himani Mishra

Lecture Plan
CO71513: Agile Software Development
Total Lectures:40

S.No	Unit	Topic to be covered	No of Lectures
1	I	Fundamentals of Software Engineering Concepts and Process	1
2	I	Software Development Life Cycle, Important Steps and Effort Distribution	2
3	I	Prototype Model, Incremental Model	1
4	I	Spiral Model, RAD	2
5	II	The Genesis of Agile, Introduction and background	1
6	II	Agile Manifesto and principles	1
7	II	Agile development Lifecycle	1
8	II	Agile Development Methods: Adaptive Software Development (ASD), Dynamic Systems Development Methods (DSDM)	1
9	II	Extreme Programming (XP): XP lifecycle	2
10	II	Feature Driven development,	1
11	II	Lean Software Development, Kanban	1
12	II	Agile project management	1
13	II	Test Driven Development, Key Principles, Examples, and Tools & Techniques for each Agile development methods	1
14	III	Impact of Agile Processes in Requirement Engineering Requirements Elicitation and Management	1
15	III	Agility in Design, Agile Architecture, Agile Design Practices	1
16	III	Role of Design Principles, Agile Product Development	1
17	III	Automated build tools, Continuous Integration, Continuous Deployment, Refactoring, Team Dynamics and Collaboration	1

18	III	Introduction to Scrum, Agile Principles - Sprints Introduction, User Stories and Product Backlog	1
19	III	Estimation, Velocity, Burndown chart, Sprint Zero	1
20	III	Roles - Team Management and Structures, Product Owner, ScrumMaster / Team Lead, Implementation Team Members	1
21	III	Planning in Scrum - Planning, Planning Stakeholders	1
22	IV	Planning Types (Portfolio, Product and Sprint)	1
23	IV	Sprint phases/meeting - Sprint Planning, Sprint Review, Sprint Retrospective, Product Demo, Daily Scrum calls	3
24	V	Agile Testing Principles, Practice and Processes	1
25	V	Difference between Testing in Traditional and Agile Approaches	1
26	V	Agile testing methods, techniques and tools	1
27	V	Estimating Test Efforts, Agile Metrics and Measurements	1
28	V	Agile Control: the 7 control parameters; Product Quality	1
29	V	Agile approach to Risk	2
30	V	Agile Approach to Configuration Management	1
31	V	Agility and Quality Assurance	1
32	V	Case study using any one of the framework	3

LAB PLAN AGILE

S.No	Lab Work	No. of labs required
1	IEEE standard SRS Formation	2
2	UML Diagrams	2
3	User stories and Test case designing	2
4	Iteration of sprints/ Sprint review and retrospective	4
5	Prototype Submission	1

Ms. Priyanka Kokate

Lecture Plan
CO71512 – Algorithmics
Semester: Jan- Apr 2023

1. Introduction and importance of the subject meaning of Design and Analysis of Algorithms, meaning of time and space complexity
2. Concept of Abstract Data Type, Examples
3. Review of Elementary Data structures
4. Internal representation of data structures- Memory management
5. Characteristics and properties of algorithms
6. Analysis of Algorithm – time and space complexity issues
7. Worst case analysis, Best case analysis
8. Asymptotic notations- Big Oh, Small Oh, Big Ω, Small Ω, Big Θ
9. Discussion on average case analysis
10. Probabilistic analysis
11. Solving recurrences – Recursion tree method
12. Master Method
13. Examples
14. Analysis of sorting methods- Heap sort
15. Hashing – hash tables and Hash functions
16. Collision Handling methods
17. 18. Binary search tree- various operations of binary search tree

19,20 AVL tree

21,22. B tree, insertion deletion and searching in B-Trees

23 Hash tables, Hash functions, Collision handling methods.

24 Binary Heaps, Binomial Heaps ; Heap Sort.

25,26 Divide and conquer: Quick sort, Merge Sort etc.; Finding median, Counting Inversion, Linear time Sorting;

27 Binary search, Dynamic Programming

28 Concept of Dynamic programming Vs Divide and Conquer,

29 Matrix Chain multiplication, 0/1 knapsack problem.

30 Greedy Algorithm: Basic Concept, fractional knapsack problem,

31 Scheduling problem.

32,33 Graph algorithms: DFS, BFS, Topological sorting, shortest path, Minimum Spanning Tree, Network flow Problem.

34 Solvable and Unsolvable problems: P, NP, NP Hard and NP complete problems

35 Cooks theorem, reduction,

36 NP-Complete problems: Satisfiability, Clique problem, Independent Set problem (ISP)

37 Introduction to Approximation Algorithms: TSP.

38 Introduction to Parallel Algorithms, PRAM model,

39,40 Threaded Fibonacci algorithm. Number Theoretic algorithms.

Dr. Urjita Thakar