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## Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024 Advanced Computer Architectures

Time: 3 hrs.

Max. Marks: 80

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

- 1 a. Explain Uniform Memory Access (UMA) and Non-Uniform Memory Access (NUMA) multiprocessor models. (06 Marks)
- b. Define the various types of data dependence. (05 Marks)
- c. Draw the dependence graph showing both data and resource dependence for the following code segment :
- P<sub>1</sub> : C = D × E
- P<sub>2</sub> : M = G + C
- P<sub>3</sub> : A = B + C
- P<sub>4</sub> : C = L + M
- P<sub>5</sub> : F = G ÷ E (05 Marks)

OR

- 2 a. Explain the topologies of the following static connection networks, in terms of network parameters :
- (i) Linear array
- (ii) Ring.
- (iii) Barrel shifter.
- (iv) Mesh. (08 Marks)
- b. Explain Flynn's classification of computer architectures, with neat block diagrams. (08 Marks)

### Module-2

- 3 a. Distinguish between RISC and CISC processor architectures with the help of block diagram. Also compare the architectural characteristics of the same. (10 Marks)
- b. Explain in detail, hierarchical memory technology. (06 Marks)

OR

- 4 a. Consider the design of a three level memory hierarchy with the following specifications ;

Memory level	Access time	Capacity	Cost / K byte
Cache	t <sub>1</sub> = 25 ns	S <sub>1</sub> = 512 kB	C <sub>1</sub> = \$ 0.12
Main memory	t <sub>2</sub> = unknown	S <sub>2</sub> = 32 MB	C <sub>2</sub> = \$ 0.02
Disk array	t <sub>3</sub> = 4 ms	S <sub>3</sub> = unknown	C <sub>3</sub> = \$ 0.00002

- (i) Compute S<sub>3</sub>, if the total cost of the memory hierarchy is upper\_bounded by \$ 1500.
- (ii) Compute t<sub>2</sub>, if effective memory access time t = 850 nS with a cache hit ratio h<sub>1</sub> = 0.98 and h<sub>2</sub> = 0.99 in main memory. (08 Marks)
- b. What is page replacement? Define the various page replacement policies. (08 Marks)

**Module-3**

- 5 a. With neat block diagrams, explain bus arbitration schemes. (10 Marks)  
 b. List the various block mapping schemes for cache memory. Explain any one in detail. (06 Marks)

**OR**

- 6 a. Explain in detail, the following mechanisms for instruction pipelining :  
 (i) Prefetch buffers.  
 (ii) Internal data forwarding (08 Marks)  
 b. Consider the following pipeline reservation table :

	1	2	3	4
S <sub>1</sub>	X			X
S <sub>2</sub>		X		
S <sub>3</sub>			X	

- (i) What are the forbidden latencies?  
 (ii) Draw the state transition diagram.  
 (iii) List all the simple and greedy cycles.  
 (iv) Compute Minimal Average Latency (MAL)  
 (v) Determine the throughput using MAL. (08 Marks)

**Module-4**

- 7 a. Explain in detail, write invalidate and write update cache coherence protocols for write through caches. (08 Marks)  
 b. Explain the format of message used in a message passing network. Also differentiate between store-and-forward routing and wormhole routing. (08 Marks)

**OR**

- 8 a. Explain the various prefetching techniques used in shared virtual memory. (04 Marks)  
 b. Define the following :  
 (i) Sequential consistency  
 (ii) Processor consistency.  
 (iii) Weak consistency  
 (iv) Release consistency. (04 Marks)  
 c. Explain the various context-switching policies adopted in multithreaded architectures. (08 Marks)

**Module-5**

- 9 a. Define the two basic mechanisms used for inter process communication. (04 Marks)  
 b. Explain any four language features for parallel programming. (08 Marks)  
 c. Illustrate spin locks and suspend locks used for protected access of shared variables. (04 Marks)

**OR**

- 10 a. Define loop unrolling. Illustrate the same with a suitable example. (05 Marks)  
 b. With a state transition diagram, explain 2 bit branch predictor. (05 Marks)  
 c. Explain Tomasulo's algorithm. (06 Marks)

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15CS73

## Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024 Machine Learning

Time: 3 hrs.

Max. Marks: 80

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

- 1 a. Define well posed learning problem with an example. (02 Marks)
- b. Explain the major applications of the machine learning. (04 Marks)
- c. Apply the candidate elimination algorithm for the following data samples. Give the algorithm for the same.

Data sample	Sky	Air Temp	Humidity	Wind	Water	Forecast	Enjoy sports
1	Sunny	Warm	Normal	Strong	Warm	Same	Yes
2	Sunny	Warm	High	Strong	Warm	Same	Yes
3	Rainy	Cold	High	Strong	Warm	Change	No
4	Sunny	Warm	High	Strong	Cool	Change	No

(10 Marks)

**OR**

- 2 a. Explain the futility of bias free learning for any concept learning method. Give the inductive bias for candidate elimination algorithm. (06 Marks)
- b. Design a learning system in detail for playing checkers problem. (10 Marks)

### Module-2

- 3 a. Define decision tree. Explain the appropriate problems for decision tree learning. (06 Marks)
- b. Mention the different issues in decision tree learning and explain any two in detail. (10 Marks)

**OR**

- 4 a. Differentiate between restriction bias and preference bias with an example. (03 Marks)
- b. Define entropy and information gain. (03 Marks)
- c. Construct the decision tree for the given data samples using ID3 algorithm. Represent the same tree with the help of hypothesis [Target concept : Play Tennis]

Day	Outlook	Temperature	Humidity	Wind	Play Tennis
D1	Sunny	Hot	High	Weak	No
D2	Sunny	Hot	High	Strong	No
D3	Overcast	Hot	High	Weak	Yes
D4	Rain	Mild	High	Weak	Yes
D5	Rain	Cool	Normal	Weak	Yes
D6	Rain	Cool	Normal	Strong	No
D7	Overcast	Cool	Normal	Strong	Yes
D8	Sunny	Mild	High	Weak	No
D9	Sunny	Cool	Normal	Weak	Yes
D10	Rain	Mild	Normal	Weak	Yes
D11	Sunny	Mild	Normal	Strong	Yes
D12	Overcast	Mild	High	Strong	Yes
D13	Overcast	Hot	Normal	Weak	Yes
D14	Rain	Mild	High	Strong	No

(10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

**Module-3**

- 5 a. Define perceptron. Give the representation of different Boolean functions by perceptron. (05 Marks)  
 b. Differentiate between perceptron training rule and delta rule. (05 Marks)  
 c. Explain the derivation of gradient descent with an algorithm. (06 Marks)

**OR**

- 6 a. Explain the sigmoid function in detail. (04 Marks)  
 b. Give the algorithm of back propagation for the multilayer neural network and explain the derivation of: (i) Output unit weights (ii) Hidden unit weights (12 Marks)

**Module-4**

- 7 a. Define Bayes theorem. Explain in detail the different features of Bayesian learning. (06 Marks)  
 b. Consider a medical diagnosis problem in which there are 2 alternative hypothesis (i) the patient has a particular form of cancer  $\oplus$  positive and (ii) the patient does not  $\ominus$  negative. We have prior knowledge that over the entire population of people only 0.008 have this disease. The test returns a correct positive result in only 98% of the cases in which the disease is actually present, and a correct negative result in only 97% of the cases in which the disease is not present. Find out does new patient have cancer or not. (10 Marks)

**OR**

- 8 a. Mention different methods of Bayes theorem used for concept learning. Explain any one in detail. (06 Marks)  
 b. Explain Naïve Bayes Classifier (NBC) learning method. For the training examples (samples) given in question 4C apply NBC to classify the following novel instance. (Outlook = Sunny, Temperature = Cool, Humidity = High, Wind = Strong) (10 Marks)

**Module-5**

- 9 a. Differentiate between true error and sample error. (06 Marks)  
 b. Give the following definitions of sampling theory:  
 (i) Random variable (ii) Probability distribution  
 (iii) Mean (iv) Variance  
 (v) Standard deviation (vi) Binomial distribution  
 (vii) Normal distribution (viii) Central limit theorem  
 (ix) Estimator and estimation bias (x) N% confidence interval (10 Marks)

**OR**

- 10 a. What is reinforcement learning? Give an example. (04 Marks)  
 b. Write short notes on:  
 (i) K-Nearest Neighbour Learning  
 (ii) Locally Weighted Regression (12 Marks)

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15CS754

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024

## Storage Area Networks

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- 1 a. Define Datacenter. Explain the key characteristics of Datacenter. (05 Marks)  
b. With a neat diagram, explain how storage centric IT Architecture can overcome the limitations of severcentric IT architecture. (05 Marks)  
c. Illustrate read and write operations in cache. (06 Marks)

OR

- 2 a. Describe RAID levels with reference to RAID0, RAID1, RAID3 and RAID6. (06 Marks)  
b. What is File system? Illustrate the process of mapping user files to the disk storage subsystem with an LVM. (05 Marks)  
c. With a neat diagram, explain the types of Intelligent storage system. (05 Marks)

### Module-2

- 3 a. List and explain different FC connectivity options with a neat diagram. (08 Marks)  
b. With diagram explain ISCSI implementation. (08 Marks)

OR

- 4 a. What is NAS? Explain NAS implementation in detail. (08 Marks)  
b. List the key features of Content Addressed Storage (CAS). Illustrate with a neat block diagram the unified storage for CAS system. (08 Marks)

### Module-3

- 5 a. What is Business Continuity? Explain the BC Terminology in detail. (08 Marks)  
b. Explain Backup and Restore operations, with neat diagram. (08 Marks)

OR

- 6 a. What is Data Deduplication? Explain the implementation of Data deduplication. (08 Marks)  
b. Explain Synchronous + Asynchronous and Synchronous + Disk Buffered methods of three – site replication, with neat diagram. (08 Marks)

### Module-4

- 7 a. List various cloud computing characteristics. Explain the cloud computing infrastructure components with a neat diagram. (08 Marks)  
b. With diagram explain different cloud deployment models. (08 Marks)

OR

- 8 Explain in detail in band and out of band virtualization appliances with a neat diagram. (16 Marks)

### Module-5

- 9 a. Explain FC SAN security architecture with neat diagram. (08 Marks)  
b. Explain the concept of Kerberos, with neat diagram. (08 Marks)

OR

- 10 a. Explain the Storage Management activities in detail. (08 Marks)  
b. Explain Information Lifecycle Management (ILM) in detail with challenges. (08 Marks)

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