Registration No.: | | | | | | | | | | |

Total Number of Pages: 02 **Course: M.Tech**
Sub_Code: P1CSBC03

1st Semester Regular/Back Examination: 2024-25
SUBJECT: Advanced Computer Architecture
BRANCH(S): Computer Science and Engg
Time: 3 Hours
Max Marks: 100
Q.Code: R472

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) If computer A runs a program in 10 seconds, and computer B runs the same program in 15 seconds, how much faster is A over B?
b) What do you mean by Spatial and Temporal locality of reference?
c) Define Cache coherence problem.
d) Is VLIW a RISC or CISC? Justify.
e) Define – Superscalar Processor.
f) Given page reference string: 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6. Find the number of page faults for optimal page replacement algorithm
g) What is a Delayed branch? How does it improve the Performance of a pipeline architecture?
h) Differentiate between Address space and Memory space.
i) Write any two differences between Superscalar architecture and Super pipelined architecture.
j) Define the term "Virtual Memory ".

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Compare CISC and RISC computer architectures.
b) Explain the memory interleaving technique with suitable example.
c) A computer has an 8 GByte memory with 64 bit word sizes. Each block of memory stores 16 words. The computer has a direct-mapped cache of 128 blocks. The computer uses word level addressing. What is the address format? If we change the cache to a 4- way set associative cache, what is the new address format?
d) Describe Flynn's classification of computer architecture.
e) What do you mean by Speed-Up of pipeline? Derive equations of Speed-Up and Efficiency for Pipeline, Super pipeline, and Super scalar architecture.
f) What is the basic working principle of VLIW processor? What are the advantages of a VLIW processor?

g) Compare the features of Array Processor and Vector Processors.

h) Explain with suitable example LRU page replacement algorithm. Given page reference string: 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6
Find the number of page faults for LRU page replacement algorithm.

i) A CPU generates 32-bit virtual addresses. The page size is 4kB. The processor has a TLB which can hold a total of 256 pages table entries. The TLB is an 8-way set associative. Calculate the TLB tag size.

j) Which memory architecture is scalable UMA or NUMA? Justify.

k) Consider a 7-stage pipeline processor. In the first stage, instruction is fetched. In the second stage, the instruction is decoded as well as branch target address is computed for branch instructions. In the third stage, the branch outcome is evaluated. Assume 25% of all branches are unconditional branches. Of all the conditional branches, on the average 80% tum out to untaken. Compute the average pipeline stall cycles per branch instruction under pipeline stall, conditional taken, conditional untaken, delayed branch schemes. Ignore structural and data hazards. For delayed branch scheme assume that suitable successor is always found.

l) What is cloud computing explain its characteristics and features?

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 **a)** Define the term pipelining? Explain different types of hazards that occur in instruction pipeline. How to handle them? **(8)**

b) Consider a 4-stage pipeline that consists of Instruction Fetch (IF), Instruction Decode (ID), Execute (Ex) and Write Back (WB) stages. The times taken by these stages are 50 ns, 60 ns, 110 ns, and 80 ns respectively. The pipeline registers are required after every pipeline stage, and each of these pipeline register consumes 10 ns delay. What is the speedup of the pipeline under ideal conditions compare to the corresponding non-pipelined implementation? **(8)**

Q4 What is Interconnection network? Compare and contrast between static and dynamic networks. Draw a Shuffle network and explain the communication mechanism. **(16)**

Q5 What is Locality of Reference and explain about Cache memory in detail. Illustrate the mapping process involved in transformation of data from main to Cache memory. A computer has a 4 GByte memory with 32 bit word sizes. Each block of memory stores 32 words. The computer has a direct-mapped cache of 64 blocks. The computer uses word level addressing. What is the address format? If we change the cache to an 8-way set associative cache, what is the new address format? **(16)**

Q6 Explain in detail about data flow computer architecture. Distinguish between static data flow computer and dynamic data flow computer. **(16)**

Registration No.: | | | | | | | | | | |

Total Number of Pages: 02

Course: M.Tech
Sub_Code: P1CSBC04

1st Semester Regular/Back Examination: 2024-25
SUBJECT: Advanced Data Structure and Algorithm
BRANCH(S): COMPUTER SCIENCE AND ENGG
Time: 3 Hours
Max Marks: 100
Q.Code: R505

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) What is B-tree of order m? Draw a B-tree of order 3.
b) What are the advantages in reverse polish (prefix and postfix notation) over polish (infix) notation?
c) Write the differences between spanning tree and minimum spanning tree.
d) What is Binary heap?
e) How NP-hard problems are different from NP-Complete?
f) What is a circular queue? How do you check the queue full condition?
g) Define Binomial Heap.
h) Define Splay Tree.
i) Define B-tree.
j) What are the drawbacks of AVL trees?

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Write the algorithm to compute 0/1 Knapsack problem using dynamic programming and explain it.
b) Write and explain Cook's theorem.
c) Explain the methodology of Dynamic programming. List the applications of Dynamic programming.
d) Determine an LCS of <1, 0, 0, 1, 0, 1, 0, 1> and <0, 1, 0, 1, 1, 0, 1, 1, 0>.
e) Explain the single source shortest path problem with an example.
f) Solve the recurrence relation: $T(n) = 3\,T(n/4) + n$
g) Write an algorithm for 2-3 Tree deletion and discuss its analysis.
h) Explain Ukkonen's algorithm for constructing suffix trees. How does it improve upon the naive approach? Illustrate the algorithm with a step-by-step example.
i) Show step by step process for constructing binary heap using the following data 10, 12, 1, 14, 6, 5, 8, 15, 3, 9, 7, 4, 11, 13 and 2.

j) Find out the inorder, preorder, postorder traversal for the binary tree representing the expression (a+b*c)/(d-e) with the help of procedures.

k) A file contains only colons, spaces, newlines, commas and digits in the following frequency. colon-100, space – 605 newline – 100, comma – 705, 0-431, 1-242, 2-176, 3-59, 4-185, 5-250, 6-174,7-199, 8-205, 9-217. Construct the Huffman code. Explain Huffman algorithm.

l) Write and explain Floyd-Warshall's algorithm.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Compare and contrast Tries with other data structures like hash tables and binary search trees in terms of their efficiency and use cases in text processing. **(16)**

Q4 Explain the structure of a 2-3 tree. How does it maintain balance, and what are the advantages of using a 2-3 tree over a standard binary search tree? Illustrate the insertion and deletion processes with examples. **(16)**

Q5 Explain the relationship between class P, NP, NP-complete and NP hard problem with example of each class. **(16)**

Q6 Describe the properties of a Red-Black Tree. How does it ensure that the tree remains balanced? Provide examples of the insertion and deletion processes, highlighting the role of color changes and rotations. **(16)**

Registration No.: | | | | | | | | | | |

Total Number of Pages: 02 **Course: M.Tech**
Sub_Code: P1CSBC05

1st Semester Regular/Back Examination: 2024-25
SUBJECT: Advanced Operating System
BRANCH(S): COMPUTER SCIENCE AND ENGG
Time: 3 Hours
Max Marks: 100
Q.Code: R546

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) What are the different types of agreement protocols?
b) What is the role of central coordinator in centralized deadlock detection?
c) What is the role of global state detection in ensuring system consistency?
d) What are necessary conditions for deadlock?
e) What is phantom deadlock?
f) Define Edge chasing.
g) How does centralized deadlock detection differ from distributed deadlock detection?
h) Differentiate between transit less global state and consistent global state.
i) If the topology has a cycle then what will be problem of Raymond Tree based Algorithm?
j) What is the Message Complexity of Ricart–Agrawala's algorithm for both request message and reply message?

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) What do you mean by false deadlock in a distributed system and how can we avoid it?
b) Write Short note on Consumable Resources and Reusable Resources.
c) Why global clock is important in a distributed system? Why this is an issue? How this can be realized?
d) What are the limitations of Lamport's clock?
e) Why global state detection is an issue in distributed system?
f) Why deadlock detection is important in distributed system?
g) Compare Ricart-Agrawala's token based algorithm with Ricart-Agrawala's permission based algorithm.
h) Write the pseudocode of Raymond Tree based Algorithm.

i) Explain the advantages and disadvantages of the Ricart-Agrawala's multual exclusion algorithm in distributed systems.

j) Difference between Token based and Non-Token based Algorithms in Distributed System.

k) How Suzuki–Kasami's algorithm uses sequence numbers to distinguish between old and current requests

l) Explain the advantages and disadvantages of distributed shared memory.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 **a)** Explain Lamport's Algorithm. Is the algorithm scalable? Justify your answer. **(8)**

b) What do you understand by Vector clock? How vector clock is used to determine if two events are concurrent? **(8)**

Q4 **a)** Explain Wait-for Graphs approach for deadlock detection. Which types of deadlocks are not handled by WFG? How this can be handled? **(8)**

b) What are the key aspects required to consider the performance of deadlock detection in distributed systems? What are the Challenges of Deadlock Detection in Distributed Systems? **(8)**

Q5 **a)** Explain briefly Maekawa Algorithm. How deadlock situation can be handled by Maekawa's distributed mutual exclusion algorithm? **(8)**

b) How Hierarchical Deadlock Detection Algorithm resolve deadlock in a distributed system? **(8)**

Q6 **a)** What do you understand by Distributed File systems? Explain its Architecture. **(8)**

b) Explain Fault Tolerance in detail. What are the approaches for it? **(8)**

Registration No.: | | | | | | | | | | |

Total Number of Pages: 03 **M.Tech**
P1PGCC01

1st Semester Regular/Back Examination: 2024-25
COMPUTATIONAL METHODS AND TECHNIQUES
CIVIL ENGG., COMMUNICATION ENGG, COMMUNICATION SYSTEMS, COMPUTER SCIENCE AND ENGG, CONSTRUCTION TECH. AND MANAGEMENT, ELECTRICAL AND ELECTRO ENGG, ELECTRICAL ENGG., ELECTRO & COMM. ENGG, ELECTRO AND TELECOMMUNICATION ENGG, ENVIORN ENGG., ENVIRONMENTAL SCIENCE AND ENGG, HEAT POWER & THERMAL ENGG, HEAT POWER ENGG, ISE, MACHINE DESIGN, MECH. ENGG., MECH. SYSTEM DESIGN, PLASTIC ENGG, POLYMER NANOTECH., POWER AND ENERGY ENGG, POWER ELECTRO & DRIVES, POWER ENGG AND ENERGY SYSTEMS, POWER SYSTEM ENGG, PRODUCTION ENGG, PRODUCTION ENGG AND OPERATIONAL MGT, SOIL MECHANICS & FOUNDATION ENGG, STRUCTURAL & FOUNDATION ENGG, STRUCTURAL ENGG, THERMAL & FLUID ENGG, THERMAL ENGG, VLSI & EMBEDDED SYSTEMS, VLSI & EMBEDDED SYSTEMS DESIGN, WATER RESOURCE ENGG & MANAGEMENT
Time: 3 Hours
Max Marks: 100
Q.Code: R426
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Explain about mutation in genetic algorithm with an example.
b) How a basic artificial neuron represented?
c) Explain the importance of fitness function in the genetic algorithm.
d) What is the significance of Lagrange Multiplier in a constrained optimization problem?
e) State the basic difference between derivative based and derivative free optimization.
f) Perform the two-point crossover operation (at position 2 & 4) of the parental 011010 and 110100.
g) List the advantages of fuzzy logic control systems.
h) Define a Linear Programming optimization (Simplex Method).
i) What do you mean by hybridization of Metaheuristic Optimization Algorithms?
j) What do you mean by ANFIS?

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Name and describe the main features of Genetic Algorithms (GA).
b) Draw and explain the typical architecture of a Fuzzy Logic Controller.

c) Find the solution of the problem using the Lagrange multiplier method:
Minimize f (x, y) = $kx^{-1}y^{-2}$ subject to g (x, y) = $x^2 + y^2 - a^2 = 0$

d) Explain dynamic programming method of optimization with an example.

e) What is Karmakar's Algorithm? Explain with an example.

f) Minimize: f (x, y, z) = $x^2 + y^2 + z^2 + 20x + 10y$, subject to $x \geq 40$, $x + y \geq 80$, $x + y + z \geq 120$. Write the Kuhn-Tucker conditions for the above inequality constrained optimization problem.

g) Consider two given fuzzy sets.
A = {1/2, 0.3/4, 0.5/6, 0.2/8}, B = {0.5/2, 0.4/4, 0.1/6, 1/8}
Perform union, intersection, difference, and complement over fuzzy sets A and B.

h) What are the different types of Perceptrons? Explain with examples.

i) What is the difference between Forward propagation and Backward Propagation in Neural Networks? Explain with suitable examples.

j) Name the various genetic operators and explain each of these with an example.

k) Define membership function and its importance in fuzzy logic.

l) Explain Particle Swarm Optimization algorithm with a flow chart/ step by step method.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Consider three sets as stated below (In the context of courses offered among students) S = {s_1, s_2, s_3, s_4} is a set of students, C = {c_1, c_2, c_3} is a set of courses and P = {p_1, p_2, p_3, p_4} denotes a set of level of popularity. Two relations are given below:

R_1 =

	c_1	c_2	c_3
s_1	0.1	0.2	0.3
s_2	0.2	0.3	0.1
s_3	0.2	0.3	0.1
s_4	0.3	0.1	0.2

R_2 =

	p_1	p_2	p_3	p_4
c_1	0.4	0.3	0.2	0.5
c_2	0.1	0.3	0.5	0.7
c_3	0.2	0.4	0.6	0.8

a) Find R_1 o R_2. **(8)**

b) What are the physical implementation of R_1, R_2, and R_1 o R_2? **(8)**

Q4 Suppose a genetic algorithm uses chromosomes of the form x = abcdefgh with a fixed length of eight genes. Each gene can be any digit between 0 and 9. Let the fitness of individual x be calculated as: f(x) = (a + b) – (c + d) + (e + f) – (g + h), and let the initial population consist of four individuals with the following chromosomes:
x_1 = 65413532, x_2 = 87126601, x_3 = 23921285, x_4 = 41852094

a) Evaluate the fitness of each individual, showing all your workings, and arrange them in order with the fittest first and the least fit last. **(2)**

b) Perform the following crossover operations: i) Cross the fittest two individuals using one–point crossover at the middle point. ii) Cross the second and third fittest individuals using a two–point crossover (points b and f). iii) Cross the first and third fittest individuals (ranked 1st and 3rd) using a uniform crossover. **(6)**

c) Suppose the new population consists of the six offspring individuals received by the crossover operations in the above question. Evaluate the fitness of the new population, showing all your workings. Has the overall fitness improved? **(4)**

d) By looking at the fitness function and considering that genes can only be digits between 0 and 9 find the chromosome representing the optimal solution (i.e. with the maximum fitness). Find the value of the maximum fitness. **(2)**

e) By looking at the initial population of the algorithm can you say whether it will be able to reach the optimal solution without the mutation operator? **(2)**

Q5 Explain in detail the various methods to solve unconstrained optimization problems. What are the modifications required when a) Equality Constraints b) Inequality Constraints are introduced. **(16)**

Q6 **a)** What are the stages involved in training a neural net using Back propagation algorithm. Explain. **(10)**

b) Distinguish between binary sigmoid function and bipolar sigmoid functions. **(6)**

Registration No.: | | | | | | | | | | |

Total Number of Pages: 02 **Course: M.Tech**
Sub_Code: P1PGCC02

1st Semester Regular/Back Examination: 2024-25
SUBJECT: Internet of Things
BRANCH(S): CIVIL ENGG., COMPUTER SCIENCE AND ENGG, MECH. ENGG., MECH. SYSTEM DESIGN, MACHINE DESIGN, HEAT POWER ENGG, ELECTRO AND TELECOMMUNICATION ENGG, ELECTRICAL ENGG., ELECTRICAL AND ELECTRO ENGG, ENVIORN ENGG., ENVIRONMENTAL SCIENCE AND ENGG, HEAT POWER & THERMAL ENGG, STRUCTURAL ENGG, STRUCTURAL & FOUNDATION ENGG, THERMAL ENGG, SOIL MECHANICS & FOUNDATION ENGG, VLSI & EMBEDDED SYSTEMS DESIGN, VLSI & EMBEDDED SYSTEMS, WATER RESOURCE ENGG AND MANAGEMENT, ECVD, ME, POWER SYSTEM ENGG, PRODUCTION ENGG, POWER ELECTRO & DRIVES, POWER ENGG AND ENERGY SYSTEMS, POLYMER NANOTECH., PLASTICS ENGG.
Time: 3 Hours
Max Marks: 100
Q.Code: R451
Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right-hand margin indicate marks.

Part-I

Q1 **Answer the following questions** **(2 x 10)**

a) What is a web service? What are the different types of web services used in IoT?
b) What are the four 'V' in Big data?
c) What is Arduino and how does it work?
d) What are the architectural constraints of REST?
e) What is the function of YANG modules in device management?
f) Write a Python program for blinking LED using Raspberry Pi GPIO pin 18.
g) What is the function of MQTT in IoT?
h) Differentiate between the web of things and IoT.
i) How is Raspberry Pi different from a desktop computer?
j) Give the main components of the M2M system.

Part-II

Q2 **Only Focused-Short Answer Type Questions (Answer Any Eight out of Twelve)** **(6 x 8)**

a) Design a simple IoT project using a Raspberry Pi, an LED, and a switch. Describe the circuit setup, programming steps, and how the system can be used in a real-world application.
b) Write the different protocols used in different layers.
c) Explain the IoT level-4 architecture.
d) Explain with examples, how WSN are used in IoT systems.
e) Explain the different types of sensors used in IoT applications.
f) What are the steps for IoT device management with NETCONF-YANG?
g) What is the difference between machines in M2M and things in IOT? Explain with examples.
h) Draw the flow diagram of different steps related to IoT designing methodology.

i) Define the role of Android / IOS App Development tools in IoT.

j) Define RFID. Explain the principle of RFID.

k) Define IoT level specification and describe how determining the appropriate IoT level affects the system's performance, scalability, and functionality.

l) Draw and explain the design of IoT-based home automation system.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 **a)** Explain in detail about the Data warehouse and Hadoop framework. **(8)**

b) What is IP addressing? Explain its types in detail and which type of addressing is best suited for IoT devices. **(8)**

Q4 Explain in detail the domain model and information model for weather monitoring IoT systems. **(16)**

Q5 Construct the design of a smart home with Raspberry Pi and other hardware devices with a neat sketch. **(16)**

Q6 Explain in detail the Request-Response, Publish-Subscribe, and Push-Pull communication model of IoT. **(16)**