B.Tech 4th Semester Exam., 2019

DISCRETE MATHEMATICAL STRUCTURE AND GRAPH THEORY

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

(iv) Question No. 1 is compulsory.

1. Choose the correct answer (any *seven*) : 2×7=14

(a) The statement $p \to q$ is logically equivalent to

(i) $p \vee q$

(ii) $p \vee \sim q$

(iii) $\sim p \vee q$

(iv) $\sim p \to q$

(b) The contrapositive of the conditional statement $p \to q$ is

(i) $q \to p$

(ii) $\sim p \to \sim q$

(iii) $\sim p \to q$

(iv) $\sim q \to \sim p$

(c) If A and B are two ~~non-empty~~ sets having n elements in common, then $A \times B$ and $B \times A$ will have how many elements in common?

(i) 2^n

(ii) n^2

(iii) n^4

(iv) $2n$

(d) If a set A have n elements, then how many relations will be there on set A?

(i) n^2

(ii) 2^{n^2}

(iii) 2^n

(iv) $2n$

(e) If $P(\phi)$ represents the power set of ϕ, then $n(P(P(P(\phi))))$ equal to

(i) 1

(ii) 2

(iii) 3

(iv) 4

(f) For the poset $\{3, 5, 9, 15, 24, 45\}$; divisor of $\}$ the bus of $\{3, 5\}$ is

(i) 3

(ii) 5

(iii) 15

(iv) 45

(g) If $(S, *)$ is a monoid, where $S = \{1, 2, 3, 6\}$ and $*$ is defined by $a * b = \text{lcm}(a, b)$, where $a, b \in S$, then the identity element is

(i) 1

(ii) 2

(iii) 3

(iv) 6

(h) The total number of subgroups of group G of prime order is

(i) 1

(ii) 2

(iii) 3

(iv) 4

(i) The number of edges in a bipartite graph with n vertices is at most

(i) $\frac{n^2}{2}$

(ii) $\frac{n^2}{4}$

(iii) n^2

(iv) $2n$

(j) The number of pendant vertices of a full-binary tree is

(i) $\frac{n-1}{2}$

(ii) $\frac{n-1}{2}$

(iii) $\frac{2n+1}{2}$

(iv) $\frac{2n-1}{2}$

2. *(a)* Using truth table, show that—

(i) $((p \to (q \to r)) \to ((p \to q) \to (p \to r))$ is a tautology;

(ii) $\sim(q \to r) \wedge r \wedge (p \to q)$ is a contradiction.

(b) Obtain the principal disjunctive normal form (PDNF) and principal conjunctive normal form (PCNF) of the statement $(p \to (q \wedge r)) \wedge (\sim p \to (\sim q \wedge \sim r))$ 7+7=14

3. *(a)* For any sets A and B, prove that

(i) $(A \cup B)' = A' \cap B'$;

(ii) $(A \cap B)' = A' \cup B'$.

(b) If two sets A and B have n elements in common, then show that the sets $A \times B$ and $B \times A$ will have 2^n elements in common. 7+7=14

4. *(a)* If R is the relation on the set of positive integers, such that $(a, b) \in R$ if and only if $a^2 + b$ is even, prove that R is an equivalence relation.

(b) Define partition of a set. If the relation R on the set of integers Z is defined by aRb iff $a \equiv b \pmod 4$, find the partition induced by R. 7+7=14

5. *(a)* If R and S be relations on $A = \{1, 2, 3\}$ represented by the matrices

$$M_R = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix} \text{ and } M_S = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

find the matrices that represent *(i)* $R \cup S$, *(ii)* $R \cap S$, *(iii)* $R \circ S$, *(iv)* $R - S$, *(v)* R', *(vi)* $R \circ R$ and *(vii)* $R \oplus S$.

(b) Draw the Hasse diagram representing the partial ordering $\{(A, B) : A \subseteq B\}$ on the power set $P(S)$, where $S = \{a, b, c\}$. Find the maximal, minimal, greatest and least elements of the poset. 7+7=14

6. *(a)* Define characteristic function of a set. If A and B are any two subsets of universal set U, then show that—

$$f_{A \cap B}(x) = f_A(x) + f_B(x) - f_{A \cap B}(x),$$

for all $x \in U$

(b) If functions $f, g, h : Z \to Z$ are defined as

$$f(x) = x - 1,\ g(x) = 3x \text{ and}$$

$$h(x) = \begin{cases} 0, & \text{if } x \text{ is even} \\ 1, & \text{if } x \text{ is odd} \end{cases}$$

7. (a) Show that every group of order 3 is cyclic.

(b) Prove that the necessary and sufficient condition for a non-empty set H of a group $(G, *)$ to be a subgroup is $a, b \in H \Rightarrow a * b^{-1} \in H$. 7+7=14

8. (a) Show that the order of a subgroup of a finite group is a divisor of the order of the group.

(b) Prove that the set S of all real numbers of the form $a + b\sqrt{2}$, where a, b are integers is an integral domain with respect to usual addition and multiplication. 7+7=14

9. (a) Define adjacency matrix and incidence matrix of graph G. Draw the graph represented by the adjacency matrix

$$\begin{bmatrix} 0 & 1 & 1 & 1 \\ 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \end{bmatrix}$$

(b) Show that a tree with n vertices has $(n-1)$ edges. 7+7=14

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Code : 241401

B.Tech 4th Semester Exam., 2019

ORGANISATIONAL BEHAVIOUR AND INDUSTRIAL PSYCHOLOGY

Time : 3 hours *Full Marks* : 70

Instructions :

(i) All questions carry equal marks.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

(iv) Question No. 1 is compulsory. It has 10 subsets, attempt any seven.

1. Fill in the blanks by choosing the correct option :

   (a) Extinction is a method of controlling ____ behaviour. (desirable/undesirable)

   (b) The essence of power is to ____ over the behaviour of others. (guide/control)

   (c) It is apparent that the undesirable behaviour is eliminated through the threat of ____ motivational techniques. (negative/positive)

   (d) ____ is a state of human mind which proposes and examines whether individual acts in accordance with the values and standards of the society. (Ego/Superego)

   (e) Organisational structure depicts the ____ relationships of the people in the organisation. (formal/informal)

   (f) The hierarchy need theory was developed by ____. (Maslow/Herzberg)

   (g) Organisation development is a ____ effort to increase an organisation's problem solving and renewed capabilities. (short/long)

   (h) ____ bargaining negotiation technique calls for win win situation for both the parties. (Distributive/Integrative)

   (i) Noise is a communication ____. (barrier/energiser)

   (j) A number of employees that work together to complete a project or a job are considered as ____ group. (command/task)

2. What is communication? Describe the various steps involved in the process of communication.

3. What are the theories of personality? Discuss the trait theory.

4. What do you understand by learning? State its characteristics. Discuss the steps involved in learning process.

5. Define team. Describe the various types of team and brief its importance. Distinguish between team and group.

6. Describe the various measures for resolving organisational conflicts.

7. What do you understand by organisational change? Discuss the process involved in planned change.

8. Discuss the nature and scope of organisational behaviour.

9. What do you understand by attitude? Discuss the factors involved in the formation of attitude.

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Code : 051402

B.Tech 4th Semester Exam., 2019

COMPUTER ARCHITECTURE

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

(iv) Question No. 1 is compulsory.

1. Choose the correct answer for any *seven* of the following : 2×7=14

(a) How many 128×8 bit RAMs are required to design 32 k×32 bit RAM?

(i) 512

(ii) 128

(iii) 1024

(iv) 32

(b) The intradata transfer techniques are implemented using

(i) serial I/O

(ii) parallel I/O

(iii) Both (i) and (ii)

(iv) Neither (i) nor (ii)

(c) The sequence of events that happen during a typical fetch operation is

(i) PC→MAR→Memory→MDR→IR

(ii) PC→Memory→MDR→IR

(iii) PC→Memory→IR

(iv) PC→MAR→Memory→IR

(d) In case of pipelining processor, loop buffer is

(i) very high speed memory maintained by the instruction fetch stage

(ii) very high speed memory maintained by the instruction decode stage

(iii) very high speed memory maintained by the instruction execute stage

(iv) None of the above

(e) The average memory access time for a machine with a cache hit rate of 90% where the cache access time is 10 ns and the memory access time is 100 ns is

(i) 55 ns

(ii) 45 ns

(iii) 90 ns

(iv) 19 ns

(f) The minimum time delay between the initiations of two independent memory operations is called

(i) access time

(ii) cycle time

(iii) transfer rate

(iv) latency time

(g) In case of vectored interrupt, interrupt vector means

(i) the branch information from the source which interrupts the system

(ii) an address that points to a location in memory where the beginning address of the I/O service routine is stored

(iii) Both (i) and (ii)

(iv) None of the above

(h) A microprogrammed control unit

(i) is faster than a hardwired control unit

(ii) facilitates easy implementation of new instructions

(iii) is useful when every small program is to be run

(iv) usually refers to the control unit of the microprocessor

(i) Relative addressing mode is used to write position independent code because

(i) the code in this mode is easy to atomize

(ii) the code in this mode is easy to relocate in the memory

(iii) the code in this mode is easy to make resident

(iv) the code execution faster in this mode

(j) Which of the following holds data and processing instructions temporarily until the CPU needs it?

(i) ROM

(ii) Control unit

(iii) Main memory

(iv) Coprocessor chip

2. (a) How do instruction set, compiler technology, CPU implementation and control, and cache and memory hierarchy affect the CPU performance? Justify the effects in terms of program length, clock rate and effective CPI.

(b) How is virtual memory managed using paging and TLB? Explain with suitable example. 7+7=14

3. (a) Explain register reference and memory reference instructions in detail with suitable examples.

(b) Draw the block diagram of control unit of basic computer. Explain in detail with control timing diagrams. 7+7=14

4. (a) Explain one-, two- and three-address instruction with suitable examples.

(b) Give an integrated diagram, showing the TLB and cache operations for a logical/virtual address generated by a processor. 7+7=14

5. (a) Explain the daisy chaining mechanism for bus arbitration. Analyze the three bus arbitration methods—daisy chaining, polling and independent requesting with respect to communication reliability in the even of hardware failures.

(b) Give the block diagram of microprogram sequencer for a control memory and explain it properly. 7+7=14

6. (a) What do you understand by hardwired control? Give various methods to design hardwired control unit. Describe any one with suitable example.

(b) Describe autoincrement and auto-decrement addressing modes with proper examples. 7+7=14

7. (a) What is direct memory access? Explain. Give block diagram of circuitry required for direct memory access.

(b) A digital computer has a common bus system of 16 registers of 32 bits each. The bus is constructed with multiplexers.

(i) How many selection inputs are there in each multiplexer?

(ii) What size of multiplexers is needed? 7+7=14

8. (a) When do you say the floating point number is normalized? Explain how floating point representation of number is done. Represent the number (+46·25) as floating point binary number with 32 bits.

(b) What are hazards in pipeline architecture? Explain its type with suitable example. 7+7=14

9. (a) What is array processor? Explain SIMD array processor with suitable example.

(b) A DMA controller transfers 16-bit words to memory using cycle stealing. The words are assembled from a device that transmits characters at the rate of 2400 characters per second. The CPU is fetching and executing instructions at an average rate of 1 million instructions per second. By how much will the CPU be slowed down because of DMA transfer? 7+7=14

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Code : 051506

B.Tech 5th Semester Exam., 2019

DESIGN AND ANALYSIS OF ALGORITHMS

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

(iv) Question No. 1 is compulsory.

1. Choose the correct answer from any *seven* of the following : 2×7=14

(a) In the following C++ function, let n>=m.

```
int gcd(int n, int m) {
if (n%m==0) return m;
if (n<m) swap (n, m);
while (m > 0) {
n=n%m;
swap (n, m);
}
return n;
}
```

What is the time complexity of the above function assuming n > m ?

(i) Θ(logn)

(ii) Ω(n)

(iii) Θ(loglogn)

(iv) Θ(sqrt(n))

(b) Time complexity of Kadane's Algorithm is

(i) O(n)

(ii) O(n^2)

(iii) O(nlogn)

(iv) O(n(logn)^2)

(c) Consider an undirected random graph of eight vertices. The probability that there is an edge between a pair of vertices is ½. What is the expected number of unordered cycles of length three?

(i) 1/8

(ii) 1

(iii) 7

(iv) 8

(d) Any decision tree that sorts 'n' elements has height

(i) Ω(lg n)

(ii) Ω(n)

(iii) Ω(n lg n)

(iv) $\Omega(n^2)$

(e) An all-pairs shortest-paths problem is efficiently solved using

(i) Dijkstra's algorithm

(ii) Bellman-Ford algorithm

(iii) Kruskal algorithm

(iv) Floyd-Warshall algorithm

(f) Which of the following is an advantage of adjacency list representation over adjacency matrix representation of a graph?

(i) In adjacency list representation, space is saved for sparse graphs.

(ii) DFS and BFS can be done in O(V+E) time for adjacency list representation. These operations take O(V^2) time in adjacency matrix representation. Here V and E are number of vertices and edges respectively.

(iii) Adding a vertex in adjacency list representation is easier than adjacency matrix representation.

(iv) All of the above

(g) Which of the following is true about Huffman Coding?

(i) Huffman coding may become lossy in some cases.

(ii) Huffman codes may not be optimal lossless codes in some cases.

(iii) In Huffman coding, no code is prefix of any other code.

(iv) All of the above

(h) Which one of the following is an application of Queue Data Structure?

(i) When a resource is shared among multiple consumers

(ii) When data is transferred asynchronously (data not necessarily received at same rate as sent) between two processes

(iii) Load balancing

(iv) All of the above

(i) In linear search algorithm the worst case occurs when

(i) the item is somewhere in the middle of the array

(ii) the item is not in the array at all

(iii) the item is the last element in the array

(iv) the item is the last element in the array or is not there at all

(j) The complexity of binary search algorithm is

(i) O(n)

(ii) O(log n)

(iii) $O(n^2)$

(iv) O(n log n)

2. (a) Discuss the steps in mathematical analysis for recursive algorithm. Do the same for finding the factorial of a number? 7

(b) What are the rules of manipulate Big-Oh expression? Write about the typical growth rates of algorithms. 7

3. (a) What are the advantages of merge-sort over the quick-sort algorithm? 7

(b) What is the time complexity of the matrix multiplication and Strassen's algorithm? 7

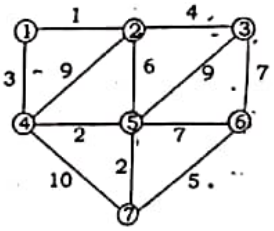
4. Prove that if $f1(n) = O(g1(n))$ and $f2(n) = O(g2(n))$, then $f1(n) + f2(n) = O(g1(n) + g2(n))$. 14

5. (a) What is the relationship among P, NP and NP complete problems? Show with the help of a diagram. 7

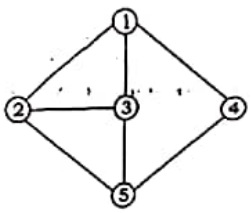
(b) Compare the various programming paradigms such as divide-and-conquer, dynamic programming and greedy approach. 7

6. Consider the array $A = \{26, 17, 41, 14, 21, 30, 47, 10, 16, 19, 21, 28, 38, 7, 12, 14, 20, 35, 39, 3\}$. Create binary search tree with one more attributes its size of node. Retrieve 17th smallest element in the tree and rank the 12th element. 14

7. What do you mean by optimal solution in greedy approach? Define the properties and function of greedy approach. Consider the graph $G = (V, E)$ given below. Find the minimum spanning tree by Prim's algorithms. 14



8. Explain back-tracking. DFS and BFS with help of small example. Differentiate in between backtracking and dynamic programming. Apply the backtracking algorithm to solve the three-colouring problem for the following graph using state space tree. Assume three colours red, green and blue. 14



9. Write short notes on : 3½×4=14

(a) Kruskal algorithms

(b) Branch and bound technique

(c) Amortized analysis

(d) Divide-N-Conquer vs Dynamic Programming

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