

St. Thomas' College of Engineering & Technology

05/03/2020

B. Tech. 4th Semester, 1st Internal Examination, March 2020

Design and Analysis of Algorithm [PCC - CS - 404]

Full Marks : 50

Time : 1 1/2 Hour.

184



GROUP-A

(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: (1×5)=5
- (i) Solve the following recurrence using Master's theorem.
 $T(n) = 2T(n/2) + n/\log n$
 (a) $T(n) = O(n)$ (b) $T(n) = O(\log n)$ (c) $T(n) = O(n^2 \log n)$
 (d) cannot be solved using master's theorem
- (ii) The following sequence is a fibonacci sequence:
 0, 1, 1, 2, 3, 5, 8, 13, 21,
 Which technique can be used to get the nth fibonacci term?
 (a) Recursion (b) Dynamic programming (c) A single for loop
 (d) Recursion, Dynamic Programming, For loops
- (iii) Fractional knapsack problem is solved most efficiently by which of the following algorithm?
 (a) Divide and conquer (b) Dynamic programming (c) Greedy algorithm
 (d) Backtracking
- (iv) If an optimal solution can be created for a problem by constructing optimal solutions for its subproblems, the problem possesses _____ property.
 (a) Overlapping subproblems (b) Optimal substructure (c) Memoization
 (d) Greedy
- (v) Average case time complexity of the Heap sort is
 (a) $O(n \log n)$ (b) $\Omega(n \log n)$ (c) $\Theta(n \log n)$ (d) $w(n \log n)$

GROUP-B

(Short Answer Type Questions)

2. Solve the recurrence $T(n) = T(\sqrt{n}) + 1$ 3 × 5 = 15
3. Discuss about different types of asymptotic notation. 5
4. Analyze the worst case time complexity of the quick sort algorithm. 5

GROUP-B

(Long Answer Type Questions)

5. Calculate the optimal solution using Greedy criteria for a knapsack having capacity 100 kg for the following fractional knapsack problem $(p_1, p_2, p_3, p_4, p_5) = (10, 20, 30, 40, 50)$, $(w_1, w_2, w_3, w_4, w_5) = (15, 25, 35, 45, 55)$. 2 × 15 = 30
- What is the solution generated by the function Job sequencing with deadline when $n = 7$, $(p_1, p_2, \dots, p_7) = (3, 5, 20, 18, 1, 6, 30)$ and $(d_1, d_2, \dots, d_7) = (1, 3, 4, 3, 2, 1, 2)$? [(3+3+3)+6]
6. Develop matrix chain multiplication algorithm.
 Calculate the minimum number of scalar multiplications needed to multiply the following chain of matrices $A_1 (10 \times 50) \times A_2 (50 \times 1) \times A_3 (1 \times 20) \times A_4 (20 \times 10) \times A_5 (10 \times 100)$ using dynamic programming method. Also, calculate the time complexity of this algorithm? [6+7+2]

OUTCOME BASED EDUCATION (OBE)						
CO mapping With Bloom's Level						
Question No.	Q1	Q2	Q3	Q4	Q5	Q6
Course Outcome	CO1	CO2	CO2	CO6	CO3	CO3
Bloom's Level	1	3	2	4	4	3

Bloom's Level: Remember = 1, Understand = 2, Apply = 3, Analyze = 4, Evaluate = 5, Create = 6

4/CS/71 05/03/2020
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St. Thomas' College of Engineering & Technology

B. Tech. 4th Semester, 1st Internal Examination, March 2020

Computer Architecture [PCC – CS – 402]

Time : 1 ½ Hour.

Full Marks : 50

Group A

5 X 1

1. Multiple choice type questions
- i) Dynamic pipeline allows
 - a) multiple functions to evaluate b) only streamline connection c) perform fixed function d) all of these
 - ii) The number of cycles required to complete n tasks in k stage pipeline is
 - a) $k+n-1$ b) $nk+1$ c) k d) constant
 - iii) The prefetching technique is a solution for
 - a) Data Hazard b) Structural Hazard c) Control Hazard d) Enhance the speed of pipeline
 - iv) Which of the following has no practical usage?
 - a) SISD b) SIMD c) MISD d) MIMD
 - v) Pipelining uses
 - a) data parallelism b) temporal parallelism c) spatial parallelism d) Control parallelism

Group B

3 X 5

- 2. What is branch hazard? Briefly discuss two methods to handle branch hazards.
- 3. What is the drawback of direct mapped cache? How is it resolved in set associative?
- 4. Explain in brief with neat diagrams the Flynn's classification of pipeline computer.

Group C

2 X 15

- 5. What is cache memory? Define global and local miss with suitable example.
Describe different techniques to reduce cache miss penalty.
Describe different techniques to reduce cache miss rate.
- 6. What is the difference between Computer Organization and Computer Architecture?
Why does the equation to calculate the CPU-time of a program often expressed in terms of average CPI of that processor? What are the different approaches taken by pipeline processor to handle branch instructions? Briefly illustrate approaches.

St. Thomas' College of Engineering & TechnologyB. Tech. 4th Semester, 1st Internal Examination, March 2020

Discrete Mathematics [PCC – CS – 401]

Full Marks : 50

Time : 1 ½ Hour.

Group A

1×5=5

1. Select the correct option

- i) The contrapositive of $p \rightarrow q$ is
 a) $\neg p \rightarrow q$ b) $\neg p \rightarrow \neg q$
 c) $p \rightarrow \neg q$ d) $\neg q \rightarrow \neg p$
- ii) The proposition $p \wedge (q \wedge \neg q)$ is a
 a) contradiction b) tautology
 c) both (a) and (b) d) none of the above
- iii) (S, \leq) is a Poset iff
 a) " \leq " is reflexive, antisymmetric and transitive
 b) " \leq " is reflexive, symmetric and transitive
 c) " \leq " is reflexive and transitive
 d) None of the above
- iv) Number of subsets of a set of order three is
 a) 3 b) 6
 c) 8 d) 9
- v) Which of the following statement is a proposition?
 a) Get me a glass of milkshake b) God bless you!
 c) What is the time now? d) The only odd prime number is 2

Group B

2. Let $S = \{0, 1\}$. Define a relation R on S^3 by " $(a_1, a_2, a_3) R (b_1, b_2, b_3)$ iff $a_1 \leq b_1, a_2 \leq b_2, a_3 \leq b_3$ " for a_i, b_i belongs to S .

Show that (S^3, R) is a poset.

3. Prove that "if a Groupoid (G, o) contains a left identity as well as right identity then they are equal and the equal element is the identity element in the Groupoid."

4. Construct the truth table for the statements:

$$(\neg p \wedge q) \wedge \neg r$$

Group C

5. a) Prove that "in a Group (G, o) each element has only one inverse".

b) Prove that in a group (G, o)

i) $aob = aoc$ implies $b=c$ (left cancellation law)

ii) $boa = coa$ implies $b=c$ (right cancellation law)

for all a, b, c belongs to G

5+(5+5)

6. a) In the groupoid $(Z, *)$ where $*$ is defined by $a*b = a+2b$, a, b belongs to Z . Zero is a right identity. Now justify the following:

i) 3 in Z is left zero invertible but not right zero invertible

ii) 4 in Z is left zero invertible as well as right zero invertible

b) Let $f: Z \rightarrow Z$ be defined by $f(x) = x+1$, x belongs to Z . Then check f is a bijection or not and justify your answer.

c) A relation R is defined on the set Z by " aRb iff $ab > 0$ " for all a, b belongs to Z . Examine if R is i) reflexive ii) symmetric iii) transitive

6+3+6

	Q1	Q2	Q3	Q4	Q5	Q6
	PCC- CS401.1, PCC- CS401.2	PCC- CS401.1	PCC- CS401.1	PCC- CS401.1	PCC- CS401.1	PCC- CS401.1
CO						
BL	1	3	3	3	3	3

Bloom's Level: Remember = 1, Understand = 2, Apply = 3, Analyze = 4, Evaluate = 5, Create = 6



St. Thomas' College of Engineering & Technology 06 MAR 2020B. Tech. 4th Semester, 1st Internal Examination, March 2020
Biology [BSC- 401]

Time : 1 ½ Hour.

Full Marks : 50

SECTION A (5*1 =5)



1. 1. Carbohydrates are also known as _____
- a) Hydrates of carbon
 - b) Carbonates
 - c) Glycolipids
 - d) Polysaccharides
2. Which of the following amino sugar are present in the bacterial cell wall?
- a) N-acetylmuramic acid
 - b) Sialic acid
 - c) Aminoglycoside
 - d) Azide
3. What is the nature of an enzyme?
- a) Vitamin
 - b) Lipid
 - c) Carbohydrate
 - d) Protein
4. Name the enzyme which catalyzes the oxidation-reduction reaction?
- a) Transaminase
 - b) Glutamine synthetase
 - c) Phosphofructokinase
 - d) Oxidoreductase
5. A piece of kidney tissue is taken and under sterile conditions, it is being ground with the help of mortar and pestle using trichloroacetic acid, to obtain a thick slurry. On filtration, where likely would you expect the presence of greater number of biomacromolecules ?
- a. The Acid soluble pool
 - b. The Retentate
 - c. Acid insoluble fraction
 - d. b and c

SECTION B (3*5 =15)

1. Explain Mutarotation of glucose, elaborating the answer with the help of associated structures.
2. Name two essential and two non essential amino acids. What do you mean by the iso-electric point of an amino acid?
3. Draw the structure of Sucrose, mentioning the monomers and the linkage formed. Why is sucrose known as invert sugar?

SECTION C (2*15 =30)

1. A. How does the rate of an enzyme catalysed reaction vary with Substrate concentration? Explain with the help of a graph. (3)
B. State Michaelis-Menten equation. What is the importance of K_m ? (2)
C. How does an enzyme enhance the rate of a chemical reaction? (2)
D. In spite of the fact that lipids are not true macromolecules, you still find it in the macromolecular fraction. Why? (2)
E. Differentiate between Nucleosides and nucleotides. At the chemical level, how do DNA and RNA differ from each other (3)
F. With the help of a graph, explain how a competitive inhibitor changes the K_m and V_{max} of an enzyme. (3)
2. A. Explain the five kingdom classification (6)
B. What do you mean by denaturation of proteins (2)
C. Name two acidic amino acids (2)
D. Differentiate between psychrophiles and thermophiles, giving examples (2)
E. Draw a typical growth curve of a bacteria, mentioning the stages. Which stage would you not observe by turbidometric analysis? Why? (3)

St. Thomas' College of Engineering & Technology

B. Tech. 4th Semester, 1st Internal Examination, March 2020
Formal Language & Automata Theory [PCC – CS – 403]

Time : 1 ½ Hour.

Full Marks : 50

GROUP- A

1 × 5 = 5

1. Multiple Choice Questions.

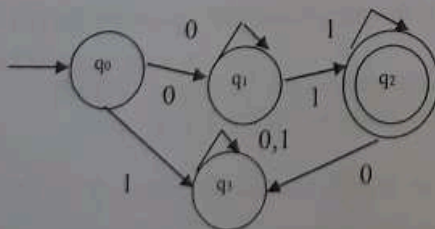
- The automaton which allows transformation to a new state without consuming any input symbols:
 - NFA
 - DFA
 - NFA-ε
 - All of the mentioned
- The minimum number of transitions to pass to reach the final state as per the following regular expression is:
{a,b}*{baaa}
 - 4
 - 5
 - 6
 - 3
- Language of finite automata is.
 - Type 0
 - Type 1
 - Type 2
 - Type 3
- Regular expression for all strings starts with ab and ends with bba is.
 - aba*b*bba
 - ab(ab)*bba
 - ab(a+b)*bba
 - All of the mentioned
- If we select a string w such that $w \in L$, and $w = xyz$. Which of the following portions cannot be an empty string?
 - x
 - y
 - z
 - all of the mentioned

GROUP- B

Short Answer Type Questions.

3 × 5 = 15

- Find the regular expression for the following transition diagram using Arden's theorem. [5]



- Let $G = (\{S, A_1, A_2\}, \{a, b\}, P, S)$, here P consists of
 - $S \rightarrow A_1 A_2 a$
 - $A_1 \rightarrow ba A_1 A_2 b$
 - $A_2 \rightarrow A_1 a b$
 - $a A_1 \rightarrow baa$

b) $A_2 b \rightarrow abab$

Test whether $w = baabbbabaaabbaba \in L(G)$.

4. Using pumping lemma prove that $L = \{ww | w \in (a,b)^*\}$ is not regular.

[5]

[5]

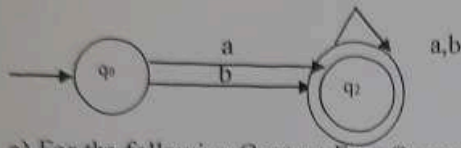
GROUP- C

Long Answer Type Questions.

$2 \times 15 = 30$

5. a) Differentiate DFA and NFA.
 b) Construct an NFA for the language $L = (a+b)^*b(a+bb)^*$.
 c) Find the language associated with the following finite automata.

[5+7+3=15]



6. a) For the following Context Free Grammar check whether the string $aaaabbb$ is accepted by the grammar or not. Use leftmost derivation. Also, draw the parse tree. Write the language accepted by the grammar.

$G = (\{S, A, B\}, \{a, b\}, P, S)$ where P consists of

$S \rightarrow AB | \epsilon$

$A \rightarrow aaA | \epsilon$

$B \rightarrow bB | \epsilon$

- b) Show that the following grammar is ambiguous.

$S \rightarrow AB | aaB$

$A \rightarrow a | Aa$

$B \rightarrow b$

- c) Eliminate ϵ productions from the following grammar.

$S \rightarrow ABaC$

$A \rightarrow BC$

$B \rightarrow b | \epsilon$

$C \rightarrow D | \epsilon$

$D \rightarrow d$

[(3+3+2)+3+4=15]

OUTCOME BASED EDUCATION (OBE)								
CO mapping With Bloom's Level								
	Q1	Q2	Q3	Q4	Q5a	Q5b	Q5c	Q6
CO	CO1	CO1	CO1	CO2	CO2	CO2	CO2	CO3
Bloom's Level	1	3	5	3	4	5	5	4

Bloom's Level: Remember = 1, Understand = 2, Apply = 3, Analyze = 4, Evaluate = 5, Create = 6

St. Thomas' College of Engineering & Technology

B.Tech. 4th Semester, 1st Internal Examination, March 2020
Environmental Science (MC - 401)

4 / CS & 134

07/03/2020

2nd

Full Marks : 30

Time : 1½ Hour.

GROUP-A
(Multiple Choice Type Questions)

5 x 1 = 5



Q1. Choose the correct alternatives for the following:

- i) The earth albedo is
 - a) 0.15
 - b) 0.30
 - c) 0.25
 - d) 0.10
- ii) Longest IR radiation is absorbed by
 - a) H₂O
 - b) CO₂
 - c) CH₄
 - d) N₂O
- iii) Present atmospheric concentration of CO₂ is
 - a) 356 ppm
 - b) 368 ppm
 - c) 400 ppm
 - d) 350 ppm
- iv) The effective temperature of earth surface by global surface temperature model is
 - a) 255K
 - b) 288K
 - c) 300K
 - d) 250K
- v) The actual surface temperature rise of earth is due to
 - a) Less earth albedo
 - b) High earth albedo
 - c) GHE
 - d) None of the above

GROUP-B
(Short Answer Type Questions)

3 x 5 = 15

- Q2. What is BOD & COD ? What is the difference ? what is CBOD ? 5
- Q3. Describe unseeded and seeded BOD₅²⁰. 5
- Q4. Assuming BOD follows first order kinetics, derive $BOD_w = BOD_u(1 - e^{-kt})$ with usual notation. 5

GROUP-C
(Long Answer Type Questions)

2 x 15

- Q5. a) Describe the structure of atmosphere based on temperature profile.
 - b) State Stefan-Boltzmann law of black body radiation. What is Wien's displacement rule ?
 - c) Based on earth albedo derive Global surface temperature model. 5+5+5
- Q6. a) Describe hydrologic cycle and mention important sources of hydrosphere.
 - b) What is Green house effect ? Name the most important six green house gases.
 - c) What are the consequences of advanced GHE ? What is the most GWP gas ? 4+5+6

OUTCOME BASED EDUCATION (OBE)						
CO mapping With Bloom's Level						
Q. No.	Q1(i - v)	Q2	Q3	Q4	Q5	Q6
Course Outcome	MC401.1	MC401.2	MC401.2	MC401.2	MC401.1	MC401.1
Bloom's Level (in fig.)	2	2	2	3	2	2

Bloom's Level: Remember = 1, Understand = 2, Apply = 3, Analyse = 4, Evaluate = 5, Create = 6