

USN : _____

Course Code : 18CS553

Fifth Semester B.E MAKEUP Examination, MARCH_MAY_2021

ADVANCED ALGORITHMS

Time: 3 hrs

Max. Marks : 100

Instructions : 1. Answer FIVE full Questions selecting at least ONE Question from Each Unit.

MODULE 1

L CO PO M

1a. Solve the following recurrence relation by applying Master's theorem.

1. $4T(n/2) + n$ b) $2T(n/2) + n/\log n$ c) $T(n) = 3T(n/2) + n^2$ d) $T(n) = 2T(n/4) + n^{0.51}$

[3] [1] [2] [8]

1b. Explain in brief the aggregate analysis based on the concept of amortized analysis

[2] [1] [1] [4]

1c. Solve the following recurrence relation by Recurrence tree method.

1. $3T(n/2) + cn^2$ b) $T(n/2) + T(n/3) + n$

[3] [1] [1] [8]

OR

2a. Discuss the 3 cases of Masters theorem and give examples for the same.

[2] [1] [1] [8]

2b. Explain binary counter as an example to justify the concept of Amortized analysis

[2] [1] [1] [4]

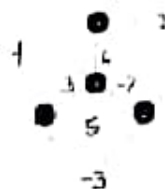
2c. Solve the following recurrence relations using Substitution method.

1. $3T(n/2) + cn^2$ b) $2T(n/4) + n/2$

[3] [1] [1] [8]

MODULE 2

3a. Apply Johnson's Algorithm to find All pairs shortest path for the graph give below.



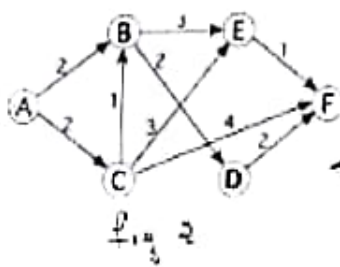
[3] [2] [1] [8]

3b. Define the following terms and explain the relation between them.

1. Flow network
2. Capacity constraint
3. Residual network

[2] [2] [1] [6]

3c. Apply Ford Fulkerson method for the following graph.



[3] [2] [1] [6]

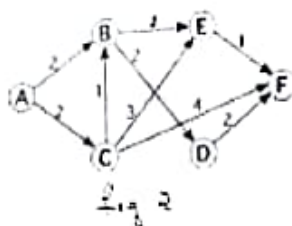
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- OR**
- 4a. Write an algorithm for single source shortest path DAG and apply the same for the following graph taking 'a' as source vertex.



[3] [2] [1] [10]

- 4b. Write an algorithm All pairs shortest path using Johnsons Algorithm.



[2] [2] [1] [10]

MODULE 3

- 5a. Write the procedural steps of RSA public key cryptosystem. And also consider an RSA key with $p=11$, $q=13$ and $e=11$. what value of d should be used in the secret key? What is the encryption of the message $M=7$

[3] [3] [1, 2] [10]

- 5b. Give the pseudo code for computing GCD of two numbers using extended form of Euclid's algorithm. Also find the GCD (161,28) and show the computational steps at each level of recursion.

[3] [3] [1] [10]

OR

- 6a. State the Modular-Linear Equation -Solver algorithm. And find all solutions to the equation $14x \equiv 12 \pmod{18}$

- 6b. Write the Chinese remainder theorem. Also find all the integers that leave the remainders 2,3,2 when divided by 3,5,7 respectively using Chinese remainder theorem.

[3] [3] [1] [10]

MODULE 4

- 7a. Apply string matching with finite automata for the pattern "ADVANCED" in the text $T = \text{"THIS IS THE CLASS OF ADVANCED ALGORITHM"}$. Show the transition state diagram and table.

[3] [3] [1, 2] [10]

- 7b. Write Naive string matching algorithm. Apply Naive string matching algorithm to find whether the pattern $P = \text{"CAT"}$ in the text $T = \text{"A A A C A C A T B A T"}$

[3] [4] [1, 2] [10]

OR

- 8a. Write an algorithm for Knuth Moris Prat string matching algorithm. Apply the same to check whether the pattern $P = \text{"Text"}$ exist in the text $T = \text{"This is a Test Text"}$.

[3] [4] [2] [10]

- Sb. Write an algorithm for Rabin Karp string matching algorithm and apply for the following pattern and the text . [1] [4] [2] [10]
T= " work is worship"
P="ship" [3] [4] [2] [10]

MODULE 5

- 9a. Explain probabilistic algorithms ,randomizing deterministic algorithms with one or two examples. [2] [5] [2] [10]
9b. Explain the concept of NP -Hard and NP Complete algorithms with examples. [2] [5] [2] [10]

OR

- 10a. Explain in brief the travelling salesperson problem with respect to probabilistic algorithm. [2] [5] [1, 2] [10]
10b. Write a short note on Probabilistic randomized deterministic algorithms. [2] [5] [1] [10]

Fifth Semester B.E Semester End Examination, JANUARY_MARCH_2021**ADVANCED ALGORITHMS**

Time: 3 hrs

Max. Marks :100

Instructions :1. Answer FIVE full Questions selecting at least ONE Question from Each Unit.

MODULE 1**L CO PO M**

1a. Use the master's method and recurrence tree method to give tight asymptotic bound for the following recurrence: $T(n)=2T(n/4)+\sqrt{n}$.

[3] [1] [1] [8]

1b. Explain in brief the aggregate analysis based on the concept of amortized analysis.

[2] [1] [1] [4]

1c. Solve the following recurrence relation by Substitution method.

a. $3T(n/2) + cn^2$

b) $T(n/2) + T(n/3) + n$

[3] [1] [1] [8]

OR

2a. Discuss the 3 cases of Masters theorem and give examples for the same.

[2] [1] [1] [8]

2b. Explain binary counter as an example to justify the concept of Amortized analysis

[2] [1] [1] [4]

2c. Solve the following recurrence relations using recurrence tree method.

a. $3T(n/2) + cn^2$

b) $2T(n/4) + n/2$

[3] [1] [1] [8]

MODULE 2

3a. Apply Johnson's Algorithm to find All pairs shortest path for the graph give below.

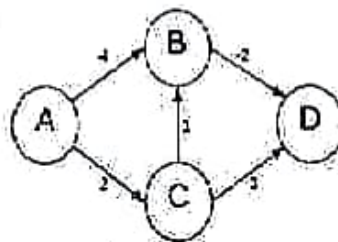


fig 1

[3] [2] [1] [8]

3b. Define Graph coloring using backtracking and write the algorithm for the same.

[2] [2] [1] [6]

3c. Define Flow network and apply Ford Fulkerson for the following graph.

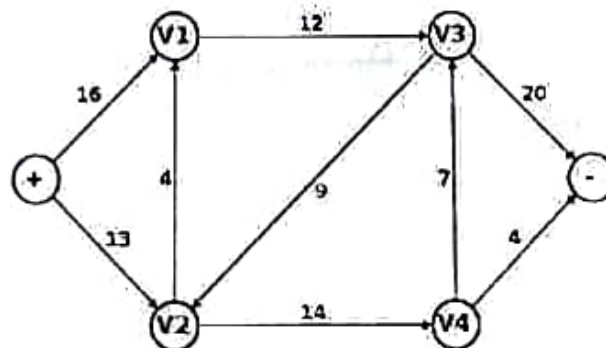
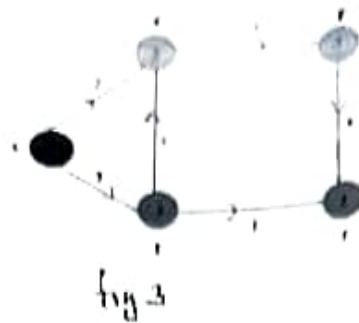


fig 2

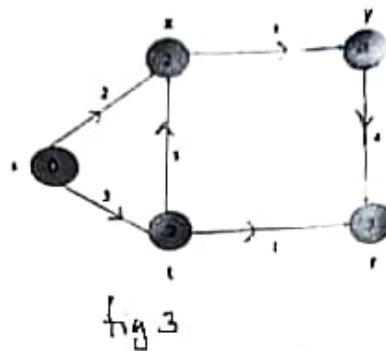
[3] [2] [1] [6]

4a. Write an algorithm for single source shortest path DAG and apply the same for the following graph taking 's' as source vertex.



[3] [2] [1, 2] [10]

4b. Write an algorithm All pairs shortest path using Johnsons Algorithm.



[1] [3] [1, 2] [10]

MODULE 3

5a. Write the procedural steps of RSA public key cryptosystem. And also consider an RSA key with $p=23$, $q=11$ and $e=7$. what value of d should be used in the secret key? What is the encryption of the message $M=5$.

[3] [3] [1] [10]

5b. Give the pseudo code for computing GCD of two numbers using extended form of Euclid's algorithm. Also find the GCD (56,15) and show the computational steps at each level of recursion.

[3] [3] [1] [10]

OR

6a. State the algorithm for primality testing using Fermat's theorem .Check if $n=79$ is prime number or a composite number.

6b. Write an algorithm for Miller Rabin primality test and verify the same for $n=71$ and $a=2$.

[3] [3] [2] [10]

MODULE 4

7a. Give the Boyer Moore string matching algorithm. Find the pattern "character" in the text "BMmatcher_shift_character_example" using the same.

7b. Apply Knuth Morris Pratt string matching algorithm for the text $T=bananobano$ and pattern $P=nob$, And analyze the same for time complexity.

[3] [4] [1] [10]

OR

8a. Write Naive string matching algorithm and show the comparisons the Naive string matching makes for the pattern $P=$ "ABC" Text $T=$ "ABAAABCDDBABCDDEBCABC".

[3] [4]

8b. Write Rabin Karp string matching algorithm. Apply the same for the given text $T = a c a a$ b a a and pattern $P = a a b$.

[3] [4] [1] [10]

MODULE 5

9a. Explain Monte Carlo and Las Vegas algorithms with suitable examples.

[2] [5] [1] [10]

9b. Explain the randomized deterministic algorithm by taking linear search as an example.

[2] [5] [1] [10]

OR

10a. Explain the need of randomizing for linear search and probabilistic linear search algorithms.

[2] [5] [1] [10]

10b. Write a note on NP-Hard and NP-Complete problems.

[2] [5] [1] [10]

Fifth Semester B.E. Semester End Examination, Dec/Jan 2018-19

ADVANCED ALGORITHMS

Time: 3 Hours

Max. Marks: 100

- Instructions:** 1. UNIT-I and UNIT-III are compulsory
2. Answer five full questions by selecting at least one question from each UNIT

UNIT – I

- | | | L | CO | PO | M |
|---|--|-----|-----|-----|------|
| 1 | a. Explain different methods of solving recurrence relation. | (2) | (1) | (1) | (09) |
| | b. Use the master's method to find tight asymptotic bound for the following recurrence: $T(n)=2T(n/2)+n^3$ | (3) | (1) | (1) | (06) |
| | c. Discuss the potential approach of amortized analysis method. | (2) | (1) | (1) | (05) |

UNIT – II

- 2 a. Write and apply the Johnson's all-pairs shortest-paths algorithm for graph in **Figure 1**

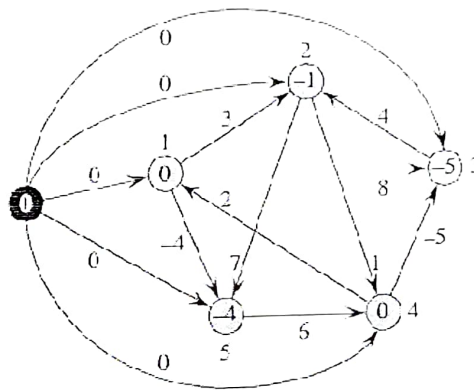


Figure 1

(3) (2) (2) (10)

- b. Explain the working of FLOW networks and find max. flow for flow network in **Figure 2**

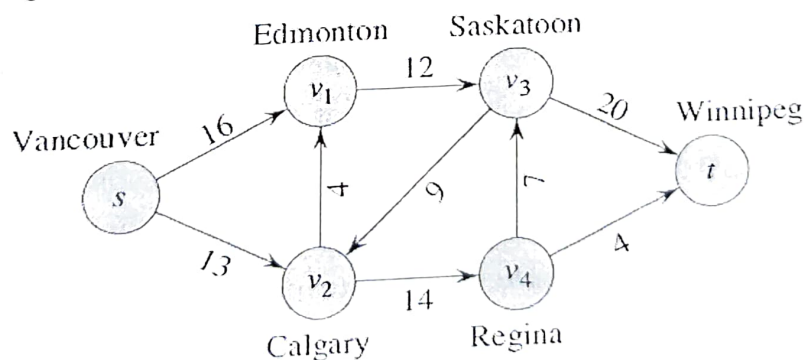


Figure 2

(3) (2) (2) (10)

OR

- a. Write an algorithm for Floyd-warshall and apply the same for the graph in Figure 3

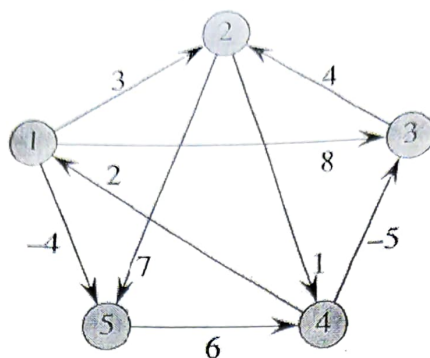


Figure 3

- b. Write DAG shortest path algorithm along with other necessary sub-algorithms used in it. (3) (2) (2) (10)
(2) (2) (2) (10)

UNIT - III

- 4 a. State Chinese remainder theorem and apply the same to solve the following problem instance. (3) (3) (2) (10)
 $a \equiv 2 \pmod{5}$
 $a \equiv 3 \pmod{13}$
- b. Write the procedural steps of RSA public key cryptosystem. And also consider an RSA key set with $p=11, q=13, e=11$. What value of d should be used in the secret key. Solve for encryption of the message with $M=7$. (3) (3) (2) (10)

UNIT - IV

- a. Compare and Contrast on Processing time and matching times of Naïve, Rabin-Karp, Finite automate and Knuth-morris algorithms. (2) (5) (1) (10)
- b. Write the naive string-matching algorithm and Show the comparisons the naive string matcher makes for the pattern $P = 0001$ in the text $T = 000010001010001$. (4) (5) (1) (10)

OR

- a. Write Rabin-Karp algorithm. Working modulo $q=11$, how many spurious hits does the Rabin-Karp matcher encounter in the text $T=3141592653589793$ when looking for the pattern $P=26$? (3) (5) (3) (10)
- b. Explain the string matching concept using FINITE-AUTOMATON and Construct state-transition diagram for the string-matching automaton that accepts all strings ending in the string ababaca (5) (5) (1) (10)

UNIT - V

- Define NP-Hard and illustrate the concept with the help of Travelling Salesperson Problem. (2) (6) (2) (10)

Discuss the LAS VEGAS algorithm and compare it with MONTE CARLO algorithm. (4) (6) (2) (10)

OR

Bring out the differences between NP-hard and NP complete problems. (4) (6) (2) (08)

Explain Monte-Carlo approach used in Polynomial multiplication. (2) (6) (2) (06)

Discuss the process of randomizing the Quick sort (2) (6) (2) (06)

ADVANCED ALGORITHMS

Time: 3 Hours

Max. Marks: 100

Instructions: I. Answer any full five Questions from the following Units.

L CO PO M

UNIT – I

- 1 a. Apply recurrence tree method to solve for the following recurrence relations.

i) $T(n) = 3T(n/4) + cn^2$ ii) $T(n) = T(n/5) + T(4n/5) + n$

(3) (1) (1) (10)

- b. Explain in brief the Aggregate method and accounting method of amortized analysis with examples.

(2) (1) (1) (10)

OR

- a. Apply substitution method for solving the following recurrence relations.

i) $T(n) = T(n-2) + n^2$ ii) $T(n) = 2T(n/2) + n$

(3) (1) (1) (10)

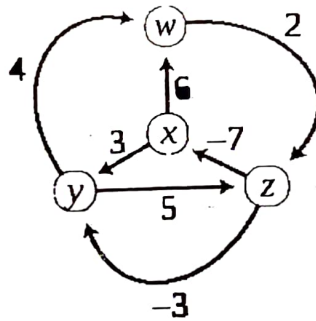
- b. Apply Master's method for the following recurrence relation.

i) $T(n) = 3T(n/2) + n^2$ ii) $T(n) = 2T(n/2) + n \log n$
 iii) $T(n) = 2T(n/4) + n^{0.51}$ iv) $T(n) = \sqrt{2}T(n/2) + \log$

(3) (1) (1) (10)
 L CO PO M

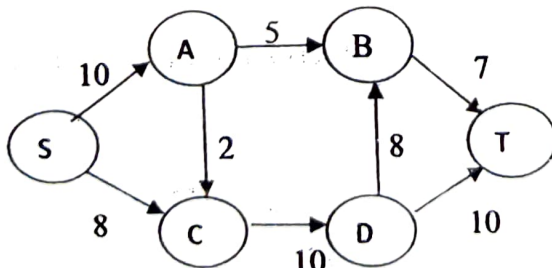
UNIT – II

- 3 a. Apply Johnson's Algorithm to find All pairs shortest path for the graph give below.



(3) (2) (2) (10)

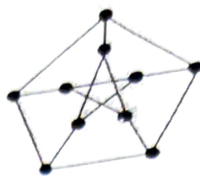
- b. Explain the term flow network. Write a algorithm and Find the maximum flow using the basic Ford Fulkerson algorithm from source(S) to sink(T)



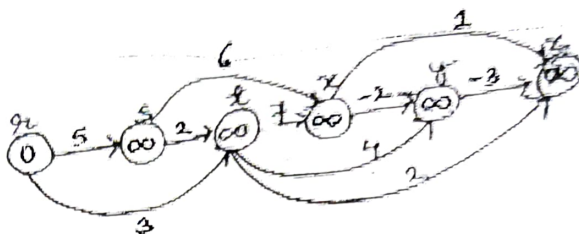
(3) (2) (2) (10)

OR

- a. Write a algorithm for graph coloring using backtracking and apply below. [assume the numbering for the vertices].



- b. Explain Single source shortest paths for DAG algorithm and apply the same for the following graph taking 'r' as source vertex.



(3) (2) (2) (10)
L CO PO M

UNIT - III

- 5 a. Give the pseudo code for computing GCD of two numbers using extended Euclids algorithm. Also find the GCD (161,28) and show the computational steps at each level of recursion.

(3) (3) (2) (10)

- b. Write the procedural steps of RSA public key cryptosystem. And also consider an RSA key with $p=11, q=29, n=319$ and $e=3$. what value of d should be used in the secret key? What is the encryption of the message $M=100$.

(3) (3) (2) (10)

- 6 a. Write the Chinese remainder theorem. Also find all the integers that leave the remainders 1,2,3 when divided by 9,8,7 respectively using Chinese remainder theorem.

(3) (3) (2) (08)

- b. State the Modular-Linear Equation -Solver algorithm and apply to find all solutions to the equation $35x \equiv 10 \pmod{50}$.

(3) (3) (2) (06)

- c. Write an algorithm for Miller-Rabin for Primality test and solve the following with $n=27, a=2$.

(3) (4) (2) (06)

UNIT - IV

- 7 a. Write naïve string matching algorithm and show the comparisons the naïve string matcher makes for the pattern: $P = "111"$ Text: $T = "1011101110"$.

L CO PO M

- b. Give the Boyer-Moore string matching algorithm. Find the pattern "character" in the text "BMmatcher_shift_character_example" using the same.

(4) (5) (2) (10)

OR

- 8 a. Give algorithm for Knuth-Morris-Pratt algorithm and show the comparisons the Knuth-Morris-Pratt algorithm matcher makes for the pattern "00100201" in text "0010010020001002012200".

(4) (5) (2) (10)

(4) (5) (2) (10)

- b. Write a algorithm for string matching with finite automata and apply the same for the Text "abababacaba" and the patter "ababaca".

(4) (5) (2) (10)

UNIT -V

L CO PO M

- 9 a. Explain the need of randomizing for linear search and probabilistic linear search algorithms. (2) (6) (1) (10)
- b. Write a note on Randomized algorithms. (2) (6) (1) (10)

OR

- 10 a. Write a note NP -Hard ad NP-Complete problems. (2) (6) (1) (10)
- b. Explain Monte Carlo ad Las Vegas algorithms with suitable examples. (2) (6) (1) (10)

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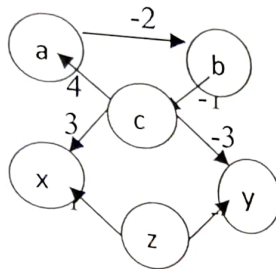
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KLS GOGTE INSTITUTE OF TECHNOLOGY

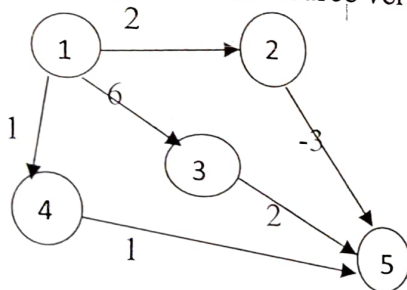
Instructions: 1. Unit I and III are compulsory
2. Answer five full question by selecting at least one question from each UNIT.

UNIT – I

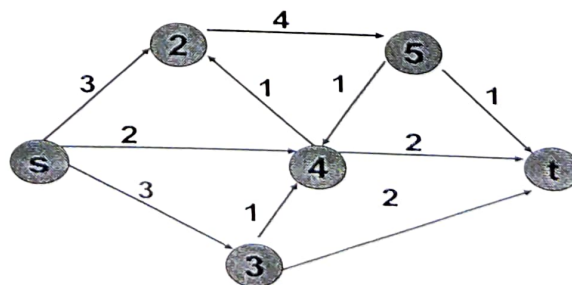
- 1 a. Explain the three basic asymptotic notations with examples for each
b. State Master's theorem and apply the same to solve $T(n) = 7T(n/3) + n^2$
- 2 a. Use Johnson's algorithm to find all pairs shortest path for the graph below.



- b. Explain with an example Floyd's Warshals algorithm and analyze its complexity.
- OR
- 3 a. Explain Single source shortest path for Directed Acyclic Graph algorithm and apply the same for the graph taking '1' as the source vertex.



- b. Apply FORD-FULKERSON algorithm for following graph to find out MAX FLOW from node s to t. Show all steps and residual graph.



(3) (2) (2) (10)

UNIT - III

- 4 a. State Chinese remainder theorem and explain with an example. (2) (3) (1) (08) USN
- b. Write steps in RSA cryptosystems. Apply RSA for $p=11, q=29, n=319$ and $e=3$ to show the encryption of $M=100$. (3) (3) (1) (08)
- c. State Fermat's theorem and write Pseudo-Prime Algorithm to test the Primality of a number (2) (4) (1) (04) Time

UNIT - IV

- 5 a. Write Naïve string matching algorithm and show the comparisons the naïve string matcher makes for the pattern $P=BAB$ in the text $T=ABCABABCDD$. (2) (5) (2) (10)
- b. Explain with an example the working of Boyer Moore algorithm. (2) (5) (2) (10) 1

OR

- 6 a. Construct the transition table using Finite automata for the pattern $P=aabab$ and illustrate its operation on the text string $T=aaababaabaababab$ (5) (5) (2) (10)
- b. Explain with an example Knuth-Morris-Pratt algorithm and analyze its complexity. (4) (5) (2) (10)

UNIT -V

- 7 a. What are non-deterministic algorithms? Explain the concept NP-Hard and NP-Complete with an example for each. (2) (6) (1) (06) 2
- b. Discuss the process of randomizing the Quick sort (2) (6) (1) (08)
- c. Compare the working of LAS VEGAS algorithm with MONTE CARLO algorithm (1) (6) (1) (06)

OR

- 8 a. Explain Monte Carlo algorithm for testing Polynomial Equality. (2) (6) (1) (10)
- b. Demonstrate with an example the process of RANDAMIZIng the Quicksort and linear search (3) (6) (1) (10) 3

Fifth Semester B.E. Semester End Examination, Dec/Jan 2018-19

ADVANCED ALGORITHMS

Time: 3 Hours

Max. Marks: 100

- Instructions: 1. UNIT-I and UNIT-III are compulsory
2. Answer five full questions by selecting at least one question from each UNIT

UNIT - I

- 1 a. Explain different methods of solving recurrence relation. L (2) CO (1) PO (1) M (09)
- b. Use the master's method to find tight asymptotic bound for the following recurrence: $T(n) = 2T(n/2) + n^3$ (3) (1) (1) (06)
- c. Discuss the potential approach of amortized analysis method. (2) (1) (1) (05)

UNIT - II

- 2 a. Write and apply the Johnson's all-pairs shortest-paths algorithm for graph in Figure 1

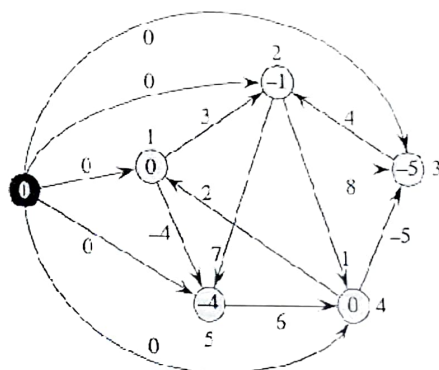


Figure 1

- b. Explain the working of FLOW networks and find max. flow for flow network in Figure 2 (3) (2) (2) (10)

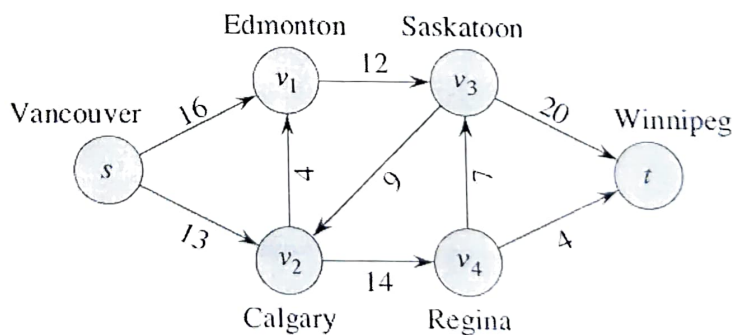


Figure 2

OR

(3) (2) (2) (10)

- 3 a. Write an algorithm for Floyd-warshall and apply the same for the

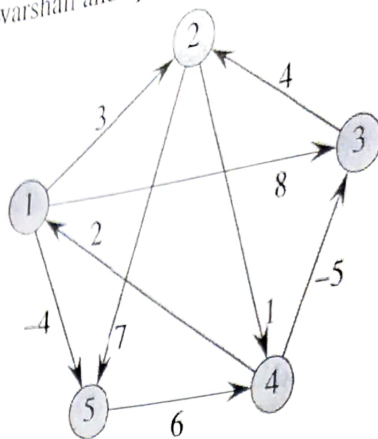


Figure 3

- b. Write DAG shortest path algorithm along with other necessary sub-algorithms used in it. (3) (2) (2) (10)

UNIT - III

- 4 a. State Chinese remainder theorem and apply the same to solve the following problem instance. (3) (3) (2) (10)
 $a \equiv 2 \pmod{5}$
 $a \equiv 3 \pmod{13}$
- b. Write the procedural steps of RSA public key cryptosystem. And also consider an RSA key set with $p=11, q=13, e=11$. What value of d should be used in the secret key. Solve for encryption of the message with $M=7$. (3) (3) (2) (10)

UNIT - IV

- 5 a. Compare and Contrast on Processing time and matching times of Naïve, Rabin-Karp, Finite automata and Knuth-morris algorithms. (2) (5) (1) (10)
- b. Write the naive string-matching algorithm and Show the comparisons the naive string matcher makes for the pattern $P = 0001$ in the text $T = 000010001010001$. (4) (5) (1) (10)

OR

- 6 a. Write Rabin-Karp algorithm. Working modulo $q=11$, how many spurious hits does the Rabin-Karp matcher encounter in the text $T=3141592653589793$ when looking for the pattern $P=26$? (3) (5) (3) (10)
- b. Explain the string matching concept using FINITE-AUTOMATON and Construct state-transition diagram for the string-matching automaton that accepts all strings ending in the string ababaca (5) (5) (1) (10)

UNIT - V

- 7 a. Define NP-Hard and illustrate the concept with the help of Travelling Salesperson Problem. (5) (5) (1) (10)
- b. Discuss the LAS VEGAS algorithm and compare it with MONTE CARLO algorithm. (2) (6) (2) (10)

OR

- 8 a. Bring out the differences between NP-hard and NP complete problems. (4) (6) (2) (10)
- b. Explain Monte-Carlo approach used in Polynomial multiplication. (4) (6) (2) (08)
- c. Discuss the process of randomizing the Quick sort. (2) (6) (2) (06)

Fifth Semester B.E. Semester End Examination, Dec/Jan 2017-18
ADVANCED ALGORITHMS

Time: 3 Hours

Max. Marks: 100

Instructions: 1. Answer five full questions by selecting at least one question from each unit
 2. UNIT-II and UNIT-IV are compulsory

UNIT – I

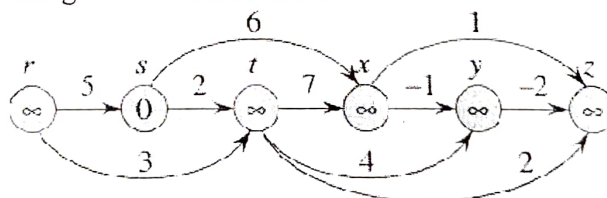
- 1 a. Solve the following recurrence relation to give a good upper bound using recurrence tree method. $T(n) = 3T(n/4) + cn^2$ 08 M
 (Level[3], CO[1], PO[1,2])
- b. Recall and state the Master Theorem for solving recurrence and apply the same for following recurrences: 06 M
 a.) $T(n) = 2T(n/4) + \sqrt{n}$
 b.) $T(n) = 3T(n/4) + n \log n$
 (Level [1,3], CO [1], PO [1,2])
- c. Illustrate the aggregate analysis of amortized cost on the INCREMENT operation in a binary counter. 06 M
 (Level [3], CO [1], PO [2])

OR

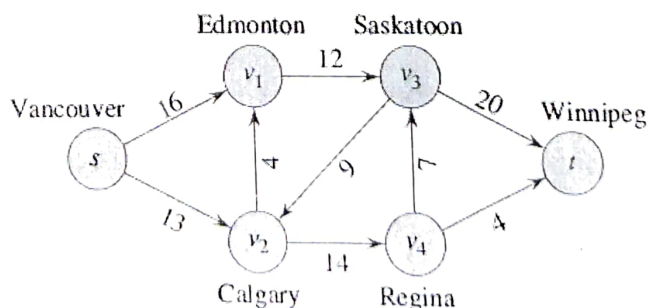
- 2 a. Use the substitution method to determine the tight upper bound on the following recurrence. $T(n) = 4T(n/2) + n^2$ 06 M
 (Level [3], CO [1], PO [2])
- b. Define and explain in detail the various asymptotic notations with related graphs and examples. 10 M
 (Level [1,2], CO [1], PO [1])
- c. What is the amortized cost per operation in worst case? Write the steps involved in MULTIPOP. 04 M
 (Level [1], CO [1], PO [1])

UNIT – II (compulsory)

- 3 a. Explain Single source shortest paths for DAG algorithm and apply the same for following graph taking 'r' as source vertex. 10 M



- (Level [3], CO [2], PO [3])
- b. Explain the term flow network. Consider the following network of a trucking company. Construct the flow network for a flow of $|f| = 19$. 10 M



(Level [3], CO [2], PO [3])

UNIT – III

4 a. Write the pseudo code for computing the GCD of two numbers using EXTENDED-EUCLID's algorithm. And also find GCD (899, 493) and show the computational steps at each level of recursion. 10 M

(Level [3], CO [3], PO [3])

b. Write the procedural steps of RSA public key cryptosystem. And also consider an RSA key set with $p = 11$, $q = 29$, $n = 319$, and $e = 3$. What value of d should be used in the secret key? What is the encryption of the message $M = 100$? 10 M

(Level [3], CO [3], PO [3])

OR

5 a. State the Modular-Linear-Equation-Solver algorithm. And find all solution to the equation $35x \equiv 10 \pmod{50}$ 10 M

(Level [1], CO [3], PO [3])

b. Explain the Miller Rabin algorithm with a suitable example 10 M

(Level [2], CO [3], PO [2])

UNIT - IV(compulsory)

6 a. Write naïve string matching algorithm and Show the comparisons the naive string matcher makes for the pattern $P = 0001$ in the text $T = 000010001010001$ 10 M

(Level [4], CO [4], PO [2])

b. Explain with an example the working of horse pool algorithm 10 M

(Level [2], CO [4], PO [1])

UNIT - V

7 a. Write a note on Probabilistic algorithms 06 M

(Level [2], CO [5], PO [1])

b. Discuss the process of randomizing the quick sort 06 M

(Level [2], CO [5], PO [1])

c. Explain MONTE CARLO algorithm for testing polynomial equality. 08 M

(Level [2], CO [5], PO [1,2])

OR

8 a. Demonstrate use of randomizing for linear search and probabilistic linear search algorithms. 06 M

(Level [3], CO [5], PO [1,2])

b. Write and explain biased MONTE CARLO algorithm. 06 M

(Level [2], CO [5], PO [1])

c. Discuss LAS VEGAS algorithm and compare it with MONTE CARLO algorithm 08 M

(Level [2], CO [5], PO [1,2])