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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

First Semester, M. Tech - Computer Engineering (MCEN)

Semester End Examination; Jan/Feb. - 2016

Advanced Algorithms

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each **unit**.*

UNIT - I

1 a. What is : 6

i) Time Complexity of an algorithm ii) Order of growth of *n* iii) Asymptotic notation.

b. Show that : 8

i) $6Z^n + n^2 = 0\left(Z^n\right)$ ii) $a_m n^m + ...a_1 n + a_0 = O\left(n^m\right)$ iii) Bubble sort is $O\left(n^2\right)$

c. Propose an algorithm for multiplying two square matrices. Identify the order of complexity of the algorithm. 6

2 a. Formulate a recursive algorithm for merge sort. Analyze the running time of the algorithm. 8

b. Construct a recursive tree for : $T(n) = T\left(n/3\right) + T\left(2n/3\right) + 0(n)$ 6

Show that the order of execution is *n logn*.

c. Solve the following using master theorem : 6

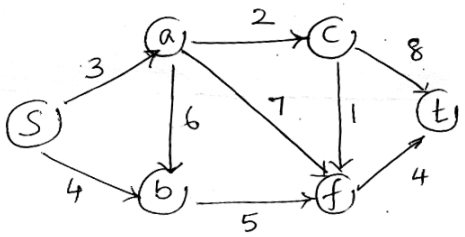
(i) $T(n) = 7T\left(n/2\right) + \theta\left(n^2\right)$ (ii) $T(n) = 2T\left(n/2\right) + \theta(n)$ (iii) $T(n) = 3T\left(n/2\right) + n\lg n$

UNIT - II

3 a. Formulate a procedure for finding the longest common subsequence the procedure on the following sequences. X = (A, B, C, B, D, A, B), Y = (B, D, C, A, B, A) 6

b. Formulate a procedure for multi pop stack operation. Estimate the amortized cost of each operation in the procedure using aggregate analysis. 6

c. Create a DAG of the following graph and find the shortest path from S.

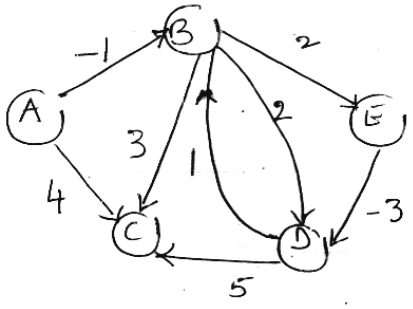


8

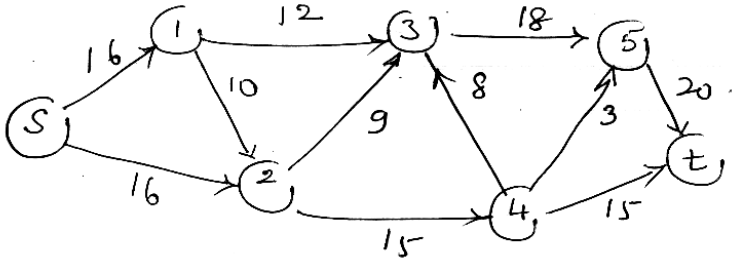
4 a. Outline a procedure to implement a incrementing binary counter. Estimate the amortized cost of each operation in the procedure using accounting method. 6

b. Show that the sub paths of shortest paths are shortest paths. Apply the said structure to find the shortest paths using Bellman – Ford Algorithm for the graph given below using A as the source vertex. 9

Contd…2



c. Explain the constraints on a flow network and find the maximum flow in the network below. 5



UNIT - III

5 a. Formulate a recursive procedure to compute the n^{th} Fibonacci number. Draw the tree for Fib(4). Deduce the time complexity of the procedure. 7

b. Translate the procedure written above to use dynamic multithreading. Redraw the tree. 5

c. Jessica breeds Rabbits. She is not sure how many she has today. But as she was moving about this morning she noticed some things :

When she fed them in groups of 5,
she had 4 left over.

When she bathed them in groups of 8, 8
she had a group of 6 left over.

She took them out to some, in groups of 9, the last group consisted of only.

She is positive that there are lesser than 250 rabbits. How many does she have? Solve the problem.

6 a. Formulate the procedure to use multithreading on a 2 x 2 matrix. For multiplying them. Compare it with the multithreads Strassen's method. 6

b. Solve the following modular equation: 6

$14\ x \equiv 30 \pmod{100}$

c. Differentiate between prime and pseudo primes. Why do we compute pseudo primes? Test 29 for primality. 8

UNIT - IV

7 a. List the steps involved in the Native algorithm for string matching. Apply the algorithm on the following pattern and text : 12

Contd…3

P = 0 0 1 0 0 2 0 1

T = 0 0 1 0 0 1 0 0 2 0 0 0 1 0 0 2 0 1 2 2 0 0

Trace the steps involved. Analyze the time complexity of the algorithm.

b. What is a Hamiltonian cycle? Explain polynomial verification using dodecahedron as an example. 8

8 a. List the steps involved in Rabin - Karp string matching algorithm. Apply the algorithm on the following text and pattern.

T = 8 9 5 7 3 2 1 0 2 6 8 3 2 3 5 5 4 4 0 3 1 12

P = 6 8 3 2 3 5 5

Show the steps involved. Analyze the running time of the algorithm.

b. How do you show problem to be NP complete? Explain. 8

UNIT - V

9 a. How are deterministic, probabilistic and randomized algorithm different from each other. 6

b. What is role of random number generator in probabilistic algorithms? 5

c. Define and write the equations for :

i) Speed up for a parallel algorithm.

ii) Cost of a parallel algorithm. 9

State Amdahl's law and relate speed up to the law.

10 a. Explain the following constraints in the design of parallel algorithms :

i) Multiple instruction execution.

ii) Number and type of processor available. 12

iii) Shared memory.

b. Propose ways to randomize Linear search and comment on the randomization achieved. 8

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