B

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER M. TECH DEGREE EXAMINATION

Computer Science & Engineering

(Computer Science & Systems Engineering)

04CS6403—Advanced Algorithmic concepts

Max. Marks : 60 Duration: 3 Hours

PART A

Answer All Questions

Each question carries 3 marks

1. Solve the recurrence equation: $T(n) = T(n-1) + n$.
2. State the properties of B Trees.
3. Compute the prefix function π for the pattern "xyzxxyxzxyz"
4. Define the net flow across a cut and capacity of a cut.
5. Define Matroids.
6. Explain the Greedy choice property.
7. Prove that the Clique problem is NP-hard.
8. Formally define the class NP. What is integer linear programming.

PART B

Each question carries 6 marks

9. A) Draw the recurrence tree for $T(n) = 4T\left(\frac{n}{2}\right) + cn$, where c is a constant & solve the recurrence.

   B) Is $2^{2n} = O(2^n)$. Justify your answer.

OR

10. A) Explain the notations used to describe the asymptotic running time of an algorithm.

    B) Using recursion tree, Solve the recurrence $T(n) = 3T\left(\frac{n}{3}\right) + n^2$

    C) Using Masters Theorem, Solve the recurrence $T(n) = 2T\left(\frac{n}{4}\right) + \sqrt{n}$

11. A) Using aggregate method of amortized analysis; calculate the amortized cost of incrementing a Binary Counter.

    B) Prove that a red black tree with n internal nodes has height at most $2\lg(n+1)$

OR

12. Demonstrate the Binomial heap union operation showing all possible cases & algorithm.
13. Let $G = (V, E)$ be a flow network with source s and sink t & let f be a flow in G. Let G_f be the residual network of G induced by f , & let f' be a flow in G_f. Then the function $f \uparrow f'$ defined as

$$f \uparrow f'(u,v) = \begin{cases} f(u,v) + f'(u,v) - f'(v,u) & if\ (u,v) \in E \\ 0 & Otherwise \end{cases}$$

is a flow in G with value $|f \uparrow f'| = |f| + |f'|$

OR

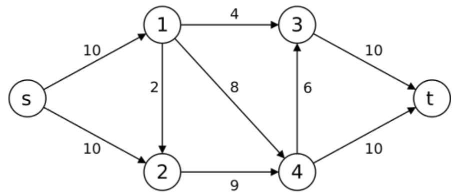
14. A) Prove the suffix function recursion lemma.

    B) Working modulo 11 how many spurious hits does the Rabin Karp Matcher encounter in the text T=2359023141526739921 when looking for the pattern 35902.

15. Prove That If the Edmond's Karp Algorithm is run on a flow network G=(V,E) with source s & sink t, then the total number of flow augmentation performed by the algorithm is O(VE).

OR

16. A) Illustrate the Ford Fulkerson Method for finding maximum flow in the given flow network.



17. Prove that Matroids exhibit optimal substructure property & greedy choice property.

OR

18. Prove that the Hamiltonian Cycle problem is NP Complete.
19. Prove that the Graph Coloring problem is NP Complete.

OR

20. Prove that Satisfiability of Boolean formulas in 3-CNF is NP Complete.