

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 relation using substitution method.

$$T(n) = T(n-1) + 1 \quad \text{for } n > 1$$
$$= 1 \quad \text{for } n = 1$$

2. Find the amortized cost using Aggregate analysis of MULTIPOP() operation in stack data structure.
3. Compute the prefix function for the pattern **abcdabca** when the alphabet is $\Sigma = \{a,b,c,d\}$.
4. Explain MPM algorithm with the help of an example.
5. Given 10 activities along with their start (S_i) and finish (F_i) time as
- $$S = (A1, A2, A3, A4, A5, A6, A7, A8, A9, A10)$$
- $$S_i = (1, 2, 3, 4, 7, 8, 9, 9, 11, 12)$$
- $$F_i = (3, 5, 4, 7, 10, 9, 11, 13, 12, 14)$$

Compute a schedule where the largest number of activities takes place using greedy strategy.

6. Write a short notes on NP Hard problems. Give an example.
7. Design a string matching automaton M, that accepts $L = \{x|x \text{ ends in the string ababaca}\}$.
8. Write a short notes on greedy strategy vs dynamic programming.

PART B

Each question carries 6 marks

9. a) Explain the proof of master theorem.
b) Solve the recurrence relation using master method $T(n) = 16T(n/4) + n^3$.

OR

10. a) Solve the recurrence $T(n) = 2T(n/2) + n$ using substitution method (guess approach).
b) Solve the recurrence $T(n) = T(n/3) + n^{4/3}$ by iteration method.

11. a) Give the different cases involved in the insertion operation in a Red Black tree.
b) Insert 2,1,4,5,9,3,6,7 into an initially empty Red Black tree.

OR

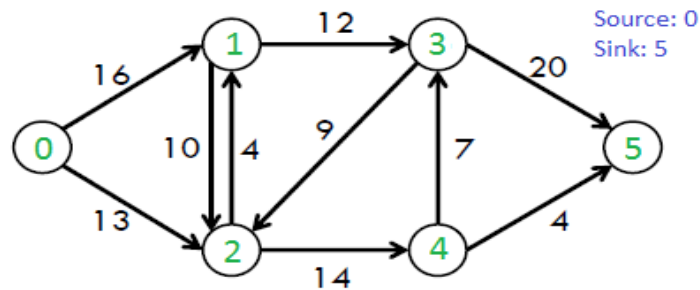
12. a) Demonstrate Fibonacci heap union operation with an example.
b) Prove, Let T be an RB tree having some internal nodes . Then the height of T is atmost $2\lg(n+1)$.

13. a) Explain Rabin-Karp algorithm ? Illustrate the Rabin Karp algorithm for the text : 3141592653589793 Pattern: 589 assign $q=7$.
 b) Explain KMP algorithm with the help of Text : abxabcabcaby Pattern: abcaby

OR

14. a) Explain Rabin-Karp algorithm ? Illustrate the Rabin Karp algorithm for the text : 3141592653589793 Pattern: 26 assign $q=11$.
 b) Draw a state transition diagram for a string matching automation for the pattern ababbabbababbaba over the alphabet $\Sigma = \{a,b\}$.

15. Show the execution of Ford Fulkerson Flow algorithm .Find the minimum cut and the maximum flow across the cut . Also find the capacity of the cut.



OR

16. a) Draw a flow network, consider a cut and find the flow across the cut and the capacity of the cut.
 b) The value of any flow in a flow network G is bounded from above by the capacity of any cut of G . Prove.
 17. What is greedy strategy? Also explain optimal substructure property and greedy choice property.

OR

18. If $G = (V,E)$ is an undirected graph, then the graphic matroid $MG = (SG,IG)$ is a matroid. (SG is the edge set of G and if $A \subseteq E$, then $A \in IG$ iff A is acyclic).

19. Prove that clique problem is NP Complete.

OR

20. Prove that 3SAT problem is NP Complete.