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06CS43

Fourth Semester B.E. Degree Examination, June 2012
Analysis and Design of Algorithms

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer FIVE full questions, selecting at least TWO questions from each part.***
2. Algorithms must be neatly documented.

PART – A

1 a. What is an algorithm? With an appropriate example, illustrate the notion of algorithm and also list the important points of an algorithm. **(06 Marks)**

b. Find the GCD of (72, 56) using middle-school procedure. Verify the result with Euclid's algorithm. **(04 Marks)**

c. Enlist the sieve algorithm to generate the prime numbers not exceeding a given number n. Illustrate the working of this algorithm for n = 30. Also prove that only numbers to consider for finding prime are upto $\sqrt{n}$. **(10 Marks)**

2 a. What do you understand by the term an "algorithm design technique"? List three important reasons for learning brute force technique. **(04 Marks)**

b. Describe the standard algorithm for finding the binary representation of a positive decimal integer, in pseudocode form. **(06 Marks)**

c. Compare and contrast array and linked list. **(04 Marks)**

d. Give the adjacency linked list for the following graph. When do you prefer adjacency linked list over adjacency matrix and why? **(06 Marks)**

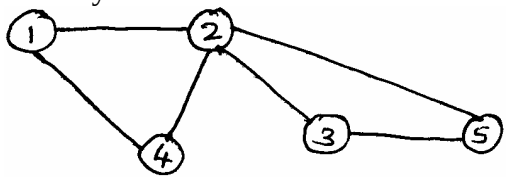

Fig.Q.2(d)

3 a. Give a brief outline of the general procedure analyzing the efficiency of recursive algorithms with an example. **(06 Marks)**

b. Which of the following are true for large values of n?
i) $n^2 \leq n \log n$
ii) $n^3 \geq 2^n$
iii) $n! \leq 2^n$
iv) $n \leq n \log n$. **(04 Marks)**

c. Give an example algorithm that needs to be analyzed for the three cases. Also find the best, worst and average efficiencies for the algorithm. **(06 Marks)**

d. Prove that $n(n-1)/2$ is in $\theta(n^2)$. **(04 Marks)**

4 a. Solve the following recurrence relations :
i) $x(n) = x(n/2) + n$ for $n > 1$, $x(1) = 1$ (solve for $n = 2^k$)
ii) $x(n) = x(n/3) + 2$ for $n > 1$, $x(1) = 1$ (solve for $n = 3^k$). **(04 Marks)**

b. Sort the following set of numbers using merge sort showing all the divide and merge steps.
7 4 2 1 6 9 21 13. **(04 Marks)**

c. Enlist both the quicksort and partition algorithms and show that the worst case efficiency is in $\theta(n^2)$. **(08 Marks)**

d. Prove that multiplication of large integers using divide and conquer methods computing time $\approx n^{1.585}$. **(04 Marks)**

PART – B

5 a. What do you understand by the term transform and conquer? What are its three major variations? With an example and algorithm explain the working heap sort algorithm. **(08 Marks)**

b. Sort the array 5 7 6 4 3 9 2 using heap sort. Also prove that the heap sorts algorithm efficiency is in 0(n log n). **(12 Marks)**

6 a. With an example, explain the working of Horspools Algorithm for string matching. With a neat table and algorithm to find shift table explain the working of Horspools string matching algorithm. **(08 Marks)**

b. What is hashing? With an appropriate hash function, explain the working of hash tables. Also discuss the two approaches for addressing collosions. **(08 Marks)**

c. Write short note on Boyer-Moore algorithm. **(04 Marks)**

7 a. What is dynamic programming? With an example illustrate how you would compute binomial coefficient using this algorithm design technique. Also print the algorithm binomial (n, k). **(10 Marks)**

b. Enlist Floyd's algorithm and explain its working with an example. Also find all pairs shortest path for the following graph using this technique. **(10 Marks)**

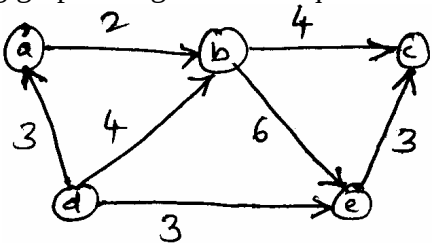

Fig.Q.7(b) Directed graph

8 a. Solve the following knapsack problem using dynamic approach :

Item	Weight	Value
1	3	25
2	2	20
3	1	15
4	4	40
5	5	50

Capacity W = 6

(06 Marks)

b. With an example and algorithm explain the working of Kruskals algorithm. **(06 Marks)**

c. Write short notes on any two of the following :
i) Backtracking
ii) Huffman trees
iii) NP-Hard and NP-Complete
iv) Branch and bound technique. **(08 Marks)**

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