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MIN-004

M.Tech. IN ADVANCED INFORMATION TECHNOLOGY - SOFTWARE TECHNOLOGY (MTECHST)

00019

Term-End Examination

December, 2014

MIN-004 : MATHEMATICAL FOUNDATION AND ALGORITHM DESIGN

Time : 3 hours *Maximum Marks : 100*

Note :

(i) *Section I is **compulsory**. Maximum marks 30.*

(ii) *In Section II, solve any **five** questions. Maximum marks 70.*

(iii) *Assume suitable data wherever required.*

(iv) *Draw suitable sketches wherever required.*

SECTION I

1. A newspaper delivery boy every day drops newspapers in a society having many lanes and each lane having many houses. Design a program to provide different paths that he could follow and also suggest the path which will make him finish his task with less effort. Solve the problem by suggesting appropriate data structures. Design the necessary structure. *10+5*

2. Consider the following algorithm to compute GCD :

```
function EuclidGCDRec(a,b)
begin
    if b == 0 then
    return (a);
    else
    return (EuclidGCDRec(b, a%b));
    endif
    end
```

Write the recurrence relation for this algorithm, solve it by using recursion tree method and decide the time complexity. *15*

SECTION II

3. (a) Prove that if any NP complete problem belongs to class P, then P = NP. *6*

(b) Let n = 3 and {k1, k2, k3} = {do, if, while}.

Let p(1:3) = {0·5, 0·1, 0·05}.

Let q(0:3) = {0·15, 0·1, 0·05, 0·05}.

Construct an OBST for the above values using Dynamic Programming. *8*

4. (a) Let S = {1,2,3} and R = {(1,2), (2,2), (2,3)}, then find R^+ and R^*. *6*

(b) Write a PSEUDO C code for Quick sort. *8*

5. (a) What are the characteristics of a good hash function ? Explain with example. *6+2*

(b) Write control abstraction for divide and conquer algorithmic strategy. *6*

6. Given a file of n records which are partially sorted as $x_1 \leq x_2 \ldots \leq x_n$ and $x_{n+1} \leq \ldots \leq x_n$. Is it possible to sort the entire file in time O(n) using only a small fixed amount of additional storage ? *14*

7. Explain how the exponentiation $x = a^n$ is computed using divide and conquer algorithmic strategy. *14*

8. Obtain Principal Conjunctive Normal Form for the following : *14*

(a) $p \wedge (p \rightarrow q)$

(b) $\neg(p \vee q) \leftrightarrow (p \wedge q)$

(c) $(p \rightarrow q) \wedge (q \rightarrow p)$

9. (a) In a survey of 60 people it was found that 25 read Business India, 26 read India Today, 26 read Times of India, 11 read both Business India and India Today, 9 read both Business India and Times of India, 8 read both India Today and Times of India and 8 read none of these. *4+4*

(i) How many read all three ?

(ii) How many read exactly one ?

(b) Prove by Mathematical Induction, for $n \geq 0$, *6*

$$1 + a + a^2 + a^3 + \cdots + a^n = \frac{1 - a^{n+1}}{1 - a}.$$