Maximum Marks: 60
Credits: 04
Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meanings.

Q.No. | Question                                                                 | M.M.
-----|--------------------------------------------------------------------------|------
1(a) | Define the asymptotic notations $O$, $\Omega$, and $\Theta$. Briefly explain them using suitable diagrams. Also, define $o$ and $\omega$ notations. [06] |
1(a*)| Use a recursion tree to give an asymptotically tight solution to the recurrence $T(n) = T(\alpha n) + T((1-\alpha) n) + cn$, where $\alpha$ is a constant in the range $0 < \alpha < 1$ and $c > 0$ is also a constant. [06] |
1(b) | Show that the solution to the recurrence $T(n) = 2T\left(\left\lfloor \sqrt{n} \right\rfloor \right) + \log n$ is $O(\log n \log \log n)$. Solve intermediate recurrence(s), if any. [06] |
2(a) | Briefly describe Bucket Sort algorithm. Show that the expected running time of Bucket Sort is $O(n)$. [05] |
2(a*)| Draw a decision tree for sorting three numbers. Prove that the lower bound on the complexity of sorting algorithm which is based on comparisons is $\Omega(n \log n)$. [05] |
2(b) | Show that $\sum_{k=1}^{n} k \log k \leq \frac{1}{2} n^2 \log n - \frac{1}{8} n^2$. Using this bound, show that the expected running time of RANDOMIZED-QUICKSORT that uses RANDOMIZED-PARTITION is $O(n \log n)$. [07] |
3(a) | Briefly compare dynamic programming with divide-and-conquer method. Where is dynamic programming applied? What are the steps in developing a dynamic programming algorithm? [04] |

Contd……..2
3(b) Let there be four matrices with the following dimensions:

<table>
<thead>
<tr>
<th>Matrix</th>
<th>Dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>$A_1$</td>
<td>$10 \times 8$</td>
</tr>
<tr>
<td>$A_2$</td>
<td>$8 \times 12$</td>
</tr>
<tr>
<td>$A_3$</td>
<td>$12 \times 4$</td>
</tr>
<tr>
<td>$A_4$</td>
<td>$4 \times 14$</td>
</tr>
</tbody>
</table>

Using a dynamic programming algorithm, determine the order of multiplying the chain of matrices $A_1A_2A_3A_4$ so that the total number of scalar multiplications is minimized. Write all intermediate steps.

OR

3(b') A strand of Deoxyribo-Nucleic Acid (DNA) consists of a string of molecules called bases, where the possible bases are adenine, guanine, cytosine, and thymine. Representing each of these bases by its initial letter, one can express a strand of DNA as a string over the finite set $\{A, C, G, T\}$. In some cases, it is required to determine the similarity between strands of two organisms. One way of measuring the similarity between two strands $S_1$ and $S_2$ is by finding a third strand $S_3$ in which the bases in $S_1$ appear in each of $S_1$ and $S_2$; these bases must appear in the same order, but not necessarily consecutively. The longer the strand $S_3$ one can find, the more similar $S_1$ and $S_2$ are. Briefly describe a dynamic programming algorithm for finding the longest common strand $S_3$. Let $S_1$ and $S_2$ be as follows:

$$S_1 = \text{CGAC}$$
$$S_2 = \text{CTGCAC}.$$ 

Use the algorithm to find the longest common strand of $S_1$ and $S_2$.

4(a) Starting from the vertex $A$, find a minimum spanning tree using Prim’s algorithm for a graph given in Figure 1. Show all intermediate steps. What is the running time of Prim’s algorithm for a graph $G=(V,E)$ in terms of the number of edges $|E|$ and the number of vertices $|V|$?
Figure 1: A graph for finding minimum spanning tree using Prim’s algorithm (Q4 (a)).

OR

4(a') Find shortest paths from a source vertex $s$ to all other nodes in a directed graph shown in Figure 2 using Dijkstra’s shortest path algorithm. Write all intermediate steps. For a directed graph $G=(V,E)$ with $|V|$ number of vertices and $|E|$ number of edges, what is the running time of the algorithm?

Figure 2: A directed graph for Dijkstra’s shortest path algorithm (Q4 (a')).

4(b) Find the maximum flow from the source $s$ to the sink $t$ in a flow network, which is shown in Figure 3, using the Ford-Fulkerson max-flow algorithm. For a graph $G=(V,E)$ with $|V|$ number of vertices and $|E|$ number of edges, what is the running time of the algorithm?

Contd......
5(a) What is meant by $P$ and $NP$ classes of problems? When a problem is said to be an $NP$-complete problem?

5(b) A vertex cover of an undirected graph $G=(V, E)$ is a subset $V' \subseteq V$ such that if $(u, v) \in E$, then $u \in V'$ or $v \in V'$ (or both). That is, each vertex "covers" its incident edges, and a vertex cover for $G$ is a set of vertices that covers all the edges in $E$. The size of a vertex cover is the number of vertices in it. The vertex cover problem is to find a vertex cover of minimum size in a given graph. Prove that the vertex cover problem is an $NP$-complete problem.

OR

5(b) In the traveling salesman problem, a salesman wishes to make a tour visiting each city exactly once and finishing at the city he starts from. The salesman incurs a nonnegative integer cost $c(i,j)$ to travel from city $i$ to city $j$, and the salesman wishes to make the tour whose total cost is minimum, where the total cost is the sum of individual costs along the edges of the tour. Prove that the traveling salesman problem is an $NP$-complete problem.
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Q.No.  

1(a) Show as to how following statement would be processed in each phase of the compiler -
\[ rgen = count \times head + bcount(count \times head) \]

1(b) Give different tokens for a typical programming language. Why lexical analyzer has to scan several characters beyond the token to recognize it. Take suitable example to explain.

2(a) Construct canonical parsing table for the following grammar -
- \( S \rightarrow aBB \)
- \( B \rightarrow d \)
- \( B \rightarrow e \)

2(b) Define viable prefixes? Construct finite automata which recognizes set of viable prefixes for the following grammar -
- \( S \rightarrow aAa | bAb \)
- \( A \rightarrow d \)

Or

2'(a) Give a grammar which recognizes list of identifiers separated by comma. Construct predictive parsing table for your grammar.

2'(b) Construct S.L.R parsing table for the following grammar -
- \( S \rightarrow aSbS | aS | d \)

Contd......2
3(a) Give type expression for xyz in each of the followings -
   i) struct {
       int min;
       struct { char category; float position; } pdata[10];
   } xyz[20];
   ii) int *xyz(char A[30], int p) {
   iii) int *xyz[10];

3(b) Define synthesized attribute and inherited attribute. Give a realistic example of syntax directed definition that is using synthesized and inherited attribute.

4(a) Give syntax directed translation scheme to translate do-while statement of C Language to three address code.

4(b) Write in brief about register allocation and register assignment. Differentiate between the two.

OR

4'(a) Convert the following to three address code using any translation scheme and subsequently obtain data flow graph for your three address code:

   while(a>b) if (c>d) then p=a+b; else if (a>f) then n=m*n;
   d=height*length;

4'(b) Give syntax directed translation scheme to translate arithmetic expression to three address code.

5 Write short note on any TWO of the followings -
   a) Identifying Loops in Data Flow Graph
   b) Live Variable Analysis
   c) Loop Jamming
2013-14
B.TECH. (AUTUMN SEMESTER) EXAMINATION
COMPUTER ENGINEERING
DESIGN OF PROGRAMMING LANGUAGES
CO-403

Maximum Marks: 60
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Answer all the questions.
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Q.No. Question M.M.
1(a) Describe the language design trade-offs on the basis of language evaluation criteria. [05]
1(b) Discuss the three general methods of implementing a programming language with their advantages and disadvantages. [05]

OR
1(b) Write all ancestors of the following programming languages: [05]
(i) Ada95, (ii) PHP, (iii) Visual Basic.NET, (iv) C#, and (v) Haskell
1(c) Elaborate the evaluation of static and dynamic scoping. [05]

2(a) Explain using example the Discriminated Unions and its implementation. [05]
2(b) What are the order of evaluation of operators and operands in a programming language? Explain with suitable example. [05]
2(c) Show the stack contents at position 1, 2, and 3 with all activation record instances of the following example C program, which uses the recursion to compute factorial:

```c
int factorial (int n) {
    ...
    if (n == 0) {
        ...
        return 1;
    } else return (n * factorial (n - 1));
    ...
}
void main () {
    int value;
    value = factorial (4);
}
```

Contd......2
2(a) Develop the access functions for both row major and column major arrangements for three dimensional arrays.

2(b) Define guarded command. Explain Dijkstra's selection construct and Dijkstra's loop structure with the help of flow graphs.

2(c) Explain the design considerations of parameter passing methods using example.

3(a) How the languages C# and Ruby are provided data abstraction? Explain.

3(b) Describe briefly the design issues used for object oriented programming languages.

3(b) What are the possible levels of concurrency in a program? Point out the differences between physical and logical concurrency.

3(c) Explain with suitable example facilities of exception and event handling in JAVA.

4(a) Write a Scheme function that takes a simple list of numbers as its parameter and return the largest and smallest number in the list.

4(b) What are the advantages and disadvantages of functional programming languages over imperative programming languages?

4(b) Differentiate between forward and backward chaining using Prolog example. Write the following English conditional statements as Prolog headed Horn Clauses:
   a. If Mary is the mother of Tom & Bob and Fred is the father of Tom & Bob, then Tom & Bob are siblings.
   b. X is the function of Y implies that F is the function of X and F is the function of Y and G is the function of X and G is the function of Y.
   c. If Mike is the father of Joe and Mary, then Joe and Mary are sisters.

4(c) Explain the deficiencies of Prolog. List the applications of logic programming.
2013-14
B.TECH. AUTUMN (VII SEMESTER) EXAMINATION
COMPUTER ENGINEERING
MOBILE COMPUTING
CO-452

Maximum Marks: 60 Credits: 04 Duration: Three Hours

Answer all the questions. Assume suitable data if missing. Notations used have their usual meaning.

Q.No. Question
1(a) List the various major mobile radio standards for North America and Europe describing the type of technology, year of introduction, multiple access, frequency band, modulation and channel width.
1(b) For current and emerging 2.5G and 3G data communication standards write down the wireless data technology used, channel bandwidth, duplexing, infrastructure change, new spectrum requirements and new handset requirements.

OR

1(b") In a tabular format, list the various characteristics of cellular and cordless low-tier PCS technologies. What is the operating frequency for cellular networks and cordless networks?

2(a) Differentiate between mobile-controlled handoff (MCHO), network-controlled handoff (NCHO) and mobile-assisted handoff (MAHO). What is the difference between Inter-RS Handoff and Intersystem Handoff? Support your answer with suitable diagrams.
2(b) Explain the MS registration process and call delivery procedure while roaming in cellular networks. Where do the entities HLR and VLR reside.

OR

2(b") What is the upgrade path of the various 2G technologies? Draw a suitable flow chart for the same and explain in detail.
3(a) What is Mobile Number Portability (MNP)? Explain the All-Call-Query approach to MNP. Draw suitable diagrams to support your answer.

3(b) Explain in detail the GPRS network architecture. What additional equipment are installed in GSM networks at the BSS and the MSC? How is EDGE different from GPRS?

OR

3(b') How would you roll out data services over D-AMPS cellular networks? Explain the network architecture. Where do the various components viz. MD-1S, MD-S, M-ES, AMPS BS, MS and AMPS MSC integrate into the network.

4(a) Compare the various 2.5G, 2.75G, 3G, 3.5G, 3.75G and 4G mobile internet access methods. List the various characteristics.

4(b) Discuss the Ericsson W-CDMA 3G trial system. Explain with the help of suitable diagrams.

OR

4(b') Explain in detail the Lucent cdma2000 3G field trial system.