

Pandit Deendayal Petroleum University, Gandhinagar  
School of Technology

Mid-Semester Examination

B. Tech. (Computer + ICT)  
Date: 06/03/2019  
Course Name: Design & Analysis of Algorithms

Semester – IV  
Time: 10.00 am to 12.00 pm  
Course Code : 17CP211T  
Max. Marks: 50

Instructions to students:

- 1. Do not write anything other than your roll number on the question paper.
- 2. Assume suitable data wherever required and mention it clearly.
- 3. You are required to answer all the questions in sequence as given in the question paper.

Q.1 Answer the following questions. (10)

- (I) The complexity of following function is  $\theta(\_\_)$

```
int fun(int n)
{
    int count = 0;
    for (int i = n; i > 0; i /= 2)
        for (int j = 0; j < count; j++)
            count += 1;
    return count;
}
```
- (II) Suppose  $g(n)$  is  $20n^3 + 2n^2 + 50$  and  $h(n)$  is  $4n^2 + 5n^2 + 12$ . Let  $f(n)$  be a third, unknown function. Which of the following is not possible. Justify.

  - A.  $f(n)$  is  $O(g(n))$  and  $f(n)$  is also  $O(h(n))$
  - B.  $f(n)$  is  $O(g(n))$  but  $f(n)$  is not  $O(h(n))$
  - C.  $f(n)$  is  $O(h(n))$  but  $f(n)$  is not  $O(g(n))$
  - D.  $f(n)$  is not  $O(g(n))$  and  $f(n)$  is also not  $O(h(n))$
- (III) Rank the following functions by order of growth; that is, find an arrangement  $g_1, g_2, \dots, g_7$  of the functions satisfying  $g_1 = \Omega(g_2), g_2 = \Omega(g_3), \dots, g_6 = \Omega(g_7)$ .

$(lg\ n)!, 2^{2^{n+1}}, lg(n!), 4^{lg\ n}, n^3, (\sqrt{2})^{lg\ n}, \left(\frac{3}{2}\right)^n$
- (IV)  $2^{2^n} = O(2^n)$  True or False. Justify.
- (V) Solve  $P(x) = 27P\left(\frac{x}{3}\right) + \theta(x^3 lg\ x)$  using master method

Q.2 Attempt any Four questions: (20)

- (I) Write algorithm for fractional knapsack and derive complexity.
- (II) Explain the Big Oh, Big Omega and Big Theta notations with example
- (III) Explain the aggregate method of stack example in amortized analysis.
- (IV) Write algorithm for shortest path using greedy method and derive complexity of it.
- (V) Explain the barometer technique of algorithm analysis.

Q.3 Attempt any Four questions: (20)

- (I) Apply heap sort on data {8,9,1,7,2,5,4,6,3,10}

(II) Apply Huffman coding on following characters with frequencies

a:1 b:1 c:2 d:3 e:5 f:8 g:13 h:21

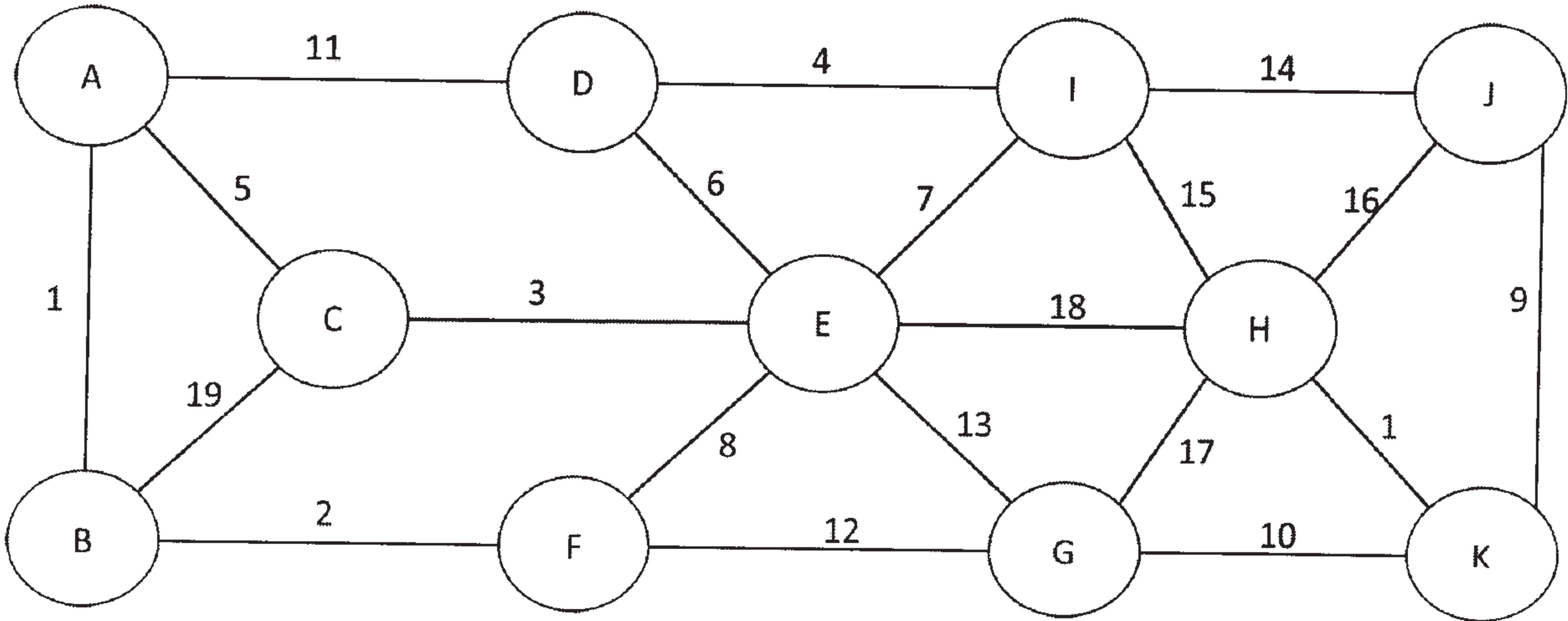
What is the sequence of characters corresponding to the following code (scan from left to right)?

1110111100111010
- (III) Find the big theta complexity of following using backward substitution method. Consider  $n$  is power of 2.

$$T(n) = \begin{cases} 1 & n = 1 \\ 3T\left(\frac{n}{2}\right) + n & n > 1 \end{cases}$$



(IV) Find the MST of following graph using Kruskal’s method. Consider A as start vertex.



(V) Find the big theta complexity of following using inhomogeneous recurrence relation method. Consider n is power of 2.

$$T(n) = \begin{cases} 1 & n = 1 \\ 8 & n = 2 \\ 4T\left(\frac{n}{2}\right) + n^2 & n > 2 \end{cases}$$

**Best Wishes**