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PES UNIVERSITY

PES University, Bangalore

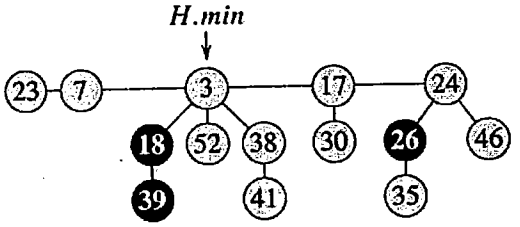
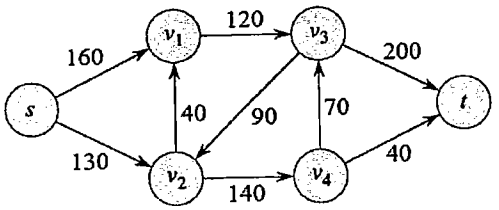
(Established under Karnataka Act No. 16 of 2013)

UE14CS311
(Class of CB)

END SEMESTER ASSESSMENT (ESA) B.Tech. V SEMESTER- Dec. 2016

UE14CS311- Advanced Algorithms

Time: 3 Hrs | Answer All Questions | Max Marks: 100

1.	a)	Compare **Big-O, Ω and θ-notations** with generic graphs of the asymptotic behavior.	06
	b)	Sort the following functions in the increasing order of asymptotic growth rate. **$n\sqrt{n}$, 1.01^n, $n^{1.3}$, 2^n, n^2, log n, n log n, $\sqrt{n}$, 10^{10}.**	06
	c)	How does **accounting method** work to find the amortized cost of an operation? Using accounting method find the amortized cost of the following operation on a data structure. A sequence of ***n*** operations is performed on a data structure. The **i^{th}** operation costs **i** if **i** is an exact power of 2, and 1 otherwise.	08
2.	a)	What is a suffix tree? Write a suffix tree of the string **"abaaba"** and explain the method searching substrings **"baa"** and **"baabb"** in the string.	06
	b)	Construct a **generalized (compact) suffix tree** of two strings **"nonsense"** and **"offense"** with unique end markers **$\$_1$** and **$\$_2$**.	06
	c)	Explain the core principle used in the **Robin-Karp algorithm**. As an example, in a text "TTATAGATCTCGTATTCTTTTATAGATCTCCTATTCTT", search for the pattern "TCCTATTCTT" using the Robin-Karp algorithm.	08
3.	a)	Write an algorithm to **insert** a node into a Fibonacci Heap and trace the algorithm to insert a node with value **21** into the following Fibonacci Heap. Dark shaded nodes are "marked". 	06
	b)	Explain the method of **decreasing the value of a node** from the Fibonacci Heap with an appropriate example.	06
	c)	Write the **Ford-Fulkerson algorithm** to find the maximum flow in a flow network. Using Ford-Fulkerson method, find the maximum flow for the flow network shown below. 	08

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4.	a)	Find the point-value representation of the polynomial $A(x) = 51 + 2x + 10x^2 + 3x^3$ using 4^{th} **roots of unity** as the distinct points.	06
	b)	Provide a proof for the **Halving lemma**: If $n > 0$ is even, then the squares of the n complex nth roots of unity are the $n/2$ complex $(n/2)$**th** roots of unity.	06
	c)	Build the reasoning behind the **recursive FFT algorithm** to find convert a polynomial from coefficient representation to point-value representation and write the algorithm.	08
5.	a)	Find x_1, y_1 in $\gcd(210, 90) = 210x_1 + 90y_1$, and x_2, y_2 in $\gcd(8400, 4620) = 8400x_2 + 4620y_2$ using Extended Euclid's Algorithm.	06
	b)	Provide a proof for the theorem: If **a** and **b** are any integers, not both zero, then **gcd(a, b)** is the smallest positive element of the set $\{ax + by : x, y \in Z\}$ of linear combinations of **a** and **b**.	06
	c)	Discuss the high-level working of **Digital signatures** in a public-key system with a simple diagram of sender Seeta sending a message M to receiver Rama.	08