NEHRU COLLEGE OF ENGINEERING AND RESEARCH CENTRE

(Accredited by NAAC, ISO 9001-2015 certified, Approved by AICTE New Delhi, Affiliated to APJKTU) **Pampady, Thiruvilwamala(PO), Thrissur(DT), Kerala 680 588**

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY QUESTION PAPERS

VISION OF THE INSTITUTION

To mould true citizens who are millennium leaders and catalysts of change through excellence in education.

MISSION OF THE INSTITUTION

NCERC is committed to transform itself into a center of excellence in Learning and Research in Engineering and Frontier Technology and to impart quality education to mould technically competent citizens with moral integrity, social commitment and ethical values.

We intend to facilitate our students to assimilate the latest technological know-how and to imbibe discipline, culture and spiritually, and to mould them in to technological giants, dedicated research scientists and intellectual leaders of the country who can spread the beams of light and happiness among the poor and the underprivileged.

ABOUT DEPARTMENT

- Established in: 2002
- Courses offered : B.Tech in Computer Science and Engineering

  M.Tech in Computer Science and Engineering

  M.Tech in Cyber Security
- Approved by AICTE New Delhi and Accredited by NAAC
- Certified by ISO 9001-2015.
- Affiliated to the A P J Abdul Kalam Technological University.

DEPARTMENT VISION

Producing Highly Competent, Innovative and Ethical Computer Science and Engineering Professionals to facilitate continuous technological advancement.

DEPARTMENT MISSION

1. To Impart Quality Education by creative Teaching Learning Process
2. To Promote cutting-edge Research and Development Process to solve real world problems with emerging technologies.
3. To Inculcate Entrepreneurship Skills among Students.
4. To cultivate Moral and Ethical Values in their Profession.

APJ ABDULKALAM TECHNOLOGICAL UNIVERSITY
08 PALAKKAD CLUSTER

Q. P. Code : CS-1B-18-2 **(Pages: 3)** **Name: .....**

Reg. No:.....

FIRST SEMESTER M.TECH. DEGREE EXAMINATION DEC 2018

Branch: Computer Science and Engineering Specialization: Computer Science and Engineering

08 CS 6021 ADVANCED DATA STRUCTURES

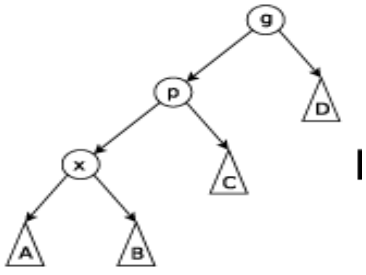
Time:3 hours **Max.marks: 60**

Answer all six questions.

Modules 1 to 6: Part 'a' of each question is compulsory and answer either part 'b' or part 'c' of each question.

Q.no.	Module 1	Marks
1.a	Is the array with values { 21, 15, 18, 8, 12, 11, 16, 4, 9 } a max-heap? Justify	**3**
	Answer b or c	
b	Explain the importance of asymptotic notations during analysis of algorithms. Explain all asyrnptotic notations with proper definitions and diagrams.	**6**
c	Construct a MAX HEAP using suitable pseudo code for MAX-HEAPIFY( ) and BUILDMAXHEAP() with the values 4,1,3,2,16,9,10,14,8,7	**6**

Q.no.	Module 2	Marks
2.a	Explain the splaying operations Zig Zig on splay tree with the following diagram	**3**



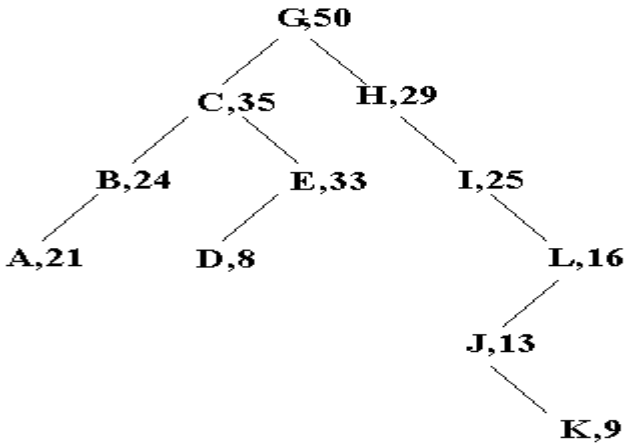
Answer b or c

b	Define an M-way tree. Start with an empty B-tree and keys arrive in the following order: 1 12 8 2 25 5 14 28 17 7 52 16 48 68 3 26 29 53 55 45. Construct a B-tree of order 5	**6**
c	Illustrate Insertion operation of the following elements 2,1,4,5,9 in the same order to an empty Red Black Tree	**6**

Q.no.	**Module 3**	**Marks**
3.a	The keys 12, 18, 13, 2, 3, 23, 5 and 15 are inserted into an initially empty hash table of length 10 using open addressing with hash function h(k) = k mod 10 and linear probing. What is the resultant hash table?	**3**

Answer b or c

b	Insert the (key,priority) pair (F,40) in this treap	**6**

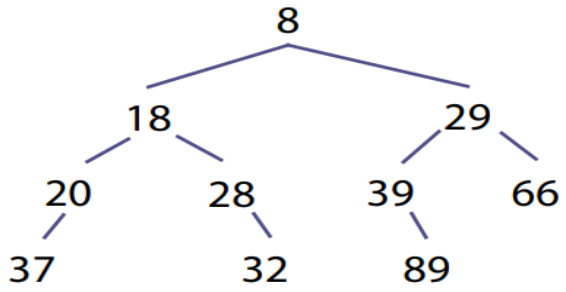


c	Explain the different methods of amortized analysis in detail in terms of stack operations.	**6**

Q.no.	**Module 4**	**Marks**
4.a	Explain the basic operations and working of Priority Queue.	**3**

Answer b or c

b	Illustrate DeleteMin operation on the following Skew heap	**6**



c	Define Leftist heap as an abstract data type. Develop algorithms for the operations on leftist heap.	**6**

Q.no.	**Module 5**	**Marks**
5.a	Compare the properties of Fibonacci heap and binomial heap.	**4**

Answer b or c

b	Write an implementation of Dijkstra's algorithm for single source shortest using Fibonacci heap. Analyse your algorithm?	**8**
c	Analyze and justify why a Fibonacci heap can be considered as a better structure than arrays and binary heaps for implementing Dijisktra's algorithm	**8**

Q.no.	**Module 6**	**Marks**
6.a	Suggest applications of Quad Tree structure	**4**

Answer b or c

b	Develop algorithm to Insert the following elements in sequence (3, 6), (17, 15), (13, 15), (6, 12), (9, 1), (2, 7), (10, 19) to a 2-D tree	**8**
c	Write applications of MX-Quad Tree and point quad tree.	**8**

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Q. P. Code : CS-1D-18-2 **(Pages: 4)** **Name: .....**

Reg. No:.....

FIRST SEMESTER M.TECH. DEGREE EXAMINATION DEC 2018

Branch: Computer Science and Engineering Specialization: Computer Science and Engineering

08 CS 6041 MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

Time:3 hours **Max.marks: 60**

Answer all six questions.

Modules 1 to 6: Part 'a' of each question is compulsory and answer either part 'b' or part 'c' of each question.

Q.no.	Module 1	Marks
1.a	For a given matrix A of order 3, $\|A\| = 32$ and two of its eigen values are 8 and 2. Find the trace of A.	**3**
	Answer b or c	
b	Using Cayley Hamilton theorem, find A^{-1} and A^4 where $A = \begin{bmatrix} 1 & -1 & 4 \\ 3 & 2 & -1 \\ 2 & 1 & -1 \end{bmatrix}$	**6**
c	Find the singular value decomposition of the matrix $A = \begin{bmatrix} 5 & 5 \\ -1 & 7 \end{bmatrix}$	**6**

Q.no.	Module 2	Marks
2.a	A family has 2 children. What is the probability that both are boys given that at least one of them is boy? Assume that each of the outcomes are equally likely.	**3**
	Answer b or c	
b	For a certain binary communication channel, the probability that a transmitted '0' is received as '0' is 0.95 and the probability that a transmitted '1' is received as '1' is 0.90. If the probability that a '0' is transmitted is 0.4, find the probability that (i) a '1' is received and (ii) a '1' was transmitted given that a '1' was received.	**6**

c	Consider 2 urns where 1st contains 2 white and 7 blue balls and the second contains 5 white and 6 blue balls. We flip a fair coin and then draw a ball from the 1st urn or 2nd urn depending on whether the outcome of the toss was head or tail respectively. What is the conditional probability that the outcome of the toss was head given that a white ball was selected?	**6**

Q.no.	**Module 3**	**Marks**
3.a	A man is at an integral point on the x-axis between the origin and the point 3. He takes a unit step to the right with probability 1/3 or to the left with probability 2/3, unless he is at the origin, where he takes a step to the right to reach the point 1 or is at the point 3, where he takes a step to the left to reach the point 2. Write down the transition probability matrix.	**3**

Answer b or c

b	The TPM of a markov chain Xn , n≥0 having three states 1,2 and 3 is $P = \begin{bmatrix} 0.2 & 0.3 & 0.5 \\ 0.1 & 0.6 & 0.3 \\ 0.4 & 0.3 & 0.3 \end{bmatrix}$ and the initial probability distribution is P(0) = [0.5 0.3 0.2]. Find (a) P [X2 =2] (b) P [X3 =3, X2 =2, X1 =1, X0 =3]	**6**
c	A salesman's territory consists of 3 cities A,B and C. He never sells in the same city on successive days. If he sells in city A, then the next day he sells in B. However, if he sells either in B or C, then the next day he is twice as likely to sell in city A as in the other city. How often does he sell in each of the cities in the steady state?	**6**

Q.no.	**Module 4**	**Marks**
4.a	A fisherman catches fish at a poisson process rate of 2per hour from a large pond with lots of fish. If he starts fishing at 10am, what is the probability that he catches 1 fish by 10.30am and 3 fish by noon (12pm)?	**3**

Answer b or c

b	On the average, a submarine on patrol sights 6 enemy ships per hour. Assuming that the number of ships sighted in a given length of time is a poisson variate, find the probability of sighting i)6 ships in the next half-an-hour ii)4 ships in the next 2h iii)at least 1 ship in the next 15 min iv)at least 2 ships in the next 20 min.	**6**

c	If people arrive at a bookstall with a poisson process with a mean rate of 3 per minute. Find the probability that the interval between two consecutive arrivals is (i) more than 2min (ii) between 2min and 3min (iii) 4min or less	**6**

Q.no.	**Module 5**	**Marks**
5.a	Consider an M/M/1 queueing system with $\lambda = 6$ and $\mu = 8$, find the probability of at least 10 customers in the system.	**4**
	Answer b or c	
b	Customers arrive at a one-man barber shop according to Poisson process with a mean inter arrival time rate of 12min. Customers spend an average of 10min in the barber's chair. (i) What is the expected number of customers in the barber shop and in the queue? (ii) How much time can a customer expect to spend in the barber's shop? (iii) What is the probability that the waiting time in the system is greater than 30min? (iv) Management will provide another chair and hire another barber, when a customer's waiting time in the shop exceeds 1.25hour. How much must the average rate of arrivals increase to warrant a second barber?	**8**
c	A supermarket has two girls attending to sales at the counters. If the service time for each customer is exponential with mean 4min and if people arrive in Poisson fashion at the rate of 10 per hour, (i)What is the probability that a customer has to wait for service? (ii)What is expected percentage of idle time for each girl? (iii)If the customer has to wait in the queue, what is the expected length of his waiting time?	**8**

Q.no.	**Module 6**	**Marks**
6.a	Write down Pollaczek-Khinchine formula.	**4**
	Answer b or c	

b A car manufacturing plant uses one big crane for loading cars into a truck. Cars arrive for loading by the crane according to a Poisson distribution with a mean of 5 cars per hour. Given that the service time for all cars is constant and equal to 6 minutes, determine L_s , L_q , W_s and W_q. **8**

c A one man barber shop takes exactly 25 minutes to complete one hair-cut. If customers arrive at the barber shop in a Poisson fashion at an average rate of one every 40 minutes, how long on the average a customer spends in the shop? Also find the average time a customer must wait for service. **8**