KINGSTON
ENGINEERING COLLEGE

QUESTION BANK

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING & INFORMATION TECHNOLOGY

YEAR/SEM	**: II YEAR- IV SEMESTER (2016-2017 EVEN SEM)**
NAME OF THE SUBJECT	**: CS6402-DESIGN AND ANALYSIS OF ALGORITHMS**
NAME OF THE FACULTY	**: 1. M.AZHAGIRI 2. J.DAPHNEYJOANN 3.S.GOPI**

UNIT I

SYLLABUS

(X) Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types –Fundamentals of the Analysis of Algorithm Efficiency.

(Y) Analysis Framework -Asymptotic Notations and its properties – Mathematical analysis for Recursive and Non-recursive algorithms.

PART-A

I X 1. What is an Algorithm? **May 2013**
I X 2. Give the notion of an algorithm.
I X 3. Design an algorithm for computing gcd(m,n) using Euclid's algorithm. **May 2016**
I X 4. Design an algorithm to compute the area and circumference of a circle. **Dec 2016**
I X 5. Differentiate Sequential and Parallel Algorithms.
I X 6. Write the process for design and analysis of algorithm.
I X 7. What are the fundamentals steps for design and analysis of an algorithm?
I X 8. Compare Exact and Approximation algorithm.
I X 9. What is an Algorithm Design Technique?
I X 10. Define Pseudo code.
I X 11. Define Flowchart.
I X 12. Prove the correctness of an algorithm's.
I X 13. Define algorithm validation. **Dec 2012**
I X 14. What is validation and program verification?
I X 15. Define program proving and program verification. **May 2014**
I X 16. Write the characteristics of an algorithm.
I X 17. What is the Efficiency of algorithm?
I X 18. What is time and space complexity? **May 2010, Dec 2012**
I X 19. What is generality of an algorithm?
I X 20. What is algorithm's Optimality?
I X 21. Write an algorithm to find the number of binary digits in the binary representation of a

positive decimal integer. **May 2015**

I Y 21. What are the types of problems in algorithm? **May 2008**

I Y 22. How will you measure input size of algorithms? **May 2008**

I Y 23. What is the average case complexity of linear search algorithm? **May 2008**

I Y 24. Differentiate searching and sorting algorithm.

I Y 25. What are combinatorial problems?

I Y 26. Define a graph and its type.

I Y 27. Define performance analysis.

I Y 28. What do you mean by Worst case-Efficiency of an algorithm?

I Y 29. What do you mean by Best case-Efficiency of an algorithm?

I Y 30. Define the Average-case efficiency of an algorithm. **May 2014**

I Y 31. What do you mean by Amortized efficiency?

I Y 32. How to analyze an algorithm framework?

I Y 33. How to measure the algorithm's efficiency?

I Y 34. What is called the basic operation of an algorithm?

I Y 35. How to measure an algorithm's running time?

I Y 36. Define time and space complexity.

I Y 37. Write an algorithm for adding 'n' natural numbers and find the time and space required by that algorithm.

I Y 38. Define order of growth.

I Y 39. What is meant by linear search? **May 2012**

I Y 40. Compare the two functions 2^n and n^2 for various values of n. Determine when the second function will become the same, smaller and larger than the first function.

I Y 41. What are the properties of big-Oh notation? **Dec 2011**

I Y 42. Define Big oh notation. **May 2006,2008,2012,2013**

I Y 43. Define little Oh and Omega notations. **May 2013**

I Y 44. Define Ω notation.

I Y 45. Define Θ – notation.

I Y 46. What is the use of Asymptotic Notations?

I Y 47. What are the properties of asymptotic notations?

I Y 48. Mention the general plan for analyzing time efficiency of Non recursive algorithms.

I Y 49. Define recursive and non – recursive algorithm.

I Y 50. What is recurrence equation? **May 2010**

I Y 51. Define Recurrence relation with an example. **Dec 2016**

I Y 52. Give the time complexity 1+3+5+7+….+999.

I Y 53. Compare order of growth n(n-1)/2 and n^2 . **May 2016**

I Y 54. Find the order of growth of the following sums.

$$\sum_{i=1}^{n-1} (i^2 + 1)^2$$

I Y 55. Solve the following recurrence relations.

$X(n)=x(n-1) + 5$ for $n>1$, $x(1) = 0$

I Y 56. Consider the following algorithm

S=0

for =1 to n do

S=S+i

return i

I Y 57. What does this algorithm compute? How many times is the basic operation executed?

I Y 58. Design an algorithm to compute the area and Circumference of a circle.

I Y 59. The (log n)th smallest number of n unsorted numbers can be determined in O(n) average-case time. **Dec 2015**

I Y 60. Write the recursive Fibonacci algorithm and its recurrence relation. **Dec 2015**

PART-B

I X 1. Describe the steps in analyzing & coding an algorithm.

I X 2. Enumerate the problem types used in the design of algorithm.

I X 3. What are the steps that need to be followed while designing and analyzing algorithm? **May 2014**

I X 4. Explain the fundamental of algorithmic problem solving.

I X 5. Use the most appropriate notation to indicate the time efficiency class of sequential algorithm in the worst case, best case and the average case. **Dec 2016**

I X 6. Consider the following algorithm for the searching problem.

Algorithm:

```
Linear search (A[0,...n-1],key)
//Searches an array for a key value by linear search
//Input: Array A[0..n-1] of values and a key value to search
//Output: Returns index if search is successful
for i<-0 to n-1 do
  if(key==A[i])
  return i
```

I X 7. Explain some of the problem types used in the design of algorithm.

I X 8. Define time complexity and space complexity. Write an algorithm for adding ‘n’ natural numbers and find the time and space required by that algorithm.

I Y 8. Explain the general framework for analyzing the efficiency of algorithm.

I Y 9. Write the Insertion Sort algorithm and estimate its running time. **Dec 2015**

I Y 10. What is space complexity? With an example, explain the components of fixed and Variable part in space complexity? **May 2014**

I Y 11. Show how to implement a stack using two queues. Analyze the running time of stack operations. **Dec 2015**

I.Y.12. Discuss the properties of asymptotic notations.

I.Y.13. Explain the various asymptotic notations used in algorithm design. With an Example **May 2010,11,12,13, Dec 2010**

I.Y.14. Give the definition and graphical representation of O notations. **May 2016**

I.Y.15. Define asymptotic notations. Distinguish between Asymptotic notation and conditional asymptotic notation. **Dec 2011, May 2012**

I.Y.16. Prove that for any two functions f(n) and g(n), we have
f(n) = θ (g(n)) if and only if f(n) = O (g(n)) and f(n) = Ω(g(n)). **Dec 2010**

I.Y.17. Write the linear search algorithm and analyze for its best worst and average case time complexity. **Dec 2010,11,13, May 2011,12**

I.Y.18. Discuss about recursive and non-recursive algorithms with example.

I.Y.19. What is the general plan for time efficiency of recursive algorithm and find the number of binary digits in the binary representation of positive decimal integer find recurrence relation and complexity. **May 2016**

I.Y.20. State the general plan for analysing the time efficiency of non recursive algorithms and explain with an example. **Dec 2016**

I.Y.21. Compare the order of the growth of the following.

i)(1/2) n(n-1) and n^2

ii)$\log_2 n$ and $\sqrt{n}$

iii)n! and 2^n

I.Y.22. Find the closest asymptotic tight bound by solving the recurrence equation
T(n)=8T(n/2)+n2 with (T(1)=1) using Recursion tree method.
[Assume that T(1) € θ (1)] **Dec 2015**

I.Y.23. Give an algorithm to check whether all the elements in a given array of n-elements are distinct, find the worst case complexity of the same. **May 2016**

I.Y.24. Explain the towers of Hanoi problem and solve it using recursion **Dec 13, May 2014**

I.Y.25. Prove the time complexity of the matrix multiplication is $O(n^3)$

I.Y.26. Define recurrence equation and explain how solving recurrence equations are done. **Dec 2011**

I.Y.27. Solve the following recurrence relations. **Dec 2016**

x(n)=x(n-1)+5 for n>1, x(1)=0

x(n)=3x(n-1)for n>1, x(1)=4

x(n)=x(n-1)+n for n>0, x(0)=0

x(n)=x(n/2)+n for n>1, x(1)=1 (solve for $n=2^k$)

x(n)=x(n/3)+1 for n>1, x(1)=1 (solve for $n=3^k$)

I.Y.28. Solve the following recurrence relations.

i)x(n)=x(n-1)+n for n>0,x(0)=0

ii)x(n)=x(n/2)+n for n>1, x(1)=1 (solve for $n=2^k$)

iii)x(n)=3x(n-1) for n>1,x(1)=4

I.Y.29. Suppose W satisfies the following recurrence equation and base case

(where c is constant) : W(n)=c.n+W(n/2) and W(1)=1. What is the asymptotic order of W(n). **Dec 2105**

I.Y.30. With a suitable example, explain the method of solving recurrence equations.

May 2012

I.Y.31. Consider the following recursion algorithm Min1(A[0 -------n-1])

If n=1 return A[0]

Else temp = Min1(A[0…….n-2]) If temp <= A[n-1] return temp

Else

Return A[n-1]

What does this algorithm compute?

I.Y.32. Consider the following algorithm.

```
Algorithm :
 Sum(n)
   // A non negative integer n
   S <- 0
   for i <- 1 to n do
      S<-S+i
   Return S
```

a. What does this algorithm compute?
b. What is its basic operation?
c. How many times is the basic operation executed?
d. What is the efficiency class of this algorithm?
e. Suggest an improved algorithm and indicate its efficiency class. If you cannot do it, try to prove that it cannot be done.

I.Y.33. Setup a recurrence relation for the algorithms basic operation count and solve it.

I.Y.34. Derive the recurrence relation for Fibonacci series algorithm; also carry out the time complexity analysis. **May 2014**

I.Y.35. Give the non recursive algorithm for finding the value of the largest element in a list of n numbers.

UNIT II

SYLLABUS

(X)* Brute Force - Closest-Pair and Convex-Hull Problems-Exhaustive Search - Traveling Salesman Problem - Knapsack Problem - Assignment problem

(Y)* Divide and conquer methodology – Merge sort – Quick sort – Binary search – Multiplication of Large Integers – Strassen's Matrix Multiplication-Closest-Pair and Convex-Hull Problems.

PART-A

II X 1. Define Brute force strategy.

II X 2. Define closest pair problem. **May 2016**

II X 3. Write an algorithm for Brute force closest pair problem. **Dec 2016**

II X 4. Mention the time complexity of closest pair problem using brute force strategy.

II X 5. Define convex hull problem.

II X 6. What is meant by extreme point? **May 2016**

II X 7. Determine the sets which are convex.
a.Star b.Cone c. Pentagon d. Semi Circle e. Arc.

II X 8. What is the time complexity of the algorithm which can solve the convex-hull problem using the brute force method?

II X 9. Give the mathematical notation to determine if a convex direction is towards left or right and write the algorithm. **Dec 2015**

II X 10. Design a brute –force algorithm for computing the value of a polynomial $p(x) = a_n x_n + a_{n-1}x_{n-1} +.....+ a_1x.....a_0$ at a given point x_0 and determine its worst case efficiency class. **May 2015**

II X 11. What is meant by exhaustive search?

II X 12. Mention the constraint of Knapsack problem using exhaustive search method.

II X 13. Define Hamiltonian circuit.

II X 14. What is assignment problem?

II X 15. Give an example for exhaustive search algorithm.

II X 16. Define assignment problem with example.

II Y 15. Define divide and conquer strategy. **May 2016**

II Y 16. What is Hungarian method?

II Y 17. How the large integers are multiplies using divide and conquer technique?

II Y 18. Give the recurrence relation for divide and conquer.

II Y 19. Define Master Theorem.

II Y 20. Find the order of growth for the following recurrence.
T (n) =4T(n/2)+n2, T(1)=1

II Y 21. Give the examples for divide and conquer method.

II Y 22. Write the control abstraction for divide and conquer technique.

II Y 23. What are the best case, worst case and average case complexity of Quick sort?

II Y 24. Solve the average case recurrence for quick sort.

II Y 25. How to search an element using binary search?

II Y 26. What are the merits of binary search?

II Y 27. What are the merits of divide and conquer technique?

II Y 28. What are the demerits of binary search?

II Y 29. Trace the operation of the binary search algorithm for the input –15, –6, 0, 7, 9, 23, 54, 82, 101, 112, 125, 131, 142, 151, if you are searching for the element 9. **Dec 2010**

II Y 30. What is the time complexity of binary search? **May 2012**

II Y 31. What is average case efficiency and worst case complexity of binary search? **May 16**

II Y 32. Derive the complexity of Binary Search algorithm. **May 2015**

II Y 33. What are the best case, worst case and average case complexity of binary Search?

II Y 34. Prove the equality $_a\log_b c = {}_c\log_b a$.

II Y 35. Solve the average case recurrence for quick sort.

II Y 36. How the operations performed in Strassen's Matrix multiplication?

II Y 37. Compute 2101*1130 by applying the divide and conquer algorithm.

II Y 38. What is the time complexity of closest pair and quick hull problem?

PART-B

II.X.1 Explain the Closest-Pair and Convex-Hull Problems by Brute Force. **May 2015**

II.X.2 Write an efficient and exhaustive search algorithm for the travelling salesmen problem. With an example and find its optimal solution. **May 2016**

II.X.3 Find the optimal solution using exhaustive search method for the assignment problem given below. **Dec 2016**

		JOBS			
		J_1	J_2	J_3	J_4
PERSONS	a	9	2	7	8
	b	6	4	3	7
	C	5	8	1	8
	d	7	6	9	4

II.X.4 Explain how to solve Knapsack problem using Brute Force approach.

II.X.5 Find the optimal solution to the fractional knapsack problem with given data **Dec 2015**

ITEM	WEIGHT	BENIFIT
A	2	60
B	3	75
C	4	90

II.Y.6 Explain divide and conquer Technique with an example **Dec 2009**

II.Y.7 What do you mean by divide and conquer strategy? Explain with an example **Dec 2011**

II.Y.8 Explain the merge sort algorithm with example and give recurrence relation and Efficiency **Dec 2011,12,13 May 2008,2016**

II.Y.9 Distinguish between Quick sort and Merge sort, and arrange the following numbers in Increasing order using merge sort. (18, 29, 68, 32, 43,37, 87, 24, 47, 50) **Dec 2011,May 2013**

II.Y.10 Sort the following elements using Merge Sort 12,24,8,71,4,23,6,89,56 **May 2014**

II.Y.11 Trace the steps of Merge sort algorithm for the elements 122,25,70,175,89,90,95,102,123 and compute its time complexity. **Dec 2012**

II.Y.12 Explain about Quick sort algorithm. With an example show that Quick sort is not a stable sorting algorithm **May 2008,2010** ,**Dec 2016**

II.Y.13 Compare the stabilities and time complexities of quick sort and merge sort algorithms.

II.Y.14 Write an algorithm to perform binary search on a sorted list of elements. Analyze the algorithm for the best case, worst case and average case. **May 2011, Dec 2012**

II.Y.15 What is divide and conquer strategy and explain binary search with suitable example.

II.Y.16 Write the algorithm to perform binary search and compute its run time complexity. **Dec 2015**

II.Y.17 Write an algorithm for performing matrix Multiplication using the Strassen's Matrix Multiplication **Dec 2015**

$$A=\begin{matrix}1&0&2&1\\4&1&1&0\\0&1&3&0\\5&0&2&1\end{matrix} \qquad B=\begin{matrix}0&1&0&1\\2&1&0&4\\2&0&1&1\\1&3&5&0\end{matrix}$$

II.Y.18 Write short notes on the following Multiplication of largest integer, how divide and conquer method can be used to solve. **May 2016**

II.Y.19 Write a pseudo code and best-case efficiency of quick hull?

II.Y.20 Explain in detail about Closest pair and convex hull problems using divide and conquer **May-11,12,13 Dec 10,12,13**

II.Y.21 Explain the upper and lower hulls in the convex-hull problem, with an example.

II.Y.22 Write down the algorithm to construct convex hull based divide and conquer strategy **Dec 2015**

UNIT III

SYLLABUS

(X) Computing a Binomial Coefficient – Warshall's and Floyd' algorithm – Optimal Binary Search Trees –Knapsack Problem and Memory functions.

(Y) Greedy Technique– Prim's algorithm- Kruskal's Algorithm- Dijkstra's Algorithm-Huffman Trees.

PART-A

III X 1. Define dynamic programming.
III X 2. Differentiate greedy method and dynamic programming. **Dec 2010, May 2011**
III X 3. Differentiate divide and conquer and dynamic programming. **Dec 2010**
III X 4. State how Binomial Coefficient is computed. **Dec 2015**
III X 5. Write down the optimization technique used for Warshall's algorithm. State the rules and assumptions which are implied behind that. M**ay 2010**
III X 6. What is meant by single source shortest path problem? **May 2016**
III X 7. Define Floyd's algorithm.
III X 8. Explain principle of optimality. **Dec 2010, 2013,2016**
III X 9. Write an algorithm to find the shortest path between all pairs of nodes. **May 2011**
III X 10. Define optimal binary search tree. **May 2010**
III X 11. Give the running time of the optimal BST algorithm.
III X 12. What is the formula used for cost of binary search tree?
III X 13. Write the running time of 0/1 knapsack problem.
III X 14. Write recurrence relation for 0/1 knapsack problem.
III X 15. List out memory functions used under dynamic programming. **May 2015**
III Y 16. Define greedy algorithm.
III Y 17. Mention the drawback of greedy algorithm. **May 2012**
III Y 18. Compare Dijkstra's and Prim's Algorithm.
III Y 19. How to calculate the efficiency of Dijkstra's Algorithm . **Dec 2016**
III Y 20. What is the running time of Prims algorithm?
III Y 21. What is single-source shortest-paths problem?
III Y 22. Define Kruskal algorithm.
III Y 23. What is the running time of Kruskal's Algorithm?
III Y 24. Define Huffman tree and Huffman code.
III Y 25. Compare fixed length encoding and variable length encoding.

PART-B

III X 1. Write an algorithm for binomial coefficient computation and analyze the efficiency of algorithm.
III X 2. Analyse Warshall's Algorithm with algorithm.
III X 3. Explain all pair shortest path problem with Floyd's algorithm in detail with example.

May 2010, 2012, 2013, 2014

III X 4. Solve the all pairs shortest path problem for the diagraph with the weight matrix given below. **May 2014, Dec 2016**

	a	b	c	d
a	0	∞	∞	3
b	2	0	∞	∞
c	∞	7	0	1
d	6	∞	∞	0

III X 5. Explain in detail about Optimal Binary Search Trees with an Example and analyze its Efficiency **May 2008,11, Dec 2013**

III X 6. Describe binary search tree with three traversal patterns? Give suitable example with neat diagram for all three traversal of binary search. **Dec 2011**

III X 7. Obtain a Optimal Search Trees for following nodes with following probabilities (0.1, 0.2, 0.4, 0.3)

III X 8. Using function OBST to compute w(I,j),r(I,j) and c(I,j) ,0<=i<j<=4, for the identifier set (a1,a2,a3,a4)=(cout,float,if,while) with p(1)=1/20, p(2)=1/5, p(3)=1/10, p(4)=1/20, q(0)=1/5, q(1)=1/10, q(2)=1/5,q(3)=1/20 and (4)=1/20.Using the r(i,j) construct optimal binary search tree. **May 2011, Dec 2013**

III X 9. Describe Knapsack problem and Memory functions with example

III X 10. Using dynamic programming , solve the following knapsack instance: N=3; $[\omega_1, \omega_2, \omega_3]$ = [1,2,2] and $[P_1,P_2,P_3]$=[18,16,6] and M=4

III X 11. Find the solution for the knapsack problem with the following instances Weights ={2,1,3,2}, Profits = {12,10,20,15} and capacity =5.

III X 12. Find an optimal solution to the knapsack instance n=7, m=15, (p1,p2,p3….p7) = (10,5,15,7,6,18,3) and (w1,w2,w3….,w7)=(2,3,5,7,1,4,1). D**ec 2011, May 2013**

III X 13. Apply the bottom up dynamic programming algorithm to the following instance of Knapsack Problem

Item	**Weight**	**Value**	
1	7	$42	
2	3	$12	
3	4	$40	
4	5	$25	Capacity W=10

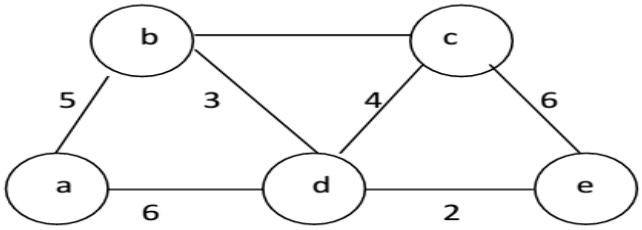
III X 14. Write the algorithm to compute the 0/1 knapsack problem and Solve the following instance of the 0/1, knapsack problem given the knapsack capacity is W = 5, **Dec 2010**

Items	**Weight**	**Value**
1	2	12
2	1	10
3	3	20
4	2	15

III Y 15. Define Spanning tree. Discuss design steps in Prim's algorithm to construct minimum spanning tree with an example. **May 2016**

III Y 16. Explain Kruskal's algorithm for constructing minimum cost spanning tree. **Dec 2013**

III Y 17. Write the kruskal's algorithms apply it to find a minimum spanning tree for the following graph. **May 2011, Dec 2016**



III Y 18. Explain Dijikstra algorithm. With situable examples

III Y 19. Write the procedure to compute Huffman Code. **Dec 2015**

III Y 20. Write the Huffman's Algorithm. Construct the Huffman's tree for the following Data and obtain its Huffman's Code

Character	A	B	C	D	E	-
probability	0.5	0.35	0.5	0.1	0.4	0.2

III Y 21. The binary string below is the title of a song encoded using Huffman codes.

00110001011111011001110111011000001001110100101 01.

Given the letter frequencies listed in the table below, build Huffman codes and use them to decode the title. In cases where there are multiple "greedy" choices, the codes are assembled by combining the first letters (or groups of letters) from left to right, in the order given in the table. Also, the codes are assigned by labelling the left and right branches of the prefix/code tree with '0' and '1', respectively. **Nov/Dec 2015**

Letter	a	h	v	w	''	e	t	l	o
Frequency	1	1	1	1	2	2	2	3	3

III Y 22. Let A={l/119, m/96, c/247, g/283, h/72, f/77, k/92, j/19} be the letters and its frequency of distribution in a text file. Compute a suitable Huffman coding to compress the data effectively. **Apr/May 15**

UNIT IV

SYLLABUS

(X)* The Simplex Method-The Maximum-Flow Problem

(Y)* Maximum Matching in Bipartite Graphs- The Stable marriage Problem.

PART-A

IV X 1. Define the iterative improvement technique? **Dec 2016**

IV X 2. Define simplex method.

IV X 3. Differentiate optimal and feasible solution.

IV X 4. Define the following.

a) Pivot element b) entering Variable c) Departing Variable

IV X 5. Mention the advantages of Simplex Method.

IV X 6. What are the steps to convert GLPP to SLPP?

IV X 7. Solve the linear programming problem geometrically

Maximize 3x+y

Subject to

-x + y<= 1

2x + y < =4

X >= 0 y > =0

IV X 8. Determine the Dual linear program for the following LP, **Dec 2015**

Maximize 3a + 2b+c

Subject to,

2a + b + c <=3

a +b + c <=4

3a +3b +6c <=6 a, b, c>=0

IV X 9. Define Network Flow and Cut. Nov/Dec 2015

IV X 10. What is transportation network? Mention its Properties.

IV X 11. Define flow network.

IV X 12. Write the requirement of flow conservation.

IV X 13. Compare value of the flow and feasible flow.

IV X 14. Define Maximum flow Problem.

IV X 15. What is flow augmenting?

IV X 16. Define Maximum flow time complexity.

IV X 17. What is maximum cardinality match? **Dec 2016**

IV X 18. Explain Ford Fulkerson method.

IV X 19. Differentiate Forward and Backward edge.

IV Y 18. Define the following.

a) Capacity b) Cut c) Max flow min cut theorem.

IV Y 19. Define Flow Cut. **May 2015**

IV Y 20. How will you find minimum cut?

IV Y 21. What is maximum matching?

IV Y 22. Define Matching.

IV Y 23. Define a bipartite graph.

IV Y 24. What do you mean by perfect match in bipartite graph? **May 2015**

IV Y 25. How will you check the stability?

IV Y 26. What is stable marriage problem?

IV Y 27. Define the term stable pair

PART-B

IV X 1. What are the steps involved in iterative improvement method?

IV X 2. Write short notes on simplex method. **May 2016, Dec 2016**

IV X 3. Write the procedure to initialize simplex which determines if a linear program is feasible or not **Dec 2015**

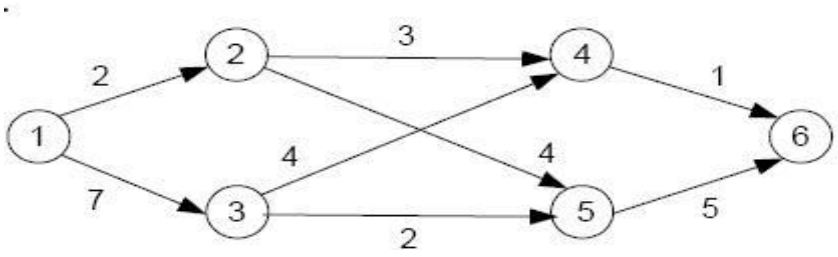
IV X 4. Trace the simplex method on the following problems

Maximize = 2x-3y=4z
Subject to 4x-3y+z<=3
x+y+z <=10
2x+y- z<=10
Where x, y and z are non negative

IV X 5. Write short notes on maximum flow problem and maximum flow algorithm. **May 2016**

IV X 6. Explain briefly on Fold-Fulkerson algorithm

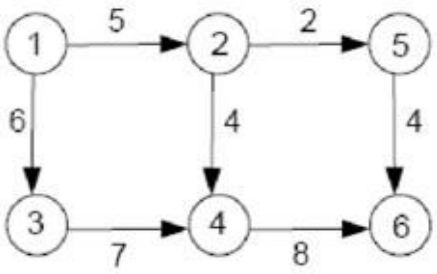
IV X 7. Illustrate pictorially the Ford –Fulkerson method by showing the flow augmenting paths in bold for the given flow network **May 2016**

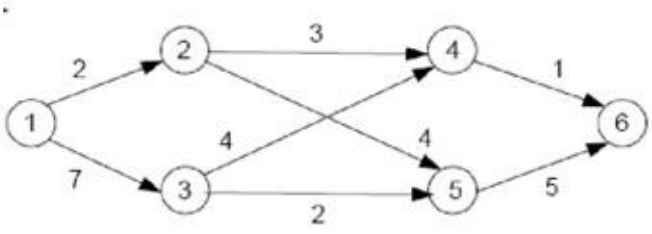


IV X 8. Prove the maximum flow and minimum cut theorem. **Dec 2016**

IV X 9. Explain the maximum flow problem algorithm and prove the max Flow min cut theorem **Dec 2015**

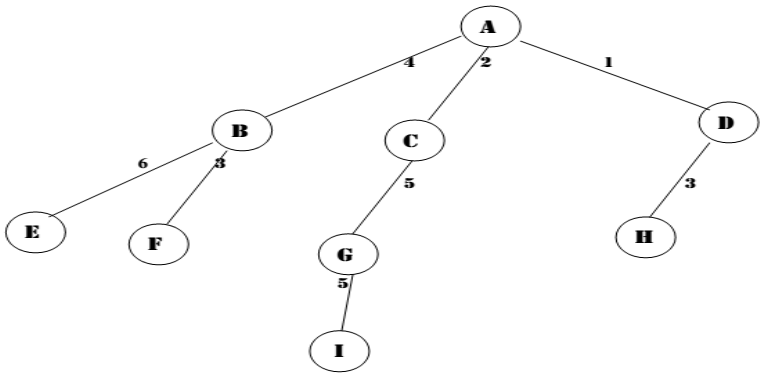
IV X 10. Apply the shortest augmenting path algorithm to find a maximum flow and Minimum cut in the following network



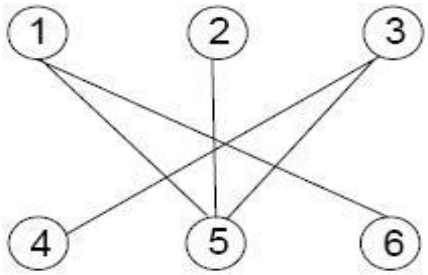


IV Y 11. Explain the maximum matching bipartite graph algorithm with supporting example.

IV Y 12. Illustrate the working of the maximum matching algorithm on the following weighted tree **Dec 2015**



IV Y 13. Apply the maximum matching algorithm to the following bipartite graphs



IV Y 14. Explain briefly on minimum weight perfect matching algorithm.

IV Y 15. Explain briefly on stable marriage problem. **May 2015**

IV Y 16. Explain the algorithm for stable marriage problem and prove the theorem with An example and determine its time efficiency **Dec 2016**

IV Y 17. Explain the following algorithm:

I. Blocking pair II. Stable marriage problem

III. Man optimal IV. Women optimal

IV Y 18. Consider an instance of the stable marriage problem given by the ranking matrix

	A	B	C
α	1,3	2,2	3, 1
β	3,1	1,3	2, 2
γ	2,2	3,1	1, 3

For each of its marriage matching's, indicate whether it is stable or not

UNIT V

SYLLABUS

(X) Limitations of Algorithm Power-Lower-Bound Arguments-Decision Trees-P, NP and NP-Complete Problems--Coping with the Limitations - Backtracking – n-Queens problem – Hamiltonian Circuit Problem – Subset Sum Problem.

(Y) Branch and Bound – Assignment problem – Knapsack Problem – Travelling Salesman Problem- Approximation Algorithms for NP Hard Problems – Travelling Salesman problem – Knapsack problem.

PART-A

V X 1. Define NP hard and NP completeness. **Dec 2010**

V X 2. Compare NP hard and NP completeness. **May 2014**

V X 3. Define the class P and NP problem.

V X 4. How NP Hard problems are different from NP Complete. **May 2015**

V X 5. Whether class P solves a problem in polynomial time? Justify.

V X 6. An NP hard problem can be solved in deterministic polynomial time, how **? May 2013**

V X 7. Give examples for NP Complete problems

V X 8. State the property of NP complete problem. **Dec 2012,2013**

V X 9. Define adversary method.

V X 10. Compare polynomial and non deterministic polynomial and give two examples for each

V X 11. Define decision tree with example.

V X 12. Write the formula for decision tree for searching a sorted array. **Dec 2016**

V X 13. What is a state space tree? **May 2016**

V X 14. What is a promising node in the state-space tree?

V X 15. What is a non-promising node in the state-space tree?

V X 16. What do leaves in the state space tree represent?

V X 17. What is backtracking? **Dec 2010**

V X 18. What is the manner in which the state-space tree for a backtracking algorithm is constructed?

V X 19. How can the output of a backtracking algorithm be thought of?

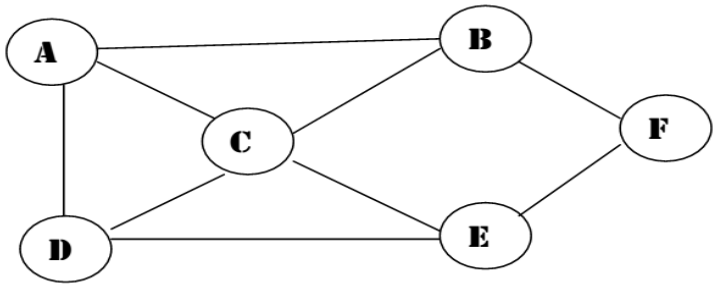
V X 20. Give a template for a generic backtracking algorithm.

V X 21. What is n-queens problem?

V X 22. What is the method used to find the solution in n-queen problem by symmetry?

V X 23. Define the Hamiltonian circuit. **May 2013,2015, Dec 2013**

V X 24. Draw the Hamiltonian circuit for the given graph.



V X 25. What is the subset-sum problem? **May 2013**

V X 26. When can a node be terminated in the subset-sum problem?

V X 27. What are the tricks used to reduce the size of the state-space tree?

V Y 28. List the lower bounds for sorting, searching and multiplication.

V Y 29. Define adversary method.

V Y 30. What is information theoretic lower bound?

V Y 31. Define local search heuristics

V Y 32. What is meant by tractable and intractable problem?

V Y 33. Compare backtracking and branch-and-bound.

V Y 34. When can a search path be terminated in a branch-and-bound algorithm?

V Y 35. What are the additional features required in branch-and-bound when compared to backtracking?

V Y 36. What is the assignment problem? **May 2016**

V Y 37. What is best-first branch-and-bound?

V Y 38. What is knapsack problem?

V Y 39. Give the formula used to find the upper bound for knapsack problem.

V Y 40. What is the travelling salesman problem?

V Y 41. What are the strengths of backtracking and branch-and-bound?

V Y 42. Define lower bound. **May 2016**

V Y 43. What type of output yields trivial lower bound?

V Y 44. What is information theoretic lower bound?

V Y 45. Define complexity theory.

V Y 46. What is halting problem?

V Y 47. What is CNFs satisfiablity problem?

V Y 48. State the reason for terminating search path at the current node in branch bound algorithm. **Dec 2016**

V Y 49. Define branch and bound problem and its methods. **Dec 2013**

V Y 50. Write nearest neighbor algorithm.

V Y 51. Define Multifragment-heuristic algorithm.

V Y 52. Define minimum spanning tree based algorithms.

PART-B

V X 1. Explain in detail about lower bound arguments.

V X 2. Draw the Decision Tree and Find the number of Key Comparison in the worst and average case for:

i. The four Element Binary search

ii. The Three-element basic insertion sort.

iii. Three Element Bubble Sort **Dec 2016**

V X 3. Write a note on deterministic and non deterministic algorithms. **Dec 2013**

V X 4. Compare polynomial and non deterministic polynomial and give two examples for each.

V X 5. Define the class P and NP problem.

V X 6. Write short notes on NP hard and NP completeness. **May 2011**

V X 7. State the relationships among the complexity class algorithms with the help of neat diagrams. **Dec 2015.**

V X 8. Explain in detail about recursive backtracking algorithm? **Dec 11, May 2013**

V X 9. Write down and explain the procedure for tackling the 8 – queen's problem using a backtracking approach. **Dec 2010,11 May 2013**

V X 10. Draw and explain the dynamic space tree for 4 queen problems. **Dec 2016**

V X 11. Write backtracking algorithm for

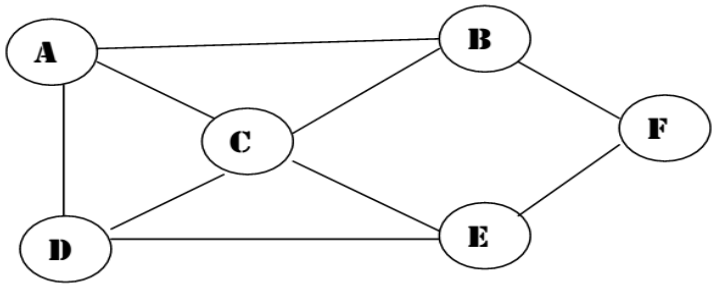
a. The n-queens problem

b. Hamiltonian problem **Dec 2011**

V X 12. Show that Hamiltonian path problems reduces to the Hamiltonian circuit problem and vice versa **Dec 2015**

V X 13. Write an algorithm to determine Hamiltonian cycle in a given graph using back tracking. For the following graph determine the Hamiltonian cycle.

May 2009,14 Dec 2008,10,11



V X 14. There are 5 distinct numbers {1,2,5,6,8}. Find the combination of these numbers such that the sum is 9.Use back tracking model . **May 2008**

V X 15. Write an algorithm to determine the sum of sub sets for a given sum and set of numbers

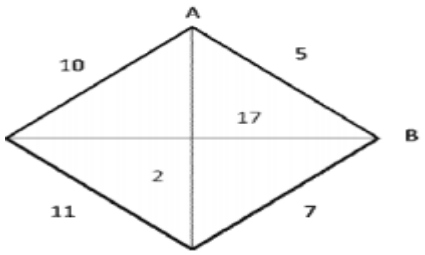
Draw the tree representation to solve the sub set sum problem given the number set as { 3,5,6,7,2} with sum=15. Derive all sub sets. **Dec 2010**

V X 16. Let m=15 and W ={ 3,5,6,7} Draw a portion of state space tree for solving sum of subset problem for the given algorithm. **May 2016**

V X 17. Let w={5,7,10,12,15,18,20} and m=35. Find all possible sub set of whose sum is equivalent to m. draw the portion of state space tree for this problem. **Dec 2012**

I Y 18. Explain the Assignment problem in Branch and bound with Example.

I Y 19. Apply the branch and bound algorithm to solve the traveling salesman Problem for the following graph



V Y 20. Solve the following instance of Knapsack problem by Branch and bound Algorithm WITH W=15 . **Dec 2016**

ITEM	WEIGHT	PROFIT
1	5	$40
2	7	$35
3	2	$18
4	4	$04
5	5	$10
6	1	$02

V Y 21. With an example, explain how the branch and bound technique is used to solve 0/1 Knapsack problem. May 2010

V Y 22. Solve the following 6 city traveling sales person problem using the branch and bound algorithm. **Dec 2013**

α	21	42	31	6	24
11	α	17	7	35	18
25	5	α	27	14	9
12	9	24	α	30	12
14	7	21	15	α	48
39	15	16	5	20	α

V Y 23. Explain Approximation Algorithms for the Traveling Salesman Problem

V Y 24. Write short notes on the following using approximation Algorithm

i) Nearest –neighbor algorithm with example

ii)Multi fragment heuristic algorithm with example

V Y 25. i)Describe in detail about Twice around the tree algorithm with example

ii) Explain local search heuristic with example

V Y 26. Suggest an approximation algorithm for TSP. Assume that the cost function satisfies the triangle inequality. **May 2015**

V Y 27. Explain the knapsack problem using approximation algorithm with example **Dec 2015**

V Y 28. Give five un decidable problems and explain famous halting problem in detail? **May 16**

V Y 29. Solve knapsack problem for following problem instances

ITEM	WEIGHT	VALUE
1	7	$49
2	3	$12
3	4	$42
4	5	$30

The capacity of Knapsack is W=10

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