INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING

TUTORIAL QUESTION BANK

Course Title	DISCRETE MATHEMATICAL STRUCTURES			
Course Code	AHS013			
Regulation	R16			
Course Structure	Lectures	utorials	Practicals	Credits
	3	1	-	4
Course Coordinator	Dr. N. Rajasekhar, Professor, CSE			
Course Faculty	Dr. J. Sirisha Devi, Professor, CSE			
	Mr. P.V.NarasimhaRao, Assistant Professor, CSE			
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	Ms. B. Dhanalaxmi, Assistant Professor, IT			

COURSE OBJECTIVES:
The course should enable the students to:

I	Describe the logical and mathematical foundations, and study abstract models of computation.
II	Illustrate the limitations of predicate logic.
III	Define modern algebra for constructing and writing mathematical proofs
IV	Solve the practical examples of sets, functions, relations and recurrence relations
V	Recognize the patterns that arise in graph problems and use this knowledge for constructing the trees and spanning trees.

COURSE OUTCOMES:
Students, who complete the course, will have demonstrated the ability to do the following:

SI. No.	Description
CAHS013.01	Understand logical connectives and compound prepositions for building compound statements.
CAHS013.02	Learn the formal symbols and use the preposition logic and predicate logic to solve problems on logical equivalences and implications.
CAHS013.03	Memorize different scientific notations to simplify the logical statements.
CAHS013.04	Prepare valid arguments from the given propositional statements by using rules of inference.
CAHS013.05	Identify ordered pairs to form a binary relation from the given sets.
CAHS013.06	Construct directed graph and a matrix representation using a binary relation on finite order pairs.
CAHS013.07	Identify the properties of relations to check for equivalence relation and partial order relation and compute relations using operations on relations.
CAHS013.08	Construct a hasse diagram to recognize the relevant partial ordered sets from the given binary relation.
CAHS013.09	Describe the types of functions (one to one, on-to, bijective, Identity and constant function).

CAHS013.10	Implement the concept of the inverse and recursive functions to get an optimized solution for an appropriate problem.
CAHS013.11	Use the concept of lattices (Greatest Lower Bound (GLB) and Least Upper Bound (LUB) to represent a defined finite set in multi-dimension applications.
CAHS013.12	Explain about the properties and types of lattices (bounded and distributive lattice).
CAHS013.13	Construct different algebraic structures by using concepts of groups, sub groups, monoids and rings.
CAHS013.14	Understand binomial and multinomial theorems to compute the coefficients for the given expansions.
CAHS013.15	Understand the concept of homomorphism and isomorphism of semi-groups.
CAHS013.16	Analyze the given sets by using inclusion and exclusion principle.
CAHS013.17	Identify the different counting techniques (permutations) related to mathematics and computer science.
CAHS013.18	Solve discrete probability and set problems by using permutations and combinatorics.
CAHS013.19	Identify the series of expansion to represent the sequence by using generating functions
CAHS013.20	Identify the general solution for first-order and second-order linear homogeneous recurrence relations.
CAHS013.21	Identify the roots of second and higher order linear non-homogeneous recurrence relations.
CAHS013.22	Understand the use of graphs and trees as representation tools in a variety of context.
CAHS013.23	Identify Euler's and Hamilton rule for a simple connected graph inNP-complete problems.
CAHS013.24	Construct a spanning tree by using search techniques (Depth First Search and Breadth First Search).
CAHS013.25	Construct a minimal spanning tree by using Kruskal's and Prim's algorithm in order to obtain a solution for a real time problem.
CAHS013.26	Possess the knowledge and skills for employability and to succeed in national and international level competitive exams.

UNIT - I		
Mathematical Logic and Predicates		
PART - A (Short Answer Questions)		
S. No	**Question**	**Blooms Taxonomy Level**	**Course Learning Outcome**
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1	Define statement and atomic statement?	Understand	CAHS013.01
2	Describelogical equivalence with an example?	Understand	CAHS013.02
3	DefineTautology?	Understand	CAHS013.01
4	Identifythe converse, inverse and contra positive for the following propositions: $P \rightarrow (Q \rightarrow R)$	Remember	CAHS013.03
5	IllustrateNAND and NOR with examples?	Understand	CAHS013.01
6	Differentiate conditional and biconditional statements?	Understand	CAHS013.01
7	Define contradiction?	Understand	CAHS013.01
8	State the definition for contradiction and provide a proof by contradiction of the following statement: For every integer 'n', if n^2 is odd then 'n' is odd.	Understand	CAHS013.03
9	Write short notes onconverse, contra-positive and inverse of implication?	Understand	CAHS013.03

10	Translate the following statements in to symbolic form:
	    a) all men are good
	    b) no men are good
		Understand	CAHS013.02

11	Identify the disjunctive normal form of the formula: P↔Q?	Understand	CAHS013.02
12	Paraphrase the value of: P↔Q in terms of {∼, V} only?	Understand	CAHS013.03
13	Definefree and bound variables?	Remember	CAHS013.01
14	Discuss about the statement "if 'm' is an even integer then m+7 is an odd integer" by indirect proof?	Understand	CAHS013.03
15	Statethe truth table for conjunction and conditional statements?	Remember	CAHS013.02
16	Describethe truth table for p→(q→r)?	Understand	CAHS013.02
17	Identify whether p∨[∼(p∧q)] is a tautology or not?	Understand	CAHS013.02
18	R: Mark is rich. H:Mark is happy Translatethe statements into symbolic form a) mark is poor but happy b)mark is poor but not happy	Understand	CAHS013.02
19	Translatethe following statement into symbolic form: "the crop will be destroyed if there is a flood".	Understand	CAHS013.02
20	Identify whether (p∨q)∨∼p is a tautology or not?	Understand	CAHS013.02
21	State the converse for the statement "If a quadrilateral is a parallelogram, then its diagonals bisect each other".	Remember	CAHS013.03
22	State the inverse for the statement "If a triangle is not isosceles, then it is not equilateral".	Remember	CAHS013.03
<center>PART-B (Long Answer Questions)</center>			
1	a) Writeconditional proposition and logical equivalence with suitable examples.	Remember	CAHS013.01

2	a) Explain the term tautology? Show that
	   $[(p→q)→r]→[(p→q)→(p→r)]$ is tautology ?
	b) Define the converse, inverse and contra positive of the following
	   propositions:
	   i. $P → (Q → R)$
	   ii. $(P ∧ (P → Q)) → Q.$
		Remember	CAHS013.01

3	Solvethat S V R is a tautologically implied by $(p ∨ q)∧ (p→ r) ∧ (q→ s)$ With reference to automatic theorem proving.	Remember	CAHS013.04
4	Show that RVS is valid conclusion from the premises: C∨D,(C∨D)→∼H),∼H→(A∧∼B),(A∧∼B)→R∨S	Remember	CAHS013.04

5	a)Prove that
	  i) ∼ (P↑Q)↔ ∼P↓∼ Q
	  ii) ∼ (P↓Q)↔ ∼P↑∼ Q
	Without using truth table?
	b)Express p→(∼ p→q)
	 i)in terms of '↑' only
	 ii)in terms of '↓'only ?
		Remember	CAHS013.04

6	(a) Describe the proposition (p ∧ q) ∼ (p ∨ q) is a contradiction.
	(b) Symbolize the following statements:
	   i. all men are good
	  ii. no men are good
	  iii. some men are good
	  iv. some men are not good
		Understand	CAHS013.02

7	Demonstrate the disjunctive normal form of the formula: P→ ((P→Q) ∧∼ (∼Q∨∼P))?	Remember	CAHS013.03
8	Explain free and bound variables with an example?	Remember	CAHS013.01

9	(a) Show that if 'm' is an even integer then m+7 is an odd integer by using direct proof?
	(b) Writeeach of the following in symbolic form
	  i)all monkeys have tails ii)no monkey have tail
	  iii)some monkey have tails iv)some monkey have no tails
		Remember	CAHS013.02

10	Explain proof by contradiction with example?	Understand	CAHS013.03
11	a) Explain the direct proof of the statement "The square of an odd integer is an odd integer" b) Explain the indirect proof of the statement "If n^2 is odd, then n is odd"	Understand	CAHS013.03
PART-C (Problem Solving and Critical Thinking Questions)		

1	Writethe negations of the following statements,
	  a) Jan will take a job in industry or go to graduate school
	  b) James will bicycle or run tomorrow
	  c) If the processor is fast then the printer is slow
		Remember	CAHS013.02

2	Write the pdnf of $(p \wedge q) \vee (\sim p \vee r) \vee (q \vee r)$ using truth table.	Understand	CAHS013.03

3	Show that:
	  a) $R \wedge (P \vee Q)$ is a valid conclusion from premises $P \vee Q, Q \rightarrow R$, $P \rightarrow M$ and $\sim M$.
	  b) $R \rightarrow S$ can be derived from the premises, $P \rightarrow (Q \rightarrow S)$, $\sim R \vee P$ and Q
		Remember	CAHS013.04

4	Show that the following premises are inconsistent.
	  (a) If jack misses many classes through illness, then he fails high school
	  (b) If jack fails high school, then he is uneducated.
	  (c) If jack reads lot of books, then he is not uneducated..
	  (d) Jack misses many classes through illness and lot of books
		Remember	CAHS013.02

5	Selectp,q and r be the propositions
	 p: you have the flee
	q: you miss the final examination
	r: you pass the course.
	Write the following propositions into statement form.
	  (i) $p \rightarrow q$
	  (ii) $\sim p \rightarrow r$
	  (iii) $q \rightarrow \sim r$
	  (iv) $p \vee q \vee r$
	  (v) $(p \rightarrow \sim r) \vee (q \rightarrow \sim r)$
	  (vi) $(p \wedge q) \vee (\sim q \wedge r)$.
		Understand	CAHS013.02

6	Write the following proposition in symbolic form, and find its negation:"If all triangles are right angled, then no triangle is equiangular"	Understand	CAHS013.03
UNIT – II		
Relations, Functions and Lattices		
PART - A (Short Answer Questions)		
1	Definea relation?	Remember	CAHS013.05
2	Listthe operations on relations?	Remember	CAHS013.05
3	Explain Reflexive relation?	Remember	CAHS013.05
4	Define Symmetric relation?	Remember	CAHS013.05
5	DefineIrreflexive relation?	Remember	CAHS013.05
6	DefineCompatibilty relation?	Remember	CAHS013.05
7	DescribeTranisitiverelation?	Remember	CAHS013.05

8	Write short notes on a partial order relation?	Remember	CAHS013.05
9	Interpretequivalance relation?	Remember	CAHS013.05
10	Define Indegree and Outdegree for diagraph?	Remember	CAHS013.06
11	Identify A X B and B X A where A = {1,2,3}, B={4,5}?	Understand	CAHS013.07
12	Define a) onto function b)one to one function	Remember	CAHS013.09
13	Explainbijective function?	Remember	CAHS013.09
14	Write short notes on constant function?	Remember	CAHS013.09
15	Define Identity function?	Remember	CAHS013.09
16	Determine Inverse function?	Remember	CAHS013.09
17	Identify inverse of f(x) and g(x) where $f(x)=x^3, g(x)=2x+3$?	Remember	CAHS013.10
18	Define lattice? If A is finite set and P(A) is power set then prove that $(P(A), \subseteq)$ is a lattice for A={a }	Remember	CAHS013.11
19	Listthe properties of lattice?	Understand	CAHS013.12
20	Describe distributive lattice?	Remember	CAHS013.12
21	Define bounded lattice?	Remember	CAHS013.12
22	Explain complemented lattice?	Remember	CAHS013.12
PART-B (Long Answer Questions)		
1	Define a relation? Explain the properties of relations and the operations on relations?	Remember	CAHS013.07
2	Let A={1,2,3,4,6}and R be a relation on A defined by aRb if and only if a is multiple of b represent the relation R as a matrix and draw its diagraph.	Remember	CAHS013.07
3	Let A={1,2} and B={p,q,r,s}and let R be a relation from A to B defined by R={(1,q),(1,r),(2,p),(2,q),(2,s)} Write the matrix and digraph of R	Remember	CAHS013.07
4	Consider the set A={ball,bed,dog,let,egg} and define the relation R on A by R={(x,y)|x,y Є A and x R y if x and y contain some letter}. Verify R is a compatibility relation which is not transitive.	Remember	CAHS013.07
5	Describe the sets A & B given that A – B = { 1,2,4 } B – A ={ 7,8 } and A U B = { 1,2,4,5,7,8,9}.	Understand	CAHS013.07
6	Construct the hasse diagram for the divisibility relation i)A={3,6,12,36,72} ii)A={1,2,3,5,6,10,15,30}	Remember	CAHS013.08
7	Let A be a given finite set and p(θ) its power set. Let <= be the inclusion relation on the elements p(θ) Construct the hasse diagram of $(P(A), \subseteq)$ i)A={a} ii)B={a,b} iii)C={a,b,c} iv)D={a,b,c,d}	Remember	CAHS013.08
8	Construct the hasse diagram represented with positive divisors of 36?	Remember	CAHS013.08
9	Describe a)onto function b)one to one function c) bijective function d)constant function	Understand	CAHS013.09
10	Describe the function and find the inverse of the function i) $f(x)=10/5\sqrt{7}-3x$ ii) $4.e^{(6x+2)}$	Understand	CAHS013.10
11	Define lattice? If A is finite set and P(A) us Power set then prove that $(P(A), \subseteq)$ is a lattice for i) A={a } ii)A={a,b}	Remember	CAHS013.11
12	Describe bounded lattice and distributive lattice? What is a partial order relation?	Understand	CAHS013.12
PART-C (Problem Solving and Critical Thinking Questions)		
1	How many relations are there on a set with `n' elements? If a set A has `m' elements and a set B has `n' elements, how many relations are there from A to B? If a set A = {1, 2}, Recognizeall relations from A to A.	Understand	CAHS013.05
2	Consider sets A={a,b,c} B={1,2,3},R={(a,1),(b,1),(c,2),(c,3) } and s={(a,1),(a,2),(b,1),(b,2) } from A to B.	Remember	CAHS013.07

	Define
	    (i) $\overline{R}$
	    (ii) $\overline{S}$
	    (iii) RUS
	    (iv) R∩S
	    (v) R^c
	    (vi) S^c		

3	Let A={1,2,3,4,6,12) on set A define the relation A to B, iff A divides B.. Show that R is partial order relation and draw the Hasse diagram form this relation.	Remember	CAHS013.08
4	Describe Complemented latticewith example.	Remember	CAHS013.08

5	Describe a bijective function. Explain with reasons whether the following functions are bijective or not. Find also the inverse of each of the functions.
	    (i) f(x) = 4x+2, A = set of real numbers
	    (ii) f(x) = 3+1/x, A= set of non- zero real numbers
		Understand	CAHS013.09

6	a) A function f(Z X Z) Z is defined by f(x,y)=4x+5y.Show that f is not one-to-one, but not onto? b) Let f(x): x^2 -3x+2. Find $f(x^2)$ and f(x+3)?	Understand	CAHS013.09
7	Explain in brief about Inversive and Recursive functions with examples?	Understand	CAHS013.10
8	Let A={1,2,3,4}, B={a,b,c}, C={w,x,y,z} with f:A→B and g:B→C given by f={(1,a),(2,a),(3,b),(4,c)} and g={(a,x),(b,y),(c,z)} Findgof and fog.	Understand	CAHS013.10

<table>
<tr><td colspan="4" align="center">UNIT – III</td></tr>
<tr><td colspan="4" align="center">ALGEBRAIC STRUCTURES AND COMBINATORICS</td></tr>
<tr><td colspan="4" align="center">PART - A (Short Answer Questions)</td></tr>
</table>

1	Define group and semi group?	Remember	CAHS013.13
2	Write short notes onmonoid and sub group?	Remember	CAHS013.13
3	Explain homomorphism?	Remember	CAHS013.15
4	Define isomorphism?	Remember	CAHS013.15
5	Discussif a, b are elements of M and a*b=b*a, then (a*b)*(a*b)=(a*a)*(b*b) where (M,*)is an algebraic system.	Understand	CAHS013.13

6	Explain whether the given table with respect to operation * on the
	
	   * a b
	   a a b
	   b b b
	
	set A={a,b} is a semi group or monoid
		Understand	CAHS013.13

7	Let(G.*) be a group and let a,b € G, thenIdentify $(a^{-1})^{-1}$=a	Understand	CAHS013.13
8	Show that the function from $< Z,+>$ to $< E,+ >$ defined by f(x)=x^2 for all x€Z is not a homomorphism.	Remember	CAHS013.15
9	Consider the semi groups $< Z,+>$ and $< E,+ >$. Define the function f:Z→E by f(x)=2x for all x€Z is a isomorphism.	Understand	CAHS013.14
10	Define Subgroup.	Remember	CAHS013.13
11	DefineSubmonoid.	Remember	CAHS013.13
1	Identifythe number of ways we can select the counting rules from the class Which having 6 boys and 5 girls	Understand	CAHS013.17
2	If a person having 4 trousers and 3 shirts then Identifythe number of ways of selecting a pair?	Understand	CAHS013.18

3	Recognizethe number of ways of forming three digit number from 5 elements?	Understand	CAHS013.18
4	Discover the number of ways of selecting 9 committees with 7 persons?	Understand	CAHS013.18
5	Enumerate the number of ways forming a 4 letter word from the word MIXTURE in which at least one letter is repeated?	Understand	CAHS013.18
6	Reportthat if there are 8 cars and 26 passengers at least one car has 4 or more passengers?	Understand	CAHS013.18
7	A library contains 30 books whose total number of pages is 2560. Report that one of the books must have at least 86 pages?	Understand	CAHS013.17
8	Explain how many words of three distinct letters can be formed from the letters of the word MAST?	Understand	CAHS013.18
9	Describe, that in how many different outcomes are possible by tossing 10 similar coins?	Understand	CAHS013.17
10	Identify in how many different 8 digit numbers can be formed by arranged digits 1, 1,1,1,2,3,3,3.	Understand	CAHS013.18
11	Describe, that in how many numbers can be formed using the digits 1, 3, 4,5,6,8 and 9 if no repetitions are allowed?	Understand	CAHS013.17
12	Express how many ways are there to seat 10 boys and 10 girls around a circular table, if boys and girls seat alternatively?	Understand	CAHS013.17
13	Report in how many ways can the digits 0,1,2,3,4,5,6,7,8,and 9 be arranged so that 0 and 1 are adjacent and in the order of 01?	Understand	CAHS013.17
14	Predict that in how many ways two slices of pizza can be chosen from a plate containing one slice each of pepperoni, sausage, mushroom, and cheese pizza?	Understand	CAHS013.18
15	Identifythat in how many five letter passwords can be generated using first three letters as any of the English alphabets and last two being any digit from 0 to 9 ?(repetition is allowed)	Understand	CAHS013.18
16	Definesum rule and product rule?	Understand	CAHS013.17
17	Ifa person is having 3 shirts and 5 ties then Enumerate the number of ways of selecting a pair?	Understand	CAHS013.18
	PART-B (Long Answer Questions)		
1	Write short notes on Ring. Explain Commutative ring and ring with unity.	Understand	CAHS013.15
2	Let G be the set of all non-zero real numbers and let a*b= ½ ab. Show that <G,*> is an abelian Group.	Understand	CAHS013.13
3	Let G be the set of real numbers not equal to -1 and * be defined by a*b = a+b+ab. Show that <G,*> is an abelian Group.	Understand	CAHS013.13
4	Show that in a group (G,*) for every a,b € G(a*b)^2 = a^2*b^2 if (G,*) is an abelian.	Understand	CAHS013.13
5	Show that If A ={1,-1,I,-1} are the fourth roots of unity. Show that (A,*) forms a group.	Remember	CAHS013.13
1	Solve that the number of ways we can select the counting rules from the class which having 6 boys and 5 girls?	Understand	CAHS013.17
2	Ifa person is having 4 trousers and 3 shirts then Find the number of ways of selecting a pair?	Understand	CAHS013.18
3	Solve, If a person has four transport modems for travelling from(Hyd to Chennai) and three transport modems travelling from(Chennai to Bangalore) then find the no of ways of the person travelling from (Hyd-Bangalore) via Chennai	Understand	CAHS013.18
4	a)Identifythe number of ways of forming three digit numbers from 5elements? b) Discover thenumber of ways of selecting 9 members committee with 7 persons?	Understand	CAHS013.18

5	Solve that the number of ways of arranging 5 boys and 4 girls in a line and the line can start with boy and end with boy also?	Understand	CAHS013.17
6	Recognize the number of ways of forming committee of 5 persons from a group of 5 Indians 4 Russians such that three are at least 3 Indians committee?	Understand	CAHS013.17
7	Solve that the number of ways forming a 4 letter word from the word MIXTURE in which at least one letter is repeated?	Understand	CAHS013.17
8	Report the number of ways we can distribute 12 identical pencils to 4 children such that every children get at least one pencil?	Understand	CAHS013.18
9	i) Describe that if 8 cars 26 passengers at least one car has 4 or more passengers? ii)A library contain 30 books whose total number of pages are 2560 show that one of the book must have at least 86 pages?	Understand	CAHS013.18

PART-C (Problem Solving and Critical Thinking Questions)			
1	Solve whether the following algebraic systems satisfy the properties under binary operations * and + (a) Odd integers (b) All the positive integers.	Remember	CAHS013.13
2	Solve that (Z,*) is an abelian group where Z is a set of integers and the binary operations * is defined as a*b = a+b-3	Understand	CAHS013.13
3	If o is an operation on Z defined by xoy=x+y+1, Prove that $\langle Z,o \rangle$ is an abelian group.	Remember	CAHS013.13
4	On the set Q of all rational numbers, the operation * is defined by a * b= a+b-ab. Show that, under this operation Q forms a commutative monoid.	Remember	CAHS013.13
5	Show that a group G is abelianiff $(ab)^{-1} = a^{-1}b^{-1}$ for all a,b€G.	Understand	CAHS013.13

1	Select the number of rows of 6 Americans, 7 Mexicans and 10 Canadians in which an American invariably stands between a Mexican and a Canadian never stand side by side.	Understand	CAHS013.17
2	Solve the words. (a) TALLAHASSEE (b) MISSISSIPPI How many arrangements can be made such that, (a) No two letters A of TALLAHASSEE appear together (b) Number of 4 letter words for both the given words.	Understand	CAHS013.18
3	Find in how many integers between 1 and 10^4 contain exactly one 8 and one 9.	Understand	CAHS013.17
4	Select in how many integers between 10^5 and 10^6, (i) Have no digit other than 2,5 or8 (ii) Have no digit other than 0,2,5or 8.	Understand	CAHS013.17
5	Estimate in how many arrangements are there for the word `MISSISSIPPI` with no two pair of consecutive same letters?	Understand	CAHS013.18
6	Describe, in how many ways we can distribute 12 identical pencils to 4 children such that every children get at least one pencil?	Understand	CAHS013.18

UNIT – IV			
Recurrence Relation			
PART - A (Short Answer Questions)			
1	Discover the generating function for the following sequence1,2,3,4..	Understand	CAHS013.19
2	Identify the generating function for the following sequence 1,-2,3,- 4….	Understand	CAHS013.19
3	Predict the generating function for the following sequence 0,1,2,3...	Understand	CAHS013.19
4	Identifythe generating function for the following sequence	Understand	CAHS013.19

	0 ,1,2,3,-4…		
5	Estimate the co-efficient of x^{12} of $x^3(1-2x)^{10}$?	Understand	CAHS013.19
6	Solve the co-efficient of x^5 of $(1-2x)^{-7}$?	Understand	CAHS013.19
7	Determinethe co-efficient of x^{27} of i)$(x^4+x^5+x^6…………)^5$	Understand	CAHS013.19
8	Identify the generating function for the following sequence $1^2,2^2,3^2,………$	Understand	CAHS013.19
9	Discover the generating function for the following sequence $0^2, 1^2,2^2,3^2,……………$	Understand	CAHS013.19
10	Solve the co-efficient of x^{27} of $(x^4+2x^5+3x^6…………)^5$	Understand	CAHS013.19
11	Determine the generating functions for the following sequence $1^3,2^3,3^3,……………$	Understand	CAHS013.19
12	Solvethe recurrence relation $a_n=a_{n-1}+n^3$,n>=1 where $a_0=5$ by using substitution method ?	Remember	CAHS013.21
13	Solve the recurrence relation $a_n=a_{n-1}+3n^2+3n+1$,n>=1 where $a_0=5$ by using substitution method ?	Remember	CAHS013.21
14	Determine the generating function for the following sequence $0^3, 1^3,2^3,3^3$,-------------	Understand	CAHS013.19
15	Solve the recurrence relation $a_{n+1}=8a_n$,n>=0 where $a_0=4$	Remember	CAHS013.20
16	Solve the recurrence relation $a_{n+1}=8a_n$,n>=0 where $a_0=6$	Remember	CAHS013.20
17	Determinethe generating function for the following sequence 1,1,0,1,1,1….	Understand	CAHS013.19
18	Determinethe generating function for the following sequence 1,1,,1,1,1….	Understand	CAHS013.19
19	Determinethe generating function for the following sequence 1,-1,1,-1……..	Understand	CAHS013.19
20	Estimate the co-efficient of x^{27} of $(x^4+x^5+x^6…………)^5$	Understand	CAHS013.19
21	Solve recurrence relation $a_n=a_{n-1}+n^3$,n≥1 where $a_0=5$ by using substitution method ?	Remember	CAHS013.21
22	Solve recurrence relation $a_n=a_{n-1}+n$,n≥1 where $a_0=2$ by using substitution method ?	Remember	CAHS013.21
	PART-B (Long Answer Questions)		
1	Identify the generating functions for the following sequences i)1,2,3,4 ii)1,-2,3,-4 iii)0,1,2,3 iv)0 ,1,-2,3,-4	Understand	CAHS013.19
2	Estimate the generating function for the following sequence i)$1^2,2^2,3^2$,----------- ii)$0^2, 1^2,2^2,3^2$,-----------	Understand	CAHS013.19
3	Predict the generating function for the following sequence i)$1^3,2^3,3^3$,-------------ii)$0^2, 1^3,2^3,3^3$,-------------	Understand	CAHS013.19
4	Determine the generating function for the following sequence 1,1,0,1,1,1	Understand	CAHS013.19
5	Identify the co-efficient of x^{12} of $x^3(1-2x)^{10}$?	Understand	CAHS013.19
6	Discover the co-efficient of x^5 of $(1-2x)^{-7}$?	Understand	CAHS013.19
7	Identify the co-efficient of x^{27} of i)$(x^4+x^5+x^6…………)^5$ ii)$(x^4+2x^5+3x^6…………)^5$	Understand	CAHS013.19
8	Solve the recurrence relation $a_n=a_{n-1}+n^3$,n>=1 where $a_0=5$ by using substitution method ?	Remember	CAHS013.21
9	Solve the recurrence relation $a_n=a_{n-1}+3n^2+3n+1$,n>=1 where $a_0=5$ by using substitution method?	Remember	CAHS013.21
10	Solve the recurrence relation $a_{n+1}=8a_n$,n>=0 where $a_0=4$	Remember	CAHS013.20
11	Solve the recurrence relation $a_n-7a_{n-1}+10a_{n-2}=0$ n>=2 ,$a_0=10$ $a_1=41$	Remember	CAHS013.20
12	Solve the recurrence relation $a_n-9a_{n-1}+26a_{n-2}+24a_{n-3}=0$ n>=3 ,$a_0=0$ $a_1=1$ $a_2=10$	Remember	CAHS013.20
13	Solve the recurrence relation $a_n=3a_{n-1}+2n$ $a_1=3$	Remember	CAHS013.21
14	Solve the recurrence relation $a_n-3a_{n-1}=n$, n>=1 $a_0=1$ by using generating function ?	Remember	CAHS013.21

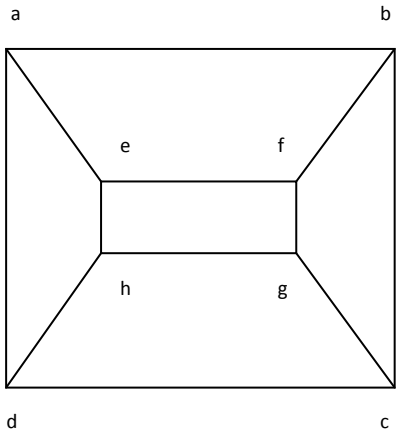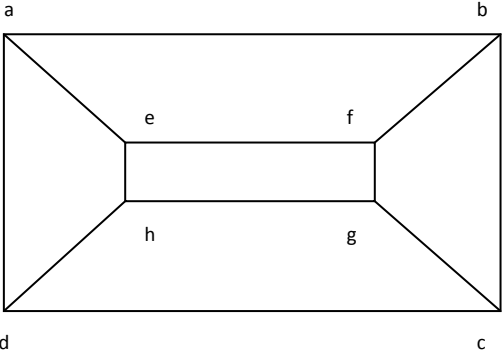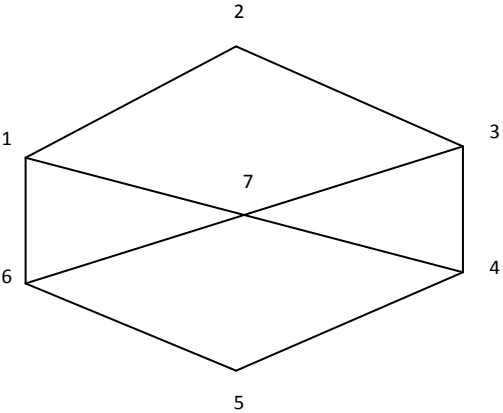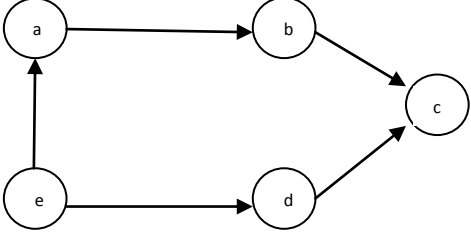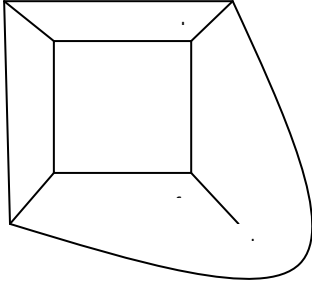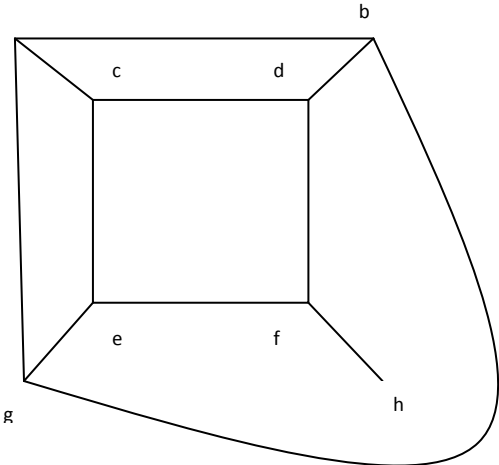| 15	Solve the recurrence relation $a_{n+1}-a_n=3^n$, n>=0 $a_0=1$ by using generating function?	Remember	CAHS013.21
16	Identify the co-efficient of x^{15} of $x^3(1+x)^4 / (1-x)^4$?	Understand	CAHS013.19
17	Identify the co-efficient of x^{10} of $(x^3-5x)/ (1-x)^3$?	Understand	CAHS013.19
18	Solve the recurrence relation $a_n+a_{n-1}-6a_{n-2}=0$, n>=2 $a_0= -1$, $a_1=8$	Remember	CAHS013.21
	PART-C (Problem Solving and Critical Thinking Questions)		
1	Solve the recurrence relation $a_n-6a_{n-1}+8a_{n-2}=9$, n>=2 $a_0=10$, $a_1=25$ by using generating function ?	Remember	CAHS013.21
2	Solve the recurrence relation $a_{n+2}-7a_{n-1}+10a_n=7*3^n+4^n$, n>=0 by usinggenerating function ?	Remember	CAHS013.21
3	Solve the recurrence relation $a_{n+2}-2a_{n+1}+a_n=2^n$,n>=0 $a_0=1$,$a_1=2$ using generating function ?	Remember	CAHS013.21
4	Identifythe co-efficient of x^{52} of 1. $(x^4+x^5+x^6 \ldots \ldots \ldots)^5$ ii. $(x^4+2x^5+3x^6 \ldots \ldots \ldots)^5$	Remember	CAHS013.19
5	Solve the recurrence relation $a_n-3a_{n-1}-2a_{n-2}=0$, n>=2where $a_0=5$, $a_1=3$	Remember	CAHS013.21
6	Solve the recurrence relation $a_{n+3}-3a_{n+2}+3a_{n+1}-a_n =3+5n$, n>=0	Remember	CAHS013.21
	UNIT – V		
	Graphs and Trees		
	PART - A (Short Answer Questions)		
1	Define graph? Write the matrix representation of the above graph.	Understand	CAHS013.22
2	Explain tree and spanning tree?	Understand	CAHS013.22
3	State the definition oforder and size of a graph?	Understand	CAHS013.22
4	Determine allspanning trees of given graph?	Understand	CAHS013.24
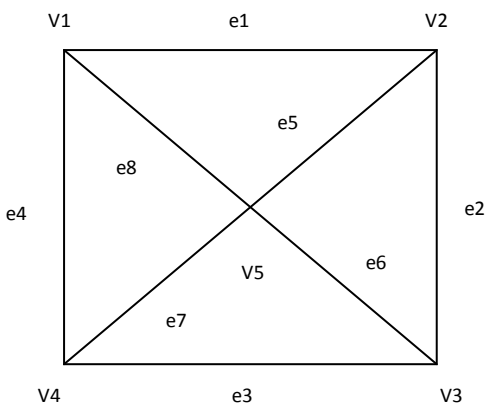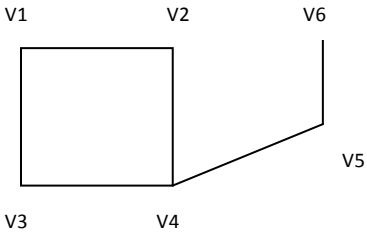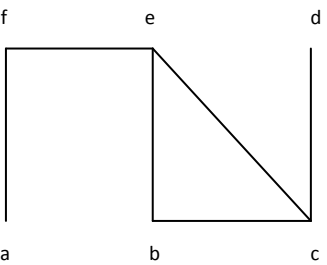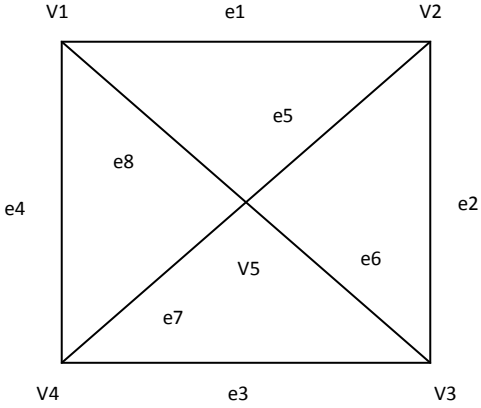
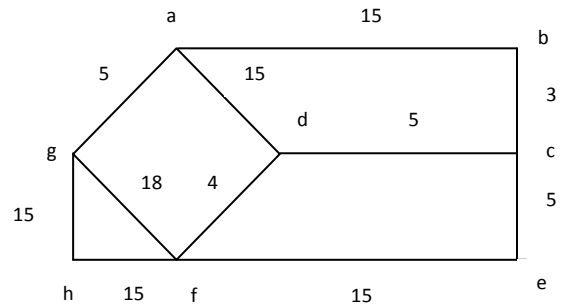| 5	Interpret the degree of each vertex for the given graph below? V1 e1 V2 e5 e8 e4 e2 e6 V5 e7 V4 e3 V3	Understand	CAHS013.22

6	Define
	  i. Null graph?
	  ii. Isolated vertex?
		Understand	CAHS013.22

7	Enumerate
	  i) Pendent vertex
	  ii) self-loop
	
	V1 V2 V6
	V5
	V3 V4
	
	What are the pendent vertices in the above graph?
		Understand	CAHS013.22

8	f e d a b c Determine order, size for the above graph?	Understand	CAHS013.22
9	Define complete graph and explain it importance?	Understand	CAHS013.22

10	Construct Hamiltonian graph for the given below graph? 		Remember	CAHS013.23
11	Assign the proper coloring for the below given graph? 		Remember	CAHS013.22
12	Identify chromatic number of given graph? 		Remember	CAHS013.22

13	Enumerate regular graph?	Understand	CAHS013.22
14	Define multi graph?	Understand	CAHS013.22
15	Determine order |V| of the graph G=(V,E) in the following cases: i. G is a cubic graph with 9 edges. ii. G is a regular graph with 15 edges.	Understand	CAHS013.22
16	Defineplanar graph? Count the orders and sizes of given graph? 	Understand	CAHS013.22
17	Describe the matrix representation of graph?	Understand	CAHS013.22
18	Explain the incidence matrix of graph?	Understand	CAHS013.22
19	Write the linked list representation of graph? 	Remember	CAHS013.22
20	Define In-degree and Out-degree of a graph.	Understand	CAHS013.22
21	Define Loop edges and multiple edges	Understand	CAHS013.22
PART-B (Long Answer Questions)			
1	Definegraph? explain i) matrix representation ii) incidence matrix iii) Linked list representation of graph?	Understand	CAHS013.22

2	Explaintree and spanning tree, find all spanning trees ofgiven graph below? 	Understand	CAHS013.24
3	Discuss Breadth first search algorithm with an example?	Understand	CAHS013.24

4	Show that the given graphs are planar?
	  i. A graph of order 5 and size 8.
	  ii. A graph of order 6 and size 12.
		Understand	CAHS013.23

5	Discuss prim's algorithm with an example?	Understand	CAHS013.25
6	Explain krushkal's algorithm with an example?	Understand	CAHS013.25
7	Define eulerian graph and explain Euler path and Euler circuit?	Understand	CAHS013.23
8	Enumerate Hamiltonian graph? Define proper coloring and chromatic number of a graph?	Remember	CAHS013.23
9	Demonstrate isomorphismwith an example?	Remember	CAHS013.22
10	Enumerate a)graph b)simple graph c)degree of vertex d)null graph e)isolated vertex f)pendent vertex g)self-loop h)order i)size j)regular graph k)complete graph	Remember	CAHS013.22
11	Define Bipartite and Complete Bipartite graphs with Examples.	Remember	CAHS013.22
12	Define Isolated vertex and Pendant vertex and identify them by taking an example graph.	Remember	CAHS013.22
	PART-C (Analytical Questions)		
1	Construct the spanning tree of given graph by using BFS 	Remember	CAHS013.24

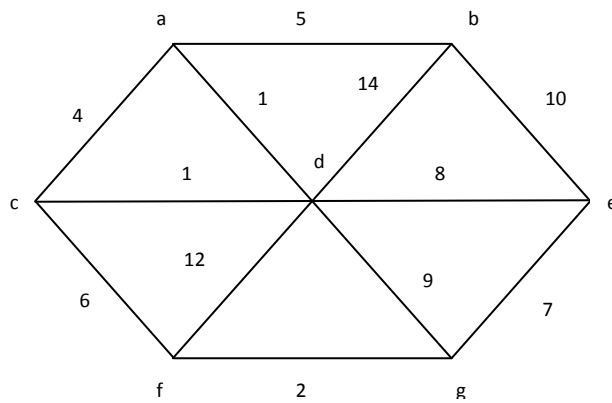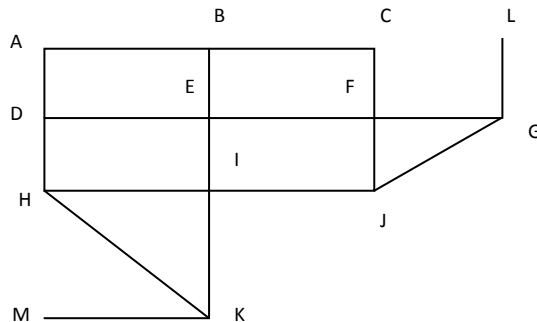| 2	Construct the minimal cost spanning tree for the given below graph using Kruskal's algorithm?	Remember	CAHS013.25
3	Construct the minimal cost spanning tree for the above graph using Prim's algorithm?	Remember	CAHS013.25
4	Construct the spanning tree for the below graph by using DFS with vertex in the ordering "abcfjihdegl"?	Remember	CAHS013.24

5	Construct the minimal cost spanning tree for the cities shown in above graph using krushkals algorithm?	Remember	CAHS013.25

6	Define the following
	   i. Walk
	   ii. Trial
	   iii. Circuit
	   iv. Path
	   v. Cycle
		Remember	CAHS013.23

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