POKHARA UNIVERSITY

Level: Bachelor | Semester: Fall | Year : 2015
Programme: BE | Full Marks: 100
Course: Mathematical Foundation of Computer Science | Pass Marks: 45
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.
Attempt all the questions.

1. a) Differentiate between directed and undirected graph. Give an example of something in the real world that can be modeled by directed graph. 8
   b) State and explain the different ways of computer representation of graph. 7
2. a) State and prove Euler's formula for planar graph. 8
   b) What is a shortest path? Write an algorithm that finds the shortest path between two vertices, with an example. 7
3. a) Define logical equivalence. Show that the propositions $p \vee (q \wedge r)$ and $(p \vee q) \wedge (p \vee r)$ are logically equivalent. 7
   b) State the rules of inference for propositional logic. Verify that the following argument is valid using the rules of inferences. 8
   If Clinton does not live in France, then he does not speak French. Clinton does not drive a Datsun. If Clinton lives in France, then he rides a motorcycle. Either Clinton speaks French or He drives a Datsun. Hence Clinton rides a motorcycle.
4. a) Differentiate between proof by contradiction and proof by contra positive with an example. 7
   b) Differentiate between universally quantified and existentially quantified statement. What is the truth value of the statement, for every real number x, $x^2-1>0$. 8
5. a) Define recurrence relation. Find an explicit formula for Fibonacci numbers. 8
   b) Write a recursive relation that computes the amount of money at the end of n years assuming an initial amount of Rs 10,000 and an interest rate of 12 percent compounded annually. 7

CamScanner

6. a) Define Chomsky hierarchy of grammar. Generate the following string using following production rules. 8

<expression> :: = (< expression>)|<expression> + <expression> | <expression> *

<expression> | <variable>

<variable>:: = x | y

Also construct a derivation tree for (x*y) + x in this grammar.

b) Draw the transition diagram of finite state machine, 7

I = {a,b,c} O = {0,1,2}

S = { σ_0 , σ_1 , σ_2 , σ_3 }

And

I	f			g		
S	a	b	c	a	b	c
σ_0	σ_1	σ_0	σ_2	1	1	2
σ_1	σ_0	σ_2	σ_2	2	0	0
σ_2	σ_3	σ_3	σ_0	1	0	1
σ_3	σ_1	σ_1	σ_0	2	0	2

7. Write short notes on: **(Any two)** 2×5

a) Application of graph

b) Predicate logic

c) Finite state automata

POKHARA UNIVERSITY

Level: Bachelor | Semester: Spring | Year : 2015
Programme: BE | Full Marks: 100
Course: Mathematical Foundation of Computer Science | Pass Marks: 45
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.
Attempt all the questions.

1. a) Give a proof by contradiction that, if four teams play seven games, some pair of teams play at least two times. 7
   b) Briefly explain Rules of Inference for Quantified Statements. 8
2. a) We are given the following hypothesis: Everyone loves either Microsoft or Apple. Lynn does not love Microsoft. Show that the conclusion, Lynn loves Apple follows from the hypothesis. 7
   b) Use resolution and proof by contradiction to prove the following expression 8
   $\neg p \vee q \vee r$
   $\neg q$
   $\neg r$
   Therefore, $\neg p$
3. a) Solve the following recurrence relation: 7
   $a_n = 7a_{n-1} - 10a_{n-2} + 16n$
   b) A fibonacci series is given by the recurrence relation 8
   $f_n - f_{n-1} - f_{n-2} = 0$, $n >= 3$, and initial conditions $f_1=1$, $f_2=2$
   Find the explicit formula for the fibonacci sequence.
4. a) Define a planar graph. Show that in any simple planar graph, e<= 3v - 6 8
   b) Show that, for a complete graph with n vertices, the number of edges is given by n(n-1)/2 7
5. a) Explain Dijkstra's Shortest Path algorithm with an example. 8
   b) A connected planar graph has nine vertices having degrees 2, 2, 2, 3, 3, 3, 4, 4 and 5. How many edges are there? How many faces are there? 7
6. a) Differentiate between Finite State Machine and Automata with 8

CamScanner

example. Explain Context Sensitive, Context-Free and Regular Grammar.

b) Draw the transition diagram of of a finite state automaton that accepts the string starts with *baa* over { a, b }

7. Write short notes on: (**Any two**)

a) Euler Cycle

b) Hamiltonian Graph

c) Direct and Indirect Proof

CamScanner

POKHARA UNIVERSITY

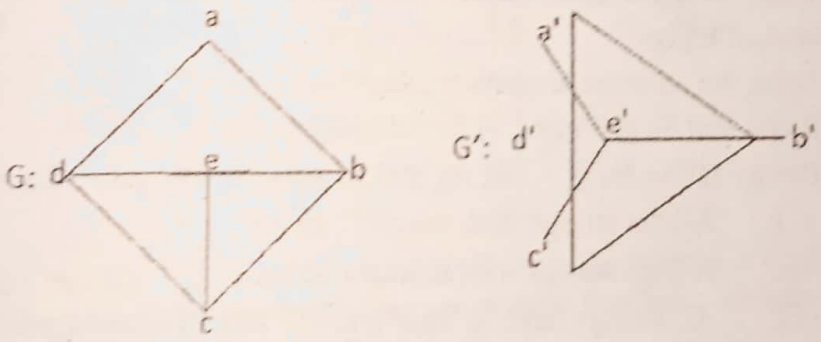
Level: Bachelor | Semester: Fall | Year : 2016
Programme: BE | Full Marks: 100
Course: Mathematical Foundation of Computer Science | Pass Marks: 45
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.
Attempt all the questions.

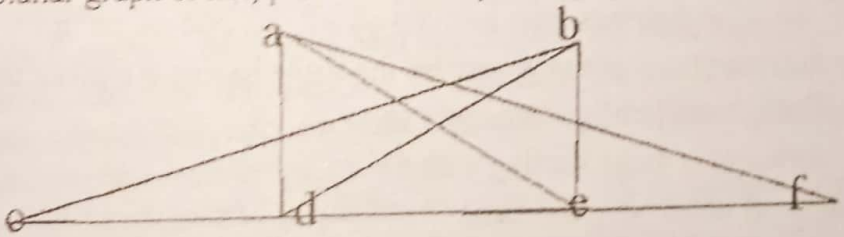
1. a) Draw the undirected graph **G**, corresponding to the given adjacency matrix: 7

$$\begin{bmatrix} 1 & 2 & 0 & 0 \\ 2 & 0 & 1 & 1 \\ 0 & 1 & 2 & 2 \\ 0 & 1 & 2 & 0 \end{bmatrix}$$

b) Show that the graphs **G** and **G'** are isomorphic. 8



2. a) Is it planar graph or not, prove it. If it is planar graph re-draw it. 5



b) Derive a formula for number of edges in k_n. 5

c) When does a complete bipartite graph $k_{m,n}$ contains a Hamiltonian cycle? Prove it by showing an example. 5

3. a) Show that: $p \leftrightarrow q \equiv (p \vee q) \rightarrow (p \wedge q)$ using:
   i. Truth Table
   ii. Algebra of propositions

   b) Use mathematical induction to show that if $r \neq 1$, then
   $$a + ar^1 + ar^2 + \ldots\ldots + ar^n = \frac{a(r^{n+1} - 1)}{r - 1}$$

4. a) Rewrite the following arguments using quantifiers, variables and predicate symbols.
   i. All birds can fly.
   ii. Not all birds can fly.
   iii. Some men are genius.
   iv. Some numbers are not rational.
   v. Some real numbers have square 3.
   vi. Every Student either can speak English or Knows programming JAVA.
   vii. There is a student who likes MFCS but not Applied Mechanics.

   b) What is logical equivalence? State and prove DeMorgan's Laws using laws of logic.

5. a) Solve the recurrence relation : $2a_n = 7a_{n-1} - 3a_{n-2} + 2^n$
   b) Prove that $6n \equiv 0 \pmod 9$ for all integers $n \geq 2$

6. a) Design DFAs for $\sum = \{m, n\}$, that accepts the sets consisting of
   i. All the strings with exactly one 'm'.
   ii. All the strings with at least one 'm'.
   iii. All strings have at least one 'm' and followed by exactly two 'n'.
   iv. All strings have even no of 'm' and odd no. of 'n'.

   b) Write a grammar that generates the string having the given properties. 8
   String over {a,b} ending with ba
   String over {a,b} starting with a

7. Write short notes on: **(Any two)** 2×5
   a) Euler's graph vs Hamiltonian graph
   b) Predicate logics
   c) FSA

POKHARA UNIVERSITY

Level: Bachelor
Programme: BE
Course: Mathematical Foundation of Computer Science

Semester: Spring

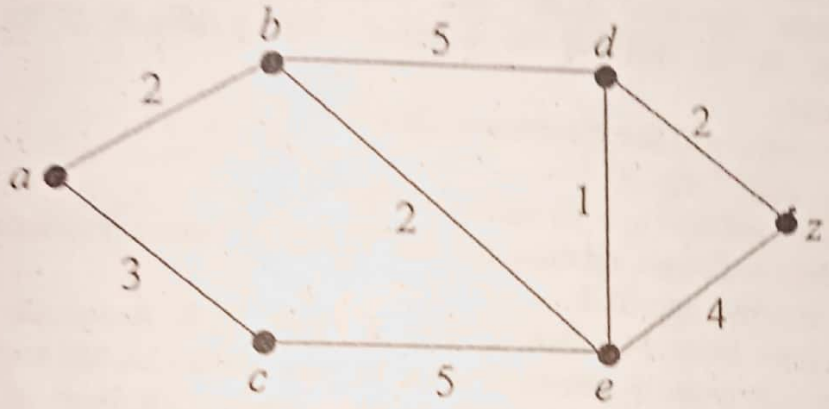
Year : 2016
Full Marks: 100
Pass Marks: 45
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) Use Dijkstra's algorithm to find the length of the shortest path between the vertices a and z in the weighted graph displayed below. 8



b) Explain the Euler path and Euler circuit with the help of a diagram. State the necessary and sufficient conditions for Euler circuits and paths. 4+3

2. a) In a round-robin tournament the Tigers beat the Blue Jays, the Tigers beat the Cardinals, the Tigers beat the Orioles, the Blue Jays beat the Cardinals, the Blue Jays beat the Orioles, and the Cardinals beat the Orioles. Model this outcome with a directed graph. Draw the figure for the complete bipartite graph $K_{3,4}$. 4+3

b) Show that an undirected graph has an even number of vertices of odd degree. Explain the Hamiltonian path and Hamiltonian circuit with the help of a diagram. 4+4

3. a) Use mathematical induction to prove that 7
$2 - 2 \cdot 7 + 2 \cdot 7^2 - \ldots\ldots\ldots + 2(-7)^n = (1-(-7)^{n+1})/4$ whenever n is a non-negative integer

सुगम स्टेसनरी सप्लायर्स एण्ड फोटोकपी सर्भिस
बालकुमारी, ललितपुर ९८४१५९९५९२
NCIT College

b) Express the following statements using quantifiers. 4+4

i. "Every student in the class has studied calculus." Assume that the domain consists of all people.

ii. "Some student in this class has visited Mexico". Assume that the domain consists of all people.

4. a) We are given the following hypotheses: 8

If the Chargers get a good linebacker then the Chargers can beat the Broncos

If the Chargers can beat the Broncos, then the Chargers can beat the Jets.

If the Chargers can beat the Broncos, then the Chargers can beat the Dolphins.

The Chargers get a good linebacker.

Show using the rules of inference that the conclusion, the Chargers beat the Jets and the Chargers can beat the Dolphins, follows from the hypotheses.

b) Differentiate between direct and indirect proofs with suitable examples. Prove that $\sqrt{2}$ is irrational by giving a proof by contradiction. 3+4

5. a) Find all solutions of the recurrence relation 8

$a_n = 5a_{n-1} - 6a_{n-2} + 42 \cdot 4^n$

with initial condition $a_1 = 56$ and $a_2 = 278$.

b) Derive the recurrence relation for the Tower of Hanoi and solve it using an iterative approach. 7

6. a) Define Finite State Machine. Design a Finite State Automata that accepts precisely those strings over {a, b} that contain an odd number of b's. Your design should include the proper definition of the finite-state automaton, transition table and the transition diagram. 2+6

b) Discuss regular expressions and regular languages in detail with suitable examples. Explain the different properties of regular languages. 4+3

7. Write short notes on: **(Any two)** 2×5

a) Adjacency and Incidence Matrix

b) Converse and Contrapositive statements

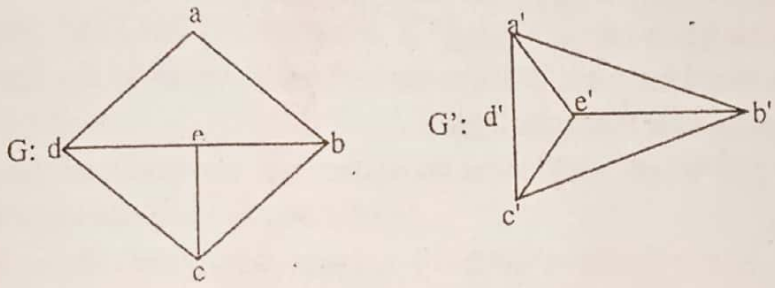
c) Equivalence Relation

POKHARA UNIVERSITY

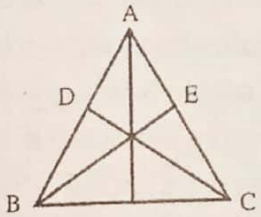
Level: Bachelor | Semester: Fall | Year : 2017
Programme: BE | Full Marks: 100
Course: Mathematical Foundation of Computer Science | Pass Marks: 45
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.
Attempt all the questions.

1. a) What are the applicable fields of graph theory? Explain Hamilton graph with their properties. 7
   b) Show that the graphs **G** and **G'** are isomorphic. 8



2. a) For a given graph define incidence and adjacency matrix. 5



10

   b) Explain dijkstra's algorithm to fine distance from source to destination with your own example.
3. a) Rewrite the following arguments using quantifiers, variables and predicate symbols 7
   - All fish can swim.
   - Not all birds can fly.
   - Some men are dumb.
   - Some numbers are not complex.

CamScanner

- Some real numbers have square 3.
- Every IT student can speak English or Knows programming JAVA.
- There is a student who likes MFCS but not English.

b) What is induction? Illustrate with an example. 8

4. a) Use Mathematical induction to prove the given statement. 7
$6.7^n - 2.3^n$ is divisible by 4, for n = 1,2,3….

b) $p \leftrightarrow r$ 8

i. Use resolution to derive conclusion: $r \therefore \frac{r}{p}$

5. a) Solve the recurrence relation: $2a_n = 9a_{n-1} + 5a_{n-2} + 2$. 8

b) Solve the recurrence relation of Fibonacci series. 7

6. a) Define Alphabet and Language in Finite State Automata. Describe working principle of DFA. 7

b) State the rules to be in Regular expression. Design a DFA which accepts the string ends with '00'.(eg. 1100, 10100, 00) 8

7. Write short notes on: **(Any two)** 2x8

a) Eular Graph

b) Truth functions

c) Preposition vs. Predicate logic

1. a

b

2. a

b

3. a

b

4. a

b

5. a

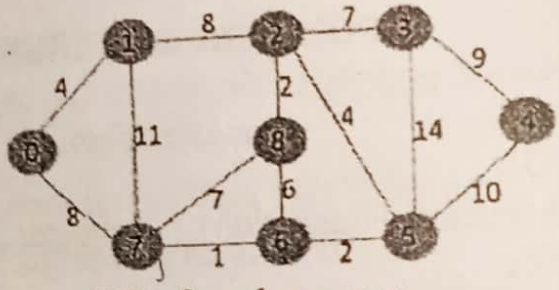
POKHARA UNIVERSITY

Level: Bachelor | Semester: Spring | Year : 2017
Programme: BE | Full Marks: 100
Course: Mathematical Foundation of Computer Science | Pass Marks: 45
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.
Attempt all the questions.

1. a) Define proposition and predicate logic. Use truth table to show that $p \rightarrow q \equiv \neg p \vee q$ — 7
   b) Prove $\neg(A \vee B) and [(\neg A) \wedge (\neg B)]$ are equivalent. — 8
2. a) Show that $n^2 > 2n+1$ for $n \geq 3$ by the mathematical induction. — 7
   b) Prove the validity of the following argument "If I get the job and work hard, then I will get promoted. If I get promoted, then I will be happy. I will not be happy. Therefore either I will not get the job or I will not work hard." — 8
3. a) Describe direct and indirect proof techniques. Proof that product of two odd integer is an odd integer. — 8
   b) Solve the recurrence relation $Fn=5Fn-1-6Fn-2$ where $F0=1$ and $F1=4$. — 7
4. a) Define the terms: Multigraph, pseudograph, complete graph, platonic graph. List out the application of graph theory. — 7
   b) A connected graph contains Eulerian trail, but not Eulerian circuit if and only if it has exactly two vertices of odd degree. Prove it. — 8
5. a) State Dirac's & Ore's theorem. Let 'G' be a connected planar graph with 20 vertices and the degree of each vertex is 3. Find the number of regions in the graph. — 7
   b) What is minimum spanning tree? Find the minimum spanning tree of the graph using Kruskal algorithm. — 8

CamScanner



6. a) Define DFA. Design a DFA for a language:
   L={w $\in$(0,1)* | Second symbol of w is '0' and fourth input is '1'.
   b) Define regular expression. Design a Finite automata from regular expression 01(10+11)*1.
7. Write short notes on: (**Any two**)
   a) Hamiltonian Circuit
   b) Alphabet, language, string
   c) Tautology and contradiction

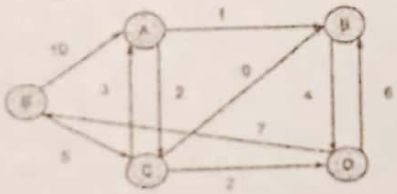
CamScanner

POKHARA UNIVERSITY

Level: Bachelor | Semester: Fall | Year : 2018
Programme: BE | Full Marks: 100
Course: Mathematical Foundation of Computer Science | Pass Marks: 45
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.
Attempt all the questions.

1. a) Show that the premises "Everyone in this college has purchased a computer" and "Pankaj is a student in this college" imply the conclusion "Pankaj has purchased a computer". 7
   b) Prove that following propositions are tautology: 8
   a) $\neg(p \wedge q) \vee q$ b) $p \rightarrow (p \vee q)$
2. a) Explain the mathematical induction theorem with example. 7
   b) Show that the 't' is valid conclusion from the premises $p \rightarrow q$, $q \rightarrow r$, $r \rightarrow s$, $\neg s$ and $p \vee t$. 8
3. a) What are the major differences between direct proof and indirect proof techniques? Explain with example. Prove that $\sqrt{2}$ is irrational by contradiction method. 8
   b) Solve the recurrence relation: 7
   $a_{n+2} - 5a_{n+1} + 6a_n = 2$ with initial condition $a_0 = 1$ & $a_1 = -1$
4. a) Briefly explain & prove the Handshaking theorem in undirected graph. 7
   b) Describe Euler's theorem with an example. For what values of 'n' the graph of K_n is Eulerian? Explain. 8
5. a) Define regular and isomorphic graph. Differentiate between Walk, Path & Trail in graph. 7
   b) State Dijkstra's Shortest Path Algorithm. Find the shortest path of the graph using Dijkstra's algorithm. 8



6. a) Describe the working mechanism of Finite automata. Design finite automata which accepts even number of a's .
   L={w $\in$(0,1)* | Second symbol of w is '0' and fourth input is '1'.
   b) Define regular with formal definition. Show that aa*(a+b)*a is a regular expression.
7. Write short notes on: (Any two)
   a) Bipartite graph
   b) Hamiltonian circuit
   c) Universal & Existential quantifier

1.

2.

3

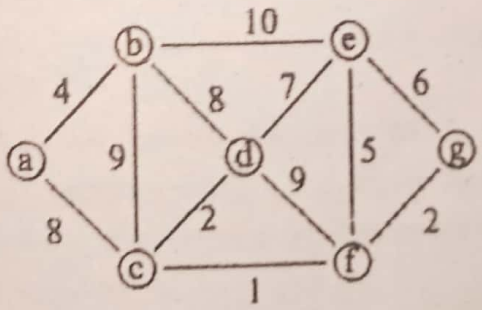
CamScanner

POKHARA UNIVERSITY

Level: Bachelor | Semester: Spring | Year : 2018
Programme: BE | Full Marks: 100
Course: Mathematical Foundation of Computer Science | Pass Marks: 45
Time : 3hrs.

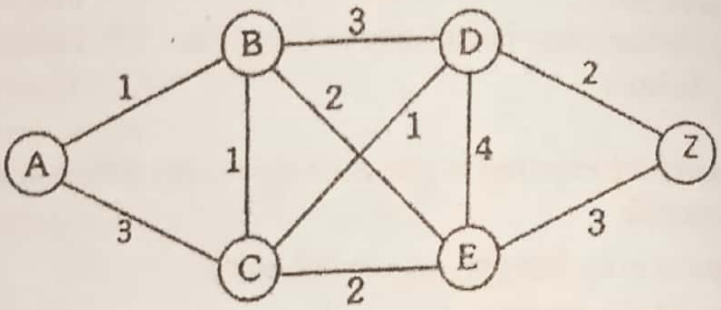
Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.
Attempt all the questions.

1. a) Define tautology, show that $[(p \rightarrow q) \wedge (q \rightarrow r)] \rightarrow (p \rightarrow r)$ is a tautology. 7
   b) Define conditional statement. Write inverse, converse & contrapositive of conditionals with truth table. 8
2. a) Prove the validity of the following argument "If I get the job and work hard, then I will get promoted. If I get promoted, then I will be happy. I will not be happy." Therefore "either I will not get job or I will not work hard." 7
   b) Use direct proof to prove "if x is odd than x^{2}" is also odd. Show by giving a proof by contradiction that if 100 balls are placed in 9 boxes some box contains 12 or more balls. 8
3. a) What are regular expression? Design a DFA which accepts the string with even number of a's and b's over {a,b}. 7
   b) How can you convert NFA in to DFA explain with suitable example. 8
4. a) Define the terms: Multigraph, Pseudo graph, bi-partite graph and regular graph with suitable example. 8
   b) What is minimum spanning tree? Find the minimum spanning tree of the graph using Prim's algorithm. 7



5. a) Show that for a complete graph with n vertices, the number of edges is given by n(n-1)/2.

   b) Find the shortest path from a to z using Dijkstra's Algorithm.



6. a) Define linear homogeneous recursion relation of degree K with constant coefficient with suitable examples. What is the solution of the recurrence relation $a_n = a_{n-1} - 2a_{n-2}$ with initial conditons $a_0 = 2$ and $a_1 = 7$

   b) Solve the recurrence relation: $2a_n = 7a_{n-1} - 3a_{n-2} + 2^n$

7. Write short notes on: **(Any two)**

   a) FSM Properties

   b) Bipartite graph

   c) Euler cycle vs Hamilton cycle

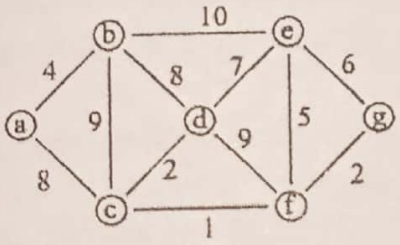
CamScanner

POKHARA UNIVERSITY

Level: Bachelor | Semester: Fall | Year : 2019
Programme: BE | Full Marks: 100
Course: Mathematical Foundation of Computer Science | Pass Marks: 45
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.
Attempt all the questions.

1. a) How can you show that two graphs are isomorphic? Discuss invariants that can be used to show that two graphs are not isomorphic with suitable example. 8
   b) What is Euler's formula for planar graphs? How can Euler's formula for planar graphs be used to show that a simple graph is non-planar. 7
2. a) Explain different graph representation technique with suitable example. 8
   b) What is minimum spanning tree? Find the minimum spanning tree of the graph using Kruskal's algorithm. 7



3. a) Differentiate between universally quantified and existentially quantified statements. What is the truth value of the statement, $x^2-1>0$ for every real number x. 7
   b) Use mathematical induction to show that if $r\neq1$ then $a+ar^1+ar^2+\ldots+ar^n=a(r^{n+1}-1)/(r-1)$. 8
4. a) Hypothesis: "Everyone in the Discrete Math class loves proofs. Someone in the discrete math class have never taken calculus. Conclusion "Someone who loves proof has never taken calculus." Use rule of inference to prove it. 7
   b) i) Use direct proof to prove "if x is odd than x^{2}" is also odd. 4+4

ii) Show by giving a proof by contradiction that if 100 balls are placed in 9 boxes Some box contains 12 or more balls.

5. a) Define linear homogeneous recursion relation of degree K with constant coefficient with suitable examples. What is the solution of the recurrence relation $a_n = a_{n-1} - 2a_{n-2}$ with $a_0 = 2$ and $a_1 = 7$ 8

   b) Suppose that a person deposits Rs. 10,000/- in a fixed account at a bank yielding 11% per year with interest compounded annually. How much will be in the account after 10 years? Solve the problem with modeling it into recursion relations. 7

6. a) Define deterministic finite state automata. Construct a DFA whose language is the set of strings that ends with 111 and contains odd number of one's. 7

   b) What is CFG? Write the CFG that can accept all the palindrome string over $\sum = \{0, 1\}$ and also construct derivation tree. 8

7. Write short notes on: **(Any two)** 2×

   a) Tautology, Contradiction and Contingency

   b) Euler Graph

   c) Chomsky hierarchy of grammar

CamScanner

POKHARA UNIVERSITY

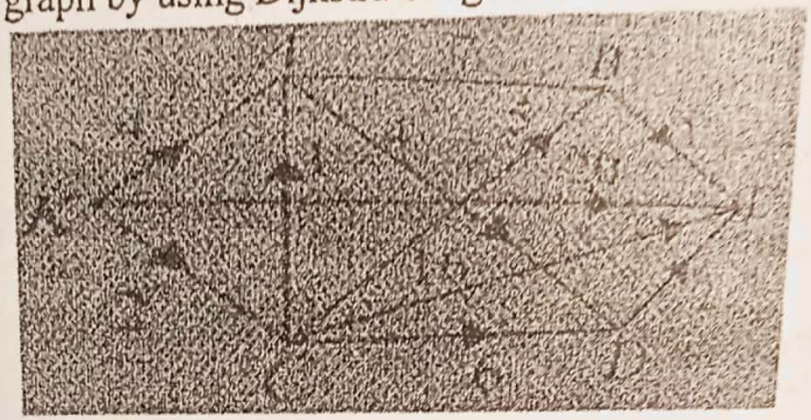
Level: Bachelor | Semester:Spring | Year : 2019
Programme:BE | Full Marks: 100
Course: Mathematical Foundation of Computer Science | Pass Marks: 45
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.
The figures in the margin indicate full marks.
Attempt all the questions.

1. a) Explain the importance of predicate logic in computer science. Use truth table to prove that $(p \rightarrow q) \vee \sim p \equiv \sim p \vee q$ 7
   b) Prove $(P \vee Q) \wedge \sim(P \vee Q)$ is a contradiction. 8
2. a) Show that n^3+2n, for all n is divisible by three through mathematical induction. 7
   b) Analyze the validity of the following argument "If he does not have an explanation then he will be found guilty. He either has an explanation or he has been framed. Therefore, if he has been framed he will be found guilty." 8
3. a) Describe techniques of direct and indirect proofs. Prove that product of two odd integer is an odd integer and the product of two even integers is even. 8
   b) Solve the recurrence relation $2a_n=7a_{n-1}-3a_{n-2}+2n$ where $a_0=1$ and $a_1=4$. 7
4. a) Define the terms: Multigraph, pseudograph, complete graph and bipartise graph. List out the application of graph theory. 7
   b) What is a Eulerian graph? How can we tell that a graph is Eulerian. Explain with the help of an example. 8
5. a) State Dirac's & Ore's theorem. Show that a connected simple planar graph all of whose vertices have degree at least 5 must have at least 12 vertices. 7

CamScanner

b) Find the minimum distance between two vertices K and L of the graph by using Dijkstra's algorithm.



6. a) Define DFA. Design a DFA that accepts even number of a's and b's over the alphabet [a, b] 7

b) Define regular expression. Design a Finite automata from regular expression 01(10+11)*1. 8

7. Write short notes on: (**Any two**) 2×5

a) Euler Theorem

b) Rules of inferences

c) Logical equivalence relation

CamScanner

POKHARA UNIVERSITY

Level: Bachelor | Semester: Fall | Year : 2020
Programme: BE | Full Marks: 100
Course: Mathematical Foundation of Computer Science | Pass Marks: 45
Time : 3hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) What is graph? What are the application of graph in real world problem? Draw K_6. 7

   b) Describe the following families of graphs. 8

   i. K_n, the complete graph on n vertices

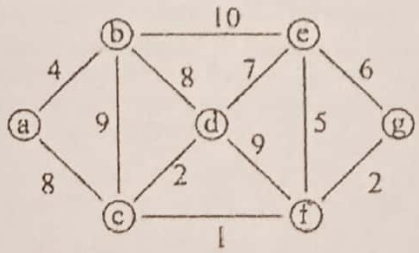
   ii. $K_{m,n}$, the complete bipartite graph on m and n vertices

   iii. C_n, the cycle with n vertices

   iv. W_n, the wheel of size n.

2. a) Describe Euler and Hamilton graph in detail. State Dirac's and Ore's theorem. 8

   b) What is minimum spanning tree? Find the minimum spanning tree of the graph using Prim's algorithm. 7



3. a) Hypothesis: "Everyone in the computer class loves arrays. Someone in the computer class has never taken loops. " Conclusion: "Someone who loves arrays has never taken loops." Use rule of inference to prove it. 7

   b) Write each axiom as a well-formed formula in first-order predicate logic. 8

   i) Anyone whom Bunu loves is a football star.

ii) Any student who does not pass does not play.

iii) Any student who does not study does not pass.

iv) Bunu is a student.

4. a) Use mathematical induction to prove the given statement. 7

$6.7^n - 2.3^n$ is divisible by 4, for n=1,2,3,.....

b) Differentiate betweeen direct proof and indirect proof with examples. State the rules of inference for propositional logic. 8

5. a) What do you understand by recurrence relation? Setup a recurrence relation for the sequence representing the number of moves needed to solve TOH problem. 7

b) Find the solution to recurrence relation:

$a_n=6a_{n-1}-11a_{n-2}+6a_{n-3}$ with initial condition $a_0=2, a_1=5$ and $a_2=15$ 8

6. a) Design a FSM having the given properties. The input is always bit string which outputs 1 whenever it sees 010 otherwise 0. 7

b) What is ambiguous grammar? Write the CFG that can generates all the signed integers. Also construct a derivation tree for W= - 432. 8

7. Write short notes on: **(Any two)** 2x5

a) Differentiate Hameltonian Graph and complete graph

b) Transaction diagram

c) Application of a recursive equation

CamScanner

POKHARA UNIVERSITY

Level: Bachelor | Semester –Spring | Year:2020

Program: BE | Full Marks: 70

Course: Mathematical Foundation of Computer Science | Pass Marks:31.5

Time: 2 hrs.

Candidates are required to answer in their own words as far as practicable.
The figures in the margin indicate full marks.

Attempt all the questions.

Section- A:(5×10=50)

Q. N. 1 Construct an argument using rule of inference to show that the hypothesis "If it does not rain or if it is not foggy then sailing race will be held and the life saving demonstration will go on," "If the sailing race is held then the trophy will be awarded," and " The trophy was not awarded" imply the conclusion "It rained." You are required to show each steps and give reasons for those steps. 10

OR

Prove that $K_{3,3}$ is not a planar graph. What is the importance of spanning tree, exhibit it by your own example. What do you understand by Bi-partite graph?

Q. N. 2 Solve the given recurrence relation
$a_n=7a_{n-1}-10a_{n-2}+16n$ with $a_0=A$ and $a_1=B$ where A an B are the second last and last digit of your exam roll number respectively. 10

Q. N. 3 Differentiate between direct and indirect proof. Prove that if n is an integer, these four statements are equivalent: (i) n is even, (ii) n + 1 is odd, (iii) 3n + 1 is odd, (iv) 3n is even 10

Q. N. 4 Differentiate between Deterministic and Non-deterministic finite state automata. Design a FSA that accepts precisely those string over {a,b} that contains an even numbers of a. Your design should include the proper definition of the finite-state automata, transition table and transition diagram. 10

Q. N. 5 Highlight the principle of mathematical induction techniques to validate the mathematical formula. Is there any limitation of mathematical induction method? If yes support your answer when mathematical induction is applicable and when it is not applicable with an example. 10

CamScanner

Section - B: (1×20=20)

Q. N. 6 Consider the following graph below and solve the following questions:

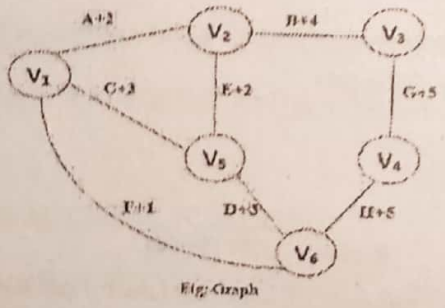


Fig: Graph

- Determine the minimum spanning tree using both Prim's and Kruskal's Algorithms. 10
- State the concept for the graph to be planar. Is the above graph a planar graph? If yes justify your answer with the facts that supports your answer. 5
- Explain the Eulers formula for Planar graph and describe its cases. 5

Note (ABCDEFGH are the first, second, third, fourth, fifth, sixth, seventh and eight digit of your exam roll number)

CamScanner

POKHARA UNIVERSITY

Level: Bachelor | Semester: Fall | Year : 2021
Programme: BE | Full Marks: 100
Course: Mathematical Foundation of Computer Science | Pass Marks: 45
Time : 3hrs.

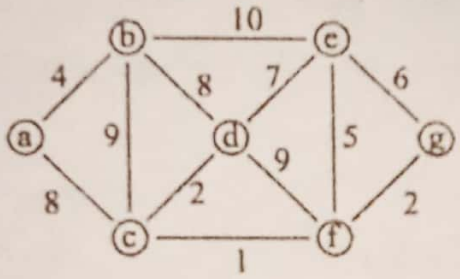
Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Attempt all the questions.

1. a) What are the real life examples of graph? Explain different graph representation technique with suitable example. 8

   b) What is minimum spanning tree? Find the minimum spanning tree of the graph using Prim's algorithm. 7



2. a) State and prove Euler's formula for planar graph. 8

   b) Show that for a complete graph with n vertices, the number of edges is given by n(n-1)/2. 7

3. a) Show that the premises "*If you send me an e-mail message, then I will finish writing the program*", "*If you do not send me an e-mail message, then I will go to sleep early*" and "*If I go to sleep early, then I will wake up feeling refreshed*" lead to the conclusion "*If I do not finish writing the program, then I will wake up feeling refreshed.*" 8

   b) Why do we use predicate Logic? Explain different types of quantifiers with suitable example. 7

4. a) Show that the premises "A student in this class has not read the book," and "Everyone in this class passed the first exam" imply the conclusion "Someone who passed the first exam has not read the book." 8

CamScanner

b) Describe direct proof and indirect proof techniques. Prove that product of two odd numbers is an even number.

5. a) Find the solution of linear non-homogenous recurrence relation with initial
Conditions $a_0 = 2$ and $a_1 = 3$.
$2a_n = 3a_{n-1} - a_{n-2} + 2^n$

b) Derive the explicit formula for Fibonacci series.

6. a) What are regular expressions? Design a DFA which accepts the strings with even number of a's and b's over {a, b}.

b) Define Chomsky Hierarchy of Grammar. Construct the grammar that generates even palindrome binary strings.

7. Write short notes on: **(Any two)**
a) NFA to DFA Conversion
b) Tautology, Contradiction and Contingency
c) Euler cycle vs Hamilton cycle

CamScanner

POKHARA UNIVERSITY

Level: Bachelor | Semester: Spring | Year : 2021
Programme: BE | Full Marks: 100
Course: Mathematical Foundation of Computer Science | Pass Marks: 45
Time : 3 hrs.

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

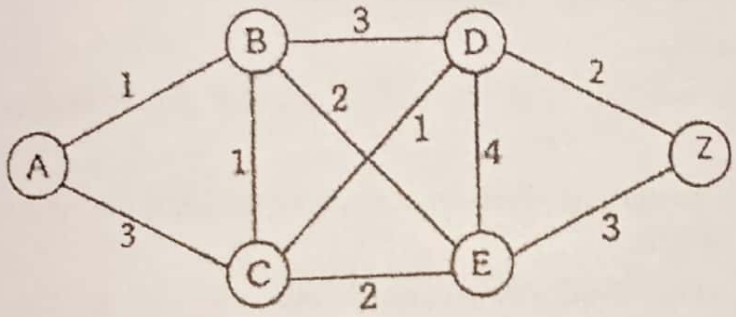
Attempt all the questions.

1. a) Show that $K_{3,3}$ does not contains planar graph. 5

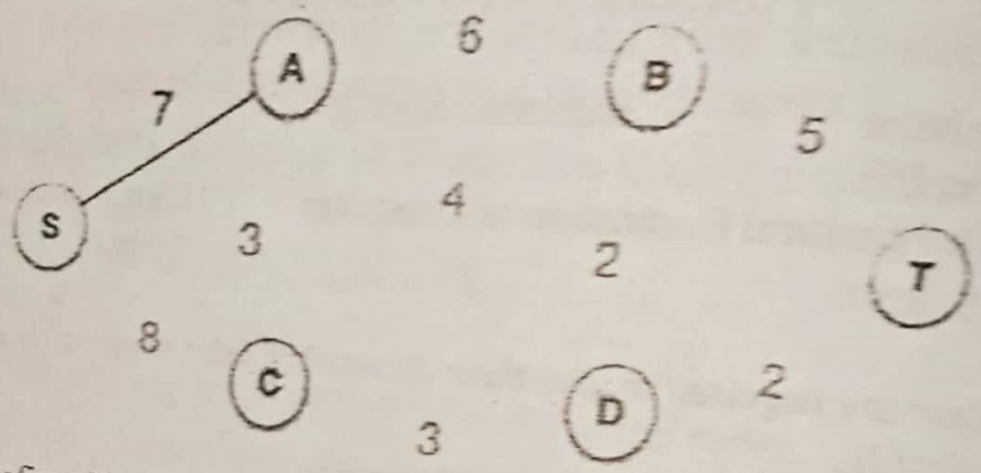
   b) A connected planar graph has 4 faces with degree 3,3,4,6? Find number of vertices and edges. 5

   c) Define the terms: Multi graph, Pseudo graph, complete graph, Bi-partite graph and regular graph with suitable examples 5

2. a) Use dijkstra's algorithm to find distance from source(A) to destination(Z). 8



   b) What do you mean by minimum spanning tree? Generate a MST of the following graph by using prim's algorithm. 7



3. a) Define Tautology, Contradiction and Contingency. Show that the propositions $p \vee (q \wedge r)$ and $(p \vee q) \wedge (p \vee r)$ are logically equivalent.

b) Prove the validity of following argument using rules of inference: You will get an extra credit if you write a paper or if you solve the test problems. You don't write a paper and you don't get an extra credit. Leads to conclusion, you have not solved the test problems

4. a) Using direct proof technique, prove that "if $3n+2$ is odd then n is odd".

b) Use mathematical induction to prove the given statement. $3.5^0 + 3.5^1 + 3.5^2 + 3.5^3 + 3.5^4 + \ldots + 3.5^n = 3(5^{n+1}-1)/4$, for $n=1,2,3,\ldots$

5. a) Find the solution of following recurrence relation. $a_n = 3a_{n-1} + 2.n$, where $a_1 = 3$.

b) Define recurrence relation. Find an explicit formula for Fibonacci numbers.

6. a) Design a FSA that accepts the given set of strings over {a,b} that starts with ab and ends with baa

b) Explain Chomsky Hierarchy of Grammar in detail.

7. Write short notes on: **(Any two)**
   a) Incidence matrix for graph representation.
   b) Predicate logic.
   c) Non deterministic finite automata

8

2×5

2. a)

b)