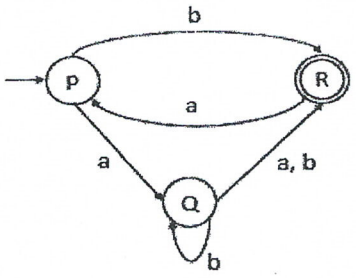
TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2083 Baishakh

Exam.	Back (New Course)		
Level	BE	Full Marks	60
Programme	BEI	Pass Marks	24
Year / Part	II / II	Time	3 hrs.

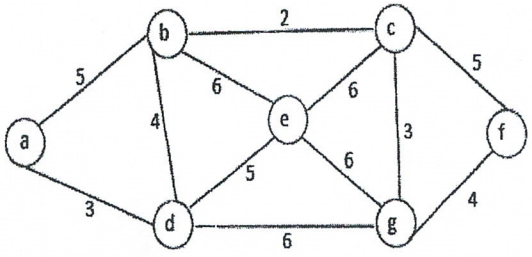
Subject: - Discrete Structure (*ENCT 251*)

- ✓ *Candidates are required to give their answers in their own words as far as practicable.*
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ *Assume suitable data if necessary.*

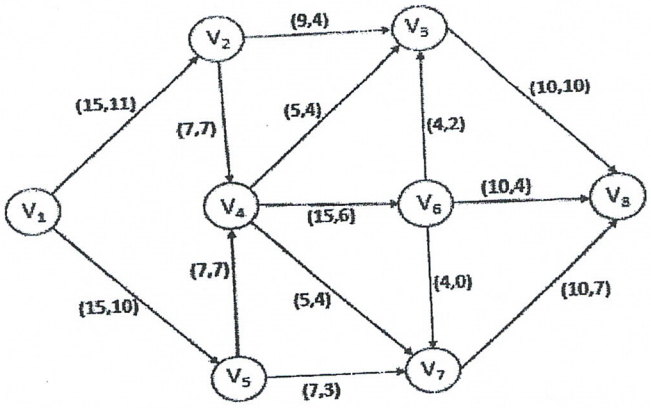
1. Consider the premises: "If I get my Dashain bonus and my friends are free then I will take a road trip with my friends." "If my friends don't find a job after Dashain, then they will be free." "I got my Dashain bonus and my friends did not find a job after Dashain." Leads to the conclusion: "I will take a road trip with my friends." using propositional logic. [3]
2. Define the term converse, inverse and contrapositive with example. Explain universal' quantification and existential quantification. Let x and y be the real number and p (x; y) denotes "x + y" >=0. What are the truth values of nested quantification? [2+2+3]
3. Prove that $\sqrt{2} + \sqrt{3}$ is irrational using proof by contradiction. [3]
4. Using mathematical induction show that $1^2+2^2+3^2+\cdots+n^2 = \frac{(n+1)(2n+1)}{6}$ [4]
5. Convert the following NDFA into equivalent DFA. [4]



6. Write a regular expression for the language that accepts all the string that does not contains three consecutive b over $\Sigma = \{a, b\}$. Write a CFG that generates the palindrome string of even length over the alphabet $\Sigma = \{0, 1\}$. Also generate the string w = 10100101 using right most derivation and draw the parse tree for the same. [2+3+2]
7. Show that regular language is closed under Kleene star and complement operation. [3]
8. Write an algorithm to perform sort operation using insertion sort. Search for key = 45 from the given data 92, 87, 32, 56, 57, 45, 11, 77, 28. [2+2]
9. Solve the recurrence relation $a_n = 5a_{n-1}-6a_{n-2} + 2^n$ with initial condition $a_0 = 1$ and $a_1 = 4$. [4]
10. Define regular graph. Explain different graph representation techniques with example. [1+4]
11. State Dirac's and Ore's theorem. Is K_5 and $K_{3,3}$ planar graph? Justify your answer. [2+2+2]
12. Draw W_6 and write its incidence matrix. Find the minimum spanning tree using Prim's algorithm from the graph given below. [2+4]



13. Find the Maximum flow for the network given below. [4]



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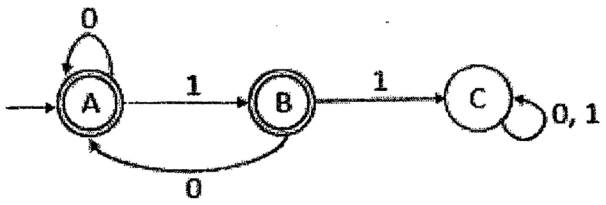
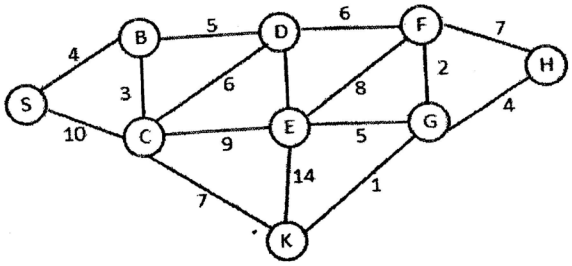
1. Explain different types of function. State the converse, contrapositive and inverse of the conditional statement "My insurance company will pay me only if the flood destroys my house or the fire destroys my house." [3+2]
2. Define the term counter example and witness with example. Using rules of inferences, show that the hypotheses "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." You are required to show each step and give reasons for those steps before you come to the desired conclusion from the hypothesis. [2+3]
3. Use the Principle of Mathematical Induction to verify that, for any positive integer n, $n^3 + 2n$ is divisible by 3. [3]
4. Check validity of the given statement using method of tableaux [4]
   $A \rightarrow B$
   $\neg A \rightarrow C$
   $C \rightarrow D$
   Hence, $\neg B \rightarrow D$
5. Give formal definition of DFA. Design a deterministic finite automata that accepts all the strings that does not starts with aba over $\Sigma\{a,b\}$. Also check for string w_1 = abbabab and w_2 = abaabaaab is accepted or rejected. [2+5]
6. Derive the regular expression for the given automata [4]

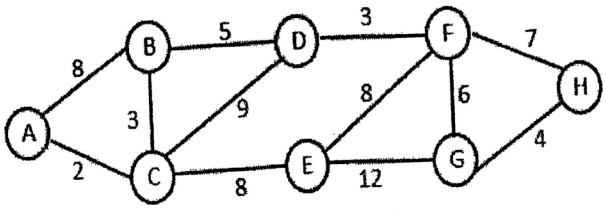


7. Write the CFG for the language L: $0^n\ 1^{2n}$ for n > =1. Also generate the string w = 000111111 and draw its derivation tree. [3]
8. Derive the explicit formula for the Fibonacci series using recurrence relation. [4]
9. Derive the worst-case time complexity for binary search algorithm. Sort the given data using bubble sort 67, 45, 54, 2, 29. [2+2]
10. Define wheel graph. Draw 3-dimensional hypercube (Q_3). Show that the total number of edges in any complete graph is $\frac{n(n-1)}{2}$. [1+1+3]
11. State and prove Euler's Formula for planar graph. [4]

12. What are saturated edges? State Max-Cut Min Flow theorem. Find the minimum spanning tree using Kruskal's algorithm from the graph given below. [1+2+4]



13. Find the shortest distance from vertex A to all other vertex using Dijkstra's algorithm. [5]



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