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Tribhuvan University

Institute of science and Technology

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Bachelor Level/First Year/Second Semester/Science

Full Marks: 60

Computer science and information Technology (CSc.155)

Pass Mark: 32

(Discrete Structure)

Time: 3 hours

Candidates are required to give their answer in their own word as far as practicable.

The figures in the margin indicate full marks.

Attempt all Question:

- 1. Show that the implication and its contrapositive are logically equivalent.
- 2. Which rule of inference is used in the following argument?

 If I work all night on this homework, then I can answer all the exercise. IF answer all the exercise, I will understand all the material. Therefore, if I work all night on this homework, then I will understand the material.
- 3. Use binomial coefficient in the expansion of $(x + y)^4$.
- 4. Determine whether the sequence $\{a_n\}$ is solution of the recurrence relation $a_n = 2a_{n-1} a_{n-2}$ where $a_n = 3n$.
- 5. Define linear nonhomogeneous recurrence relation of degree k with coefficients.
- 6. What is context free grammar?
- 7. Differentiate between DFA and NFA.
- 8. What is bipartite graph?
- 9. What is decision tree?
- 10. Define saturated and unsaturated edge?

Group B $(5 \times 4 = 20)$

11. State and prove pigeonhole principle. What is the minimum number of student required in a discrete mathematics class to be sure that at least six receive the same grade, if there are five possible grades A, B, C, D, and F?

- 12. Discuss the importance of recurrence relation in the analysis pf divide and conquer algorithms.
- 13. Let G be the grammar with vocabulary $V = \{S, A, a, b\}$, set of terminals $T = \{a,b\}$, starting symbol S, and productions $P = \{S \rightarrow aA, S \rightarrow b, A \rightarrow aa\}$. What is L(G), the language of this grammar?
- 14. What is planar graph? Show that $K_{3,3}$ is non-planar.
- 15. Prove that "a tree with n vertices has n-1 edges".

- 16. Discuss direct =, indirect and vacuous proof with suitable example.
- 17. Find the solution to the recurrence relation $a_n=6a_{n-1}-11a_{n-2}+6a_{n-3}$ with the initial conditions $a_0=2,\ a_1=5,$ and $a_2=15.$

OR

Find the explicit formula for the Fibonacci numbers. Use $f_n = f_{n-1} + f_{n-2}$ as recursive condition and $f_0 = 0$ and $f_1 = 1$ as initial condition.

- 18. Discuss finite state machine with output with suitable example. What are the strings in the regular set specified by the regular expression 01*0?
- 19. Describe Dijkstra's algorithm for finding the shortest path in a weighted graph between two vertices with suitable example.
- 20. Find all S-D cuts in the following transport network. What is the value of a maximal flow?

