

Bachelor Level / Second Semester / Science

Computer Science and Information Technology(CSC160)

((TU CSIT) Discrete Structures)

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

The figures in the margin indicate full marks.

Full marks: 80

Pass marks: 32

Time: 3 hours

Attempt all questions:(2 x10 = 20)

Group A

1. Define the term converse, contrapositive and inverse.
2. Is the following argument valid? If Socrates is human, then Socrates is mortal Socrates is human.
 \therefore Socrates is mortal.
3. State the rule for the strong form of mathematical induction with prepositions.
4. State and prove " the extended pigeonhole principle".
5. Define the terms a language over a regular grammer and regular expression.
6. Define linear homogeneous recurrence relation.
7. Explain the state transition function of the finite state machine with a suitable table.
8. Distinguish between multigraph and pseudograph with suitable examples.
9. Define regular expression over a non empty set A.
10. What is regular graph ?

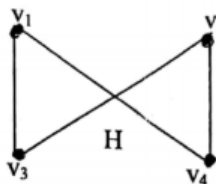
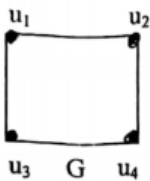
Group B (5 x 4 = 20)

11. Express the statement " Everyone has exactly one best friend " as a logical expression involving predicates, quantifiers with a domain consisting of all people and logical connectives.
12. Let $A = \{p, q, r\}$. Give the regular set corresponding to the regular expression give:
(a) $(pvq)rq^*$ (b) $p(q q) r$.
13. Explain the finite-state with output with suitable examples.

OR

Explain the deterministic finite state automata. When are two finite state automata equivalent?Give an example.

14. When does the two simple graphs $G_1 = m(V_1, E_1)$ and $G_2(V_2, E_2)$ are isomorphic. Show that the graph $G = (V, E)$ and $H = (W, F)$ displayed in the following figure are isomorphic.



15. Define rooted tree. Show that a full m-ary tree with i internal vertices contains $n = mi + 1$ vertices.

Group C (8 x 5 = 40)

16. Construct truth tables to determine whether the given statement is a tautology a contingency or an absurdity.

a) $p \Rightarrow (q \Rightarrow p)$

b) $q \Rightarrow (q \Rightarrow p)$

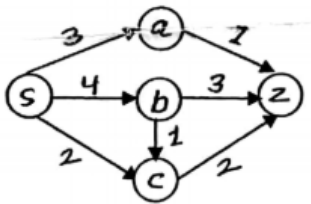
c) $p \wedge \sim p$

OR

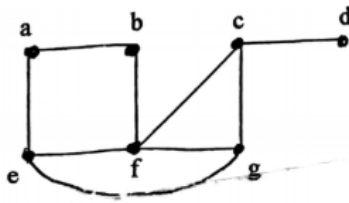
Explain the method of proving theorems by direct indirect, contradiction and by cases.

17. Define linear homogenous recursion relation of degree k with constant coefficient with suitable examples. What is the solution of recurrence relation $a_n = 6 a_{n-1} - 9 a_{n-2}$ with $a_0 = 1$ and $a_1 = 6$?

18. Find the maximum flow in the network shown in the figure.



19. What do you mean by spanning tree? Find a spanning tree of the simple graph G shown in figure.



A graph is connected if and only if it has a spanning tree.

OR

Prove that an undirected graph is a tree if and only if there is a unique simple path between any two of its vertices.

20. Explain the concept of network flows and max-flow min-cut theorem with suitable examples.