

II B.Tech I Semester Regular Examinations, November 2007
MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE
(Common to Computer Science & Engineering, Information Technology
and Computer Science & Systems Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Construct a truth table for each of the (easy) compound statements
 - i. $(p \rightarrow q) \wedge (\neg p \rightarrow q)$
 - ii. $p \rightarrow (\neg q \vee r)$
- (b) Write the negation of the following statements.
 - i. Jan will take a job in industry or go to graduate school.
 - ii. James will bicycle or run tomorrow.
 - iii. If the processor is fast then the printer is slow.
- (c) What is the minimal set of connectives required for a well formed formula.
[8+6+2]
2. Prove using rules of inference or disprove.
 - (a) Duke is a Labrador retriever
All Labrador retrievers like to swim
Therefore Duke likes to swim.
 - (b) All even numbers that are also greater than 2 are not prime
2 is an even number
2 is prime
Therefore some even numbers are prime.
UNIVERSE = numbers.
 - (c) If it is hot today or raining today then it is no fun to snow ski today
It is no fun to snow ski today
Therefore it is hot today
UNIVERSE = DAYS.
[5+6+5]
3. (a) State and explain the properties of the pigeon hole principle.
 - (b) Apply the pigeon hole principle to show that if 14 integers are selected from the set $S = \{1, 2, 3, \dots, 25\}$ there are at least two whose sum is 26. Also write a statement that generalizes this result.
 - (c) Show that if eight people are in a room, at least two of them have birthdays that occur on the same day of the week.
[4+8+4]
4. (a) Let G be a group. Then prove that $Z(G) = \{x \in G / xg = gx \text{ for all } g \in G\}$ is a subgroup of G .

- (b) Let $P(S)$ be the power set of a non-empty set S . Let ' \cap ' be an operation in $P(S)$. Prove that associate law and commutative law are true for the operation ' \cap ' in $P(S)$. [10+6]
5. (a) A chain letter is sent to 10 people in the first week of the year. The next week each person who received a letter sends letters to 10 new people and so on. How many people have received the letters at the end of the year?
- (b) How many integers between 10^5 and 10^6 have no digits other than 2, 5 or 8? [16]
6. (a) Solve $a_n - 3a_{n-1} - 4a_{n-2} = 3^n$ given $a_0 = 1, a_1 = 2$.
- (b) Solve $a_n - 7a_{n-1} + 10a_{n-2} = 0, n \geq 2$, given $a_0 = 10, a_1 = 41$ using generating functions. [8+8]
7. (a) Derive the directed spanning tree from the graph shown Figure 7a

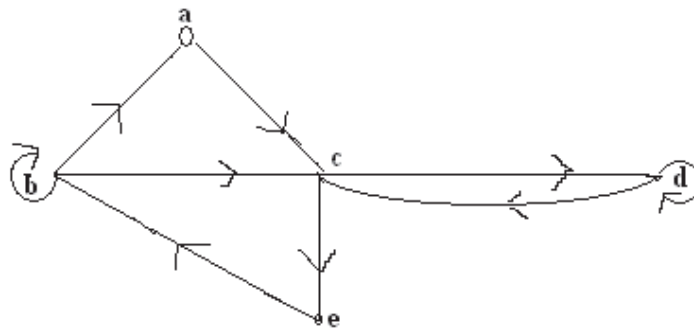


Figure 7a

- (b) Explain the steps involved in deriving a spanning tree from the given undirected graph using breadth first search algorithm. [8+8]
8. (a) Write a brief note about the basic rules for constructing Hamiltonian cycles.
- (b) Using Grinberg theorem find the Hamiltonian cycle in the following graph. Figure 8b [16]

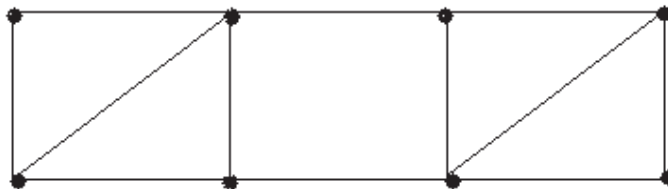


Figure 8b

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1. (a) Let p,q and r be the propositions.
 P: you have the fee
 q: you miss the final examination.
 r: you pass the course.
 Write the following proposition into statement form.
 - i. $P \rightarrow q$
 - ii. $\neg p \rightarrow r$
 - iii. $q \rightarrow \neg r$
 - iv. $p \vee q \vee r$
 - v. $(p \rightarrow \neg r) \vee (q \rightarrow \neg r)$
 - vi. $(p \wedge q) \vee (\neg q \wedge r)$
- (b) Define converse, contrapositive and inverse of an implication. [12+4]
2. Prove using rules of inference or disprove.
 - (a) Duke is a Labrador retriever
 All Labrador retriever like to swim
 Therefore Duke likes to swim.
 - (b) All even numbers that are also greater than
 2 are not prime
 2 is an even number
 2 is prime
 Therefore some even numbers are prime.
 UNIVERSE = numbers.
 - (c) If it is hot today or raining today then it is no fun to snow ski today
 It is no fun to snow ski today
 Therefore it is hot today
 UNIVERSE = DAYS. [5+6+5]
3. (a) Let $A, B, C \subseteq R^2$ where $A = \{ (x,y) / y = 2x + 1 \}$, $B = \{ (x,y) / y = 3x \}$ and $C = \{ (x,y) / x - y = 7 \}$. Determine each of the following:
 - i. $A \cap B$
 - ii. $B \cap C$
 - iii. $\overline{A \cup C}$
 - iv. $\bar{B} \cup \bar{C}$