**Department of Information and Communication Engineering**
Noakhali Science and Technology University
Term Final Examination, 2022
Year: 2, Term: II, Session: 2019-2020

**Course Code: ICE-2203** Course Title: Data Communication
Time: 4 Hours Marks: 70

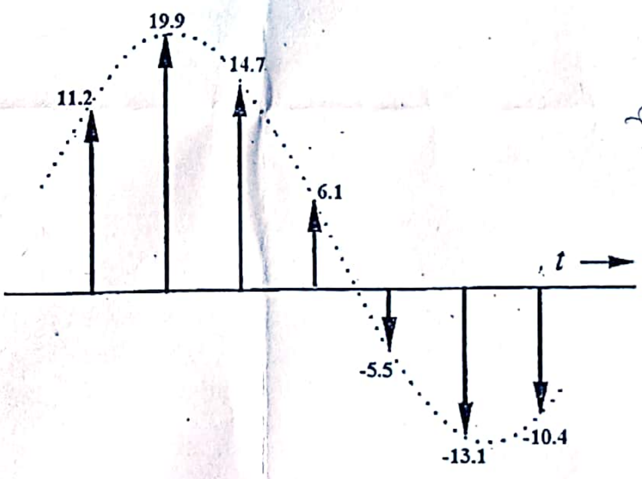
**Answer any seven of the following questions.**

| | | | Marks |
|---|---|---|---|
| 1. | (a) | If a bandpass channel is available, how can we send a digital signal from point A to point B? Make an illustration. | 4 |
| | (b) | What is composite signal? Illustrate how distortion can affect composite signal. | 3 |
| | (c) | Describing the quality of service, an important issue is that overall measurement of network performance. Describe One characteristic/parameter that measures the network performance? | 3 |
| 2. | (a) | Assume that we have a sampled signal with only seven samples using ideal sampling in which the sample amplitudes are between -20 and +20 V. If we choose eight quantization levels ($L = 8$) then construct the quantization steps and encoding of this sampled signal. The value at the top of each sample in the graph shows the actual amplitude. | 5 |

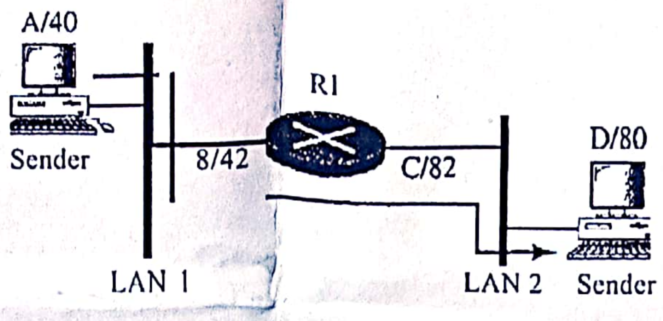
message size / bandwidth

distance / light speed

602nb + 1.06 dB




| | | | |
|---|---|---|---|
| | (b) | Compare and contrast PCM and DM. | 3 |
| | (c) | A complex bandpass signal has a bandwidth of 200 kHz. What is the minimum sampling rate for this signal? | 2 |
| 3. | (a) | Implement BFSK with proper diagram. Also calculate the bandwidth for BFSK. | 5 |
| | (b) | Explain why FM radio stations are allocated larger bandwidth than AM stations. | 3 |
| | (c) | What is the importance of modulation factor in communication system? | 2 |
| 4. | (a) | Draw digital signal encoding formats for the following latter codes for binary input 01001100011.<br>(i) NRZ-L (ii) NRZ-I (iii) Bipolar-AMI (iv) Pseudoternary<br>(v) Manchester (vi) Differential Manchester | 5 |
| | (b) | In the following figure, computer A sends a message to computer D via LAN 1, router R 1, and LAN 2. Show the contents of the packets and frames at the network and data link layer for each hop interface. | 5 |




| | | | |
|---|---|---|---|
| 5. | (a) | Describe the goals of multiplexing and de-multiplexing. | 2 |
| | (b) | What are the differences between classful addressing and classless addressing in IPv4? | 2 |
| | (c) | A sender needs to send the four data items Ox3456, OxABCC, Ox02BC, and OxEEEE.<br>Answer the following:<br>(i) Find the checksum at the sender site.<br>(ii) Find the checksum at the receiver site if there is no error.<br>(iii) Find the checksum at the receiver site if the second data item is changed to OxABCE.<br>(iv) Find the checksum at the receiver site if the second data item is changed to OxABCE and the third data item is changed to Ox02BA. | 4 |
| | (d) | Difference between error detection and error correction. | 2 |
| 6. | (a) | Define network layer. Explain the functions of the network layer. | 3 |
| | (b) | What are the propagation time and the transmission time for a 2.5-kbyte message (an e-mail) if the bandwidth of the network is 1 Gbps? Assume that the distance between the sender and the receiver is 12,000 km and that light travels at $2.4 \times 10^8$mls. | 3 |
| | (c) | Why do engineers use the decibel to measure the strength of a signal? | 2 |
| | (d) | How are OSI and ISO related to each other? | 2 |
| 7. | (a) | Define spread spectrum and its goal. Discuss the two spread spectrum techniques. | 4 |
| | (b) | Describe about supernetting. Why do we need superneeting? | 3 |
| | (c) | Explain the process of error detection in block coding method. | 3 |
| 8. | (a) | Define error. How does a single-bit error differ from a burst error? | 1+2 |
| | (b) | What is the Hamming distance? What is the minimum Hamming distance?<br>Find the minimum Hamming distance of the coding scheme in the following table | 3 |

| Data words | Code words |
|---|---|
| 00 | 000 |
| 01 | 011 |
| 10 | 101 |
| 11 | 110 |

| | | | |
|---|---|---|---|
| | (c) | Explain three types of transmission impairment. | 2 |
| | (d) | How do guided media differ from unguided media? | 2 |
| 9. | (a) | Define subnetting, subnet & subnet mask. | 3 |
| | (b) | Write down the advantage & disadvantage of subnetting. | 3 |
| | (c) | To simplify the handling of addresses, the Internet authorities impose three restrictions on classless address blocks. Explain your answer with an example. | 4 |

$1 \times 10^9$ bps

1FFFD

**Department of Information and Communication Engineering**
Noakhali Science and Technology University
Term Final Examination, 2022
Year: 2, Term: II, Session: 2019-2020

**Course Code: ICE-2201** Course Title: Programming with Java
Time: 4 Hours Marks: 70

**Answer any seven of the following questions.**

| | | | Marks |
|---|---|---|---|
| 1. | (a) | What is Bytecode in Java? How Java achieved platform independency? | 3 |
| | (b) | Differentiate among JVM, JRE and JDK. | 3 |
| | (c) | How is Java more secured than others languages? | 2 |
| | (d) | Define WORE. How does the 'instanceof' operator work in Java? | 2 |
| 2. | (a) | Why JDBC is more convenient to use? | 2 |
| | (b) | What do you understand by a JDBC driver? How many JDBC drivers are available to work in heterogeneous environment? | 3 |
| | (c) | Illustrate JDBC architecture with proper diagram. | 3 |
| | (d) | If you have different types of databases, then how you can connect JDBC to non-conventional databases? | 2 |
| 3. | (a) | What is Guarding Statement? Why is it required in programming? | 3 |
| | (b) | Write down the uses of super, this and static keywords in Java programming. | 3 |
| | (c) | "**String** objects are immutable"- Explain the statement. Do you think this immutability is a restriction of **String** class? And Why? | 4 |
| 4. | (a) | Why should use **finalize** method and **final** keyword in Java? | 2 |
| | (b) | What are command line arguments? How are they useful? | 3 |
| | (c) | Briefly describe overloading of Vararg methods with proper example. Draw an ambiguous call to an overloaded varargs method and mention the solution of it. | 5 |
| 5. | (a) | Mention the advantages and disadvantages of Java Multithreading. | 3 |
| | (b) | Describe the complete life cycle with states of a Thread in Java. | 3 |
| | (c) | Differentiate between suspending and stopping a thread. | 2 |
| | (d) | Write down the uses of **yield()**, **sleep()**, **interrupt()** and **destroy()** methods in Java thread. | 2 |
| 6. | (a) | What is difference between **paint** and **repaint** in Java Swing? | 2 |
| | (b) | Why Swing components are called lightweight components? Does Swing is thread safe? | 3 |
| | (c) | Discuss the benefits of Swing over AWT? | 3 |
| | (d) | Find the value of A[1] after execution of the following program. | 2 |

```
int[] A = {0,2,4,1,3};
for(inti = 0; i<a.length; i++){
    a[i] = a[(a[i] + 3) % a.length];
}
```

| | | | |
|---|---|---|---|
| 7. | (a) | Can interface be extended in java? | 1 |
| | (b) | What are the similarities and differences between interfaces and classes? | 2 |
| | (c) | How do we tell Java that the class we are creating implements a particular interface? | 2 |
| | (d) | Describe the various forms of implementing interfaces. Give examples of Java code for each case. | 5 |

8. (a) Define applet. Is applets in Java are mandatory? If (yes/no) then support your answer with proper reasoning. 3

(b) Show Applet architecture. 2

(c) Write the process for invoking an Applet and explain the following code with output. 3

```
<html>
<title>The Hello, World Applet</title>
<hr>
<appletcode = "HelloWorldApplet.class" width="320" height="120">
    If your browser was Java-enabled, a "Hello, World"
    message would appear here.
</applet><hr></html>
```

(d) What is wrapper class? Where you can use it? 2

loading

9. (a) Show the differences between overriding method and over~~ridden~~ method with an appropriate example. 3

(b) What will be the output of following code? 2

```
class Animal{
  public void move(){System.out.println("Animals can move");  } }
class Dog extends Animal{
  public void move(){System.out.println("Dogs can walk and run");  } }
public class TestDog{
public static void main(Stringargs[]){
Animal a = new Animal();
Animal b = new Dog();
a.move();   b.move();}
```

(c) If unchecked exception occurred then whose responsibility is to take care of it? Explain with an example. 3

(d) How FileNotFoundException and ArrayIndexOutofBound exception occurs then how can you handle them? Show with try-catch-finally statement. 2

# Department of Information and Communication Engineering

Noakhali Science and Technology University
B.Sc. (Honors); Term Final Examination, Dec'22
Year-2, Term-II; Session: 2019-2020
Course Code: **MATH-2211**; Course Title: **Laplace, Fourier series and Complex Variables**

Time: **4 Hours** | Marks: 70

(Answer any **Seven** of the following. The right-hand margin indicates full marks)

| | | |
|---|---|---|
| 1(a) | Define Laplace transform. Find the Laplace transform of the following functions: (i) $F(t) = t\sin t$ (ii) $F(t) = t\cos at$ | 4 |
| 1(b) | Find the Laplace transform of the functions $F(t)$, where $F(t) = \begin{cases} \cos\left(t - \frac{2\pi}{3}\right), & t > \frac{2\pi}{3} \\ 0, & t < \frac{2\pi}{3} \end{cases}$ | 3 |
| 1(c) | If $\mathcal{L}\{F(t)\} = f(s)$, then $\mathcal{L}\{F''(t)\} = s^2 f(s) - sF(0) - F'(0)$. | 3 |
| | | |
| 2(a) | Prove that $\mathcal{L}\left\{\frac{\cos at - \cos bt}{t}\right\} = \frac{1}{2}\log\left(\frac{s^2+b^2}{s^2+a^2}\right)$. | 5 |
| 2(b) | Find the inverse Laplace transform of $\frac{2s^2-6s+5}{s^3-6s^2+11s-6}$. | 5 |
| | | |
| 3(a) | By using convolution theorem evaluate $\mathcal{L}^{-1}\left\{\frac{1}{s^2(s+1)^2}\right\}$. | 5 |
| 3(b) | Solve the following differential equation by using the Laplace transform: $Y''(t) + Y(t) = t; Y(0) = 1, Y'(0) = -2$ | 5 |
| | | |
| 4(a) | The function $x^2$ is periodic with period $2l$ on the interval $[-l, l]$. Find its Fourier series. | 5 |
| 4(b) | Prove that $\int_0^\infty \frac{x\sin mx}{x^2+1}dx = \frac{\pi}{2}e^{-m}, m > 0$. | 5 |
| | | |
| 5(a) | Define Fourier Series with Dirichlet's conditions. Find the Fourier series for $f(x) = e^x$ in the interval $-\pi < x < \pi$ | 4 |
| 5(b) | Find the Fourier expansion expansion of $f(x) = \begin{cases} 0, -\pi < x < 0 \\ x, 0 < x < \pi \end{cases}$. Hence evaluate the sum $\sum_{n=1}^{\infty}\frac{1}{(2n-1)^2}$. | 6 |
| | | |
| 6(a) | Find the modulus and principal argument of the following complex numbers: i. $\frac{\sqrt{3}+i}{\sqrt{3}-i}$ ii. $\left(\frac{1+\sqrt{3}i}{1-\sqrt{3}i}\right)^2$. | 5 |
| 6(b) | Describe the following region geometrically $\lvert z + 2 - 3i\rvert + \lvert z - 2 + 3i\rvert < 10$. | 5 |
| | | |
| 7(a) | Define a complex number. Prove that $\lvert z_1 + z_2\rvert^2 + \lvert z_1 - z_2\rvert^2 = 2\{\lvert z_1\rvert^2 + \lvert z_2\rvert^2\}$. | |
| 7(b) | Define analytic and harmonic function with examples. | 2 |
| 7(c) | Prove that a (i) necessary and (ii) sufficient condition that $w = f(z) = u(x,y) + iv(x,y)$ be analytic in a region $\mathbb{R}$ in that the Cauchy-Riemann equations $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}$, $\frac{\partial u}{\partial y} = -\left\lvert\frac{\partial v}{\partial x}\right\rvert$ are satisfied in $\mathbb{R}$ where it is supposed that these partial derivatives are continuous. | 4 |
| | | |

$n^3 - 3.n^2.2 + 3n.2^2 - 2^3 + 12$

8 -14

| | | |
|---|---|---|
| 8(a) | Find a function $v$ such that $f(z) = u + iv$ is analytic and express it in terms of $z$, if $u = 3x^2y + 2x^2 - y^3 - 2y^2$. | 5 |
| 8(b) | Evaluate $\int_0^{1+i} (z^2 + z)\, dz$. By two different paths of integration, show that the results are the same. | 5 |
| | | |
| 9(a) | Find the value of $\oint_C \frac{e^{-iz}}{(z+3)(z-i)^2} dz$, $C = \{z: z = 1 + 2e^{i\theta}, 0 \le \theta \le 2\pi\}$ by using Cauchy's residue theorem. | 5 |
| 9(b) | Evaluate the integral $\int_0^{2\pi} \frac{d\theta}{5+4\cos\theta}$ by contour integration (use a unit circle as a contour). | 5 |

$a^2 - b^2$
$(6i)^2$
$-36$

*Department of Information and Communication Engineering*

*Noakhali Science and Technology University*

*Term Final Examination, 2022*

*Year: 2, Term: II, Session: 2019-2020*

**Course Code: ICE-2205** | *Course Title: Algorithm Design and Analysis*

*Time: 4 Hours* | *Marks: 70*

**Answer any seven of the following questions.**

Marks

1. (a) Designing an algorithm is necessary to solve a problem efficiently- do you agree? Why should we perform analysis of algorithms? 3
   (b) There are different notations that are used to describe time and space complexity of algorithms. Define those notations. Write any algorithm of your choice, and find those notations of that algorithm for running time and space. 6
   (c) If an algorithm requires a constant amount of time no matter what the number of input is, then what will be its $\Theta$ notation? 1

2. (a) Explain what does "Order of Growth" of an algorithm mean. 3
   (b) Write the following two sorting algorithms and analyze them to find the Big O, Theta ($\Theta$) and Big $\Omega$ notations of those algorithms. 2+2+3
   i) Selection Sort    ii) Insertion Sort
   You must explain how you have got them. Form the analysis, which one is better in your opinion?

3. (a) Illustrate Induction algorithm design technique with example. 3
   (b) In Radix sort, induction is applied on number of digits, not on the numbers- explain this. Write the algorithm of Radix sort technique and analyze it for time and space complexity. 7

4. (a) Explain the "Divide and conquer" algorithm design technique. Write an algorithm that can perfectly illustrate this design technique. Show how these algorithms can be analyzed by presenting an analysis of your written algorithm. 2+3+2
   (b) Perform the average case analysis of Quick sort algorithm. 3

5. (a) "Greedy approach for solving problems cannot give optimal solutions in all cases"- why is that? 2
   (b) Write Kruskal's algorithm and show its correctness, or in other words, prove that this algorithm can actually find the minimum cost spanning tree from a given connected graph. Find also its time and space complexity. 3+2+2
   (c) Greedy algorithms are fast- do you agree? Why? 1

6. (a) Write and explain the following two graph traversal algorithms: 10
   i) Depth-first search    ii) Breadth-first search
   Analyze the algorithms to obtain different notations for time and space.

E, gv

7. a) Briefly describe Algorithms with appropriate examples. List down the properties of an algorithm. 5
   b) Define recurrences. Explain the methods to solve the recurrence relations. 5

8. a) Find out the minimum number of coins by showing a table using dynamic programming to make changes given amount using given coins. **Coins**= {1, 5, 6} and **Amount**= 8, where the coin supply is infinite. 5
   b) Find the minimum Spanning Tree by showing step by step from the following graph in **Figure 01** using Prim's algorithm. 5

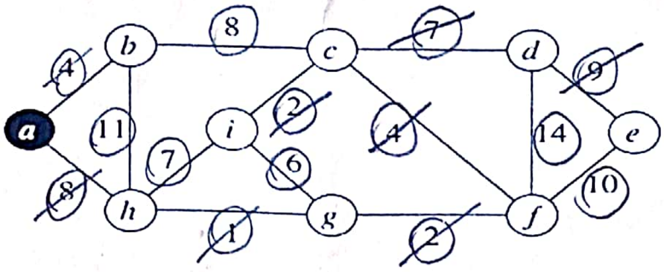


**Figure 01**

9. a) Write down the differences for the following terms: 4

   I. Kruskal vs. Prim's Algorithm

   II. Dijkstra's vs Bellman Ford Algorithm

   b) Find the shortest path using Dijkstra's algorithm showing the path in each step for the following graph in **Figure 02.** 6

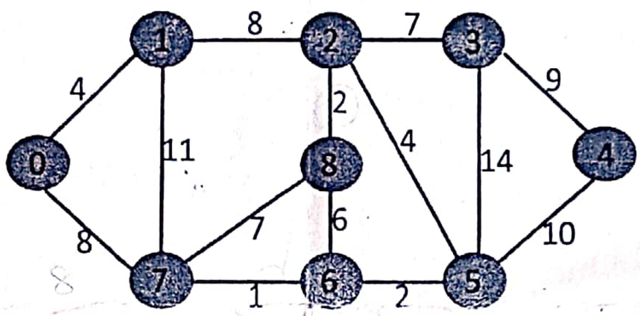


**Figure 02**

input
output
finite
defines
Effects

O(d*n)

array size

Digit of maximum value

*Noakhali Science and Technology University*
*Department of Information and Communication Engineering*
*Year 2, Term 2, Session: 2019-20, B.Sc. (Engg.), Final Examination 2022*
*Course Code: ICE 2209, Course Title: Electromagnetic fields and waves*
*Time: 3 hours, Total Marks: 70*
*[Answer any seven of the following questions. Figures in the right margin indicate full marks]*

1.a) Why electromagnetic field theory is vital for wireless communication? Given three vectors M, N and O, Prove the following relation for scalar triple products 2+4
M.(N×O) =N.(O×M) =O.(M×N)
b) If A= $5a_x$-$2a_y$ +$a_z$ , B= $-3a_x$+$4a_z$ ; 4
Find the value for i) A×B ii) A.B iii) $a_A$ iv) $\theta_{AB}$

2.a) Assuming a vector field expressed in cylindrical coordinates to be 5
$A = a_r$ (4 cosΦ) -$a_\Phi$ 4r +$a_z$ z,
i) What is the field at the point P (5, 50°, 5)?
ii) Represent the field $A_p$ at P in cartesian coordinates.
b) What is divergence? Interpret divergence from the flow of an incompressible fluid. 1+4

3.a) What really Stoke's theorem measures? Write the metric coefficients of three basic orthogonal coordinate system. 5
b) Two charges of equal magnitude and positive sign placed at a distance 2a apart. Show that E at a point x on the perpendicular bisector of the line joining the two charges at a distance is : $E = \frac{2q}{4\pi\varepsilon r^2}$ assuming r >> a. 5

4.a) Share your understanding of Capacitance (C), Dielectric constant (k), Gaussian surface area (A), electric Polarization (P), and dielectric Displacement (D). 5
b) A spherical capacitors capacitance depends only on geometrical factors. Do you agree? If yes show the mathematical proof for this. 5

5.a) Which law disapproves the presence of magnetic monopole? Show that self-inductance of a circular coil, L = ($\pi\mu N^2$ r)/2. 1+4
b) How will you measure the flux of an electric field? Calculate the torque equation for a dipole placed in an electric field. 1+4

6.a) Show a process to calculate magnetic induction (B). Deduce Amperes law for the symmetric current distribution? 2+3
b) How ampere's law Biot Savart law differs? Apply Amperes law to calculate L in an N turns solenoid coil of unit length, 1 and carrying a current, i. 1+4

7.a) State Gauss's law for magnetism. Calculate the total inductance per unit length for a coaxial transmission line. 1+4
b) Define the field vectors B, D, E, and H? Write down four Maxwell equations in differential and integral form and explain their word statement in your understanding. 2+3

8.a) Differentiate between homogeneous and isotropic medium? Suppose a boundary surface stays in between two media, show that tangential component of magnetic field is continuous at boundary. 2+4

b) Point out the condition for a uniform plane wave? What is the benefit of expressing maxwell equations in phasor (frequency domain) form? 4

9.a) Show that free space wave equation for a nonconducting medium is a second order differential equation of E or H field vector. 3

b) Elaborate Poynting's theorem. 4

c) Define TE,TM and TEM wave. 3

Noakhali Science and Technology University

Department of Information and Communication Engineering

Term Final Examination -2022

**Course Code:** ICE-2207 **Course Title:** Database Management System

**Session:** 2019-2020 **Semester:** 2nd Year 2nd Semester

**Total Marks:** 70 **Time:** 04 Hours

*Answer any seven of the following questions.*

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1. a) What is database management system? Discuss the significant application of database management systems. **1+2**

   b) Explain the advantages of database system over file processing system. **3**

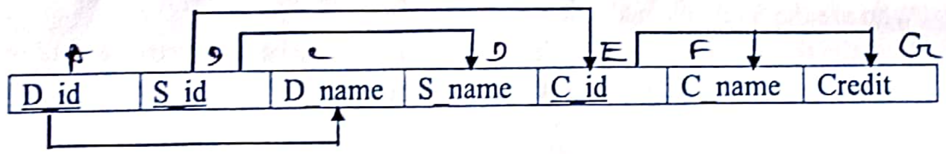
   c) What is the concept of physical data independence and its importance in database systems? **2**

   d) Discuss the level of database abstraction. **2**

2. a) Explain the following with example: **4**
      i) Primary key
      ii) Candidate key
      iii) Super key and
      iv) Foreign key.

   b) Distinguish between having and where clause in SQL **2**

   c) Using normalization process to decompose the relation up to BCNF. Also elaborate all the outputs. **4**




3. a) Define E-R model. Describe the basic concepts of ER model with appropriate example. **1+3**

   b) Explain all the types of mapping cardinality that are useful in describing binary relationship sets. **4**

   c) Compare between the complex attribute and derived attribute. **2**

4. a) Briefly describe the database design issues with example. Also explain how you can minimize those issues. **6**

   b) The main entities of the ICE Library Management system for the Entity-Relationship Model is Student (name, s_id, address, mobile_no, date_of_birth, age), Book (book_id, book_name, author, book_price) each entity must have one primary key, the attribute name is complex, the attribute address is composite, the attribute mobile_no is multi-valued, the attribute date_of_birth is stored and the attribute age is derived etc. From the above description construct the E-R diagram using Chen notation. **4**

5. a) Define UML. Briefly explain different types of UML diagram. **1+2**

   b) Using Chen and Crows feet notation, draw all the alternative ER notations. **3**

c) Consider a relation scheme R=(A,B,C,D,E,H) on which the following functional dependency hold: {A→B, BC→D, E→C, D→A}. Identify the candidate keys of R. 4

6. a) Explain the following: 2
   i) 2-phase locking
   ii) Time-stamp ordering

b) Apply the serializability technique(s) to prove whether the following schedule is serializable or not. 3

| $T_1$ | $T_2$ |
|---|---|
| read(A) | |
| write(A) | |
| | read(B) |
| read(A) | |
| | write(A) |
| | read(B) |

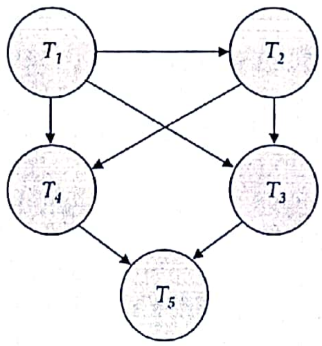
c) Explain various types of failure that may occur in a system and also write the basic recovery concept. 2

d) List the ACID properties. Explain the usefulness of each. 3

7. a) Differentiate between Instances and Schemas with example. 3
   b) Who are the Sophisticated Users? 1
   c) Explain the users of a database system who can access or retrieve data on demand using the applications and interfaces provided by the DBMS. 6

8. a) Why do we need snapshot isolation in concurrent transactions? 2
   b) Explain the terms **phantom phenomenon and predicate locking** for transactions as SQL statements. 4

c) Consider the following graph of figure. Is the corresponding schedule conflict serializable? Explain your answer. 4




9. a) What is a cascadeless schedule? Why is cascadelessness of schedules desirable? 3

b) Are there any circumstances under which it would be desirable to allow noncascadeless schedules? Explain your answer. 2

c) Consider the following two transactions: 5

$T1$: read($A$);
read($B$);
**if** $A = 0$ **then** $B := B + 1$;
write($B$).
$T2$: read($B$);
read($A$);
**if** $B = 0$ **then** $A := A + 1$;
write($A$).

Add lock and unlock instructions to transactions $T1$ and $T2$, so that they observe the two-phase locking protocol. Can the execution of these transactions result in a deadlock?