

- N.B. (i) Answer any SIX questions taking any THREE from each section.
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SECTION : A

- Q.1 (a) Find out which types of data is, of the followings: 4
 i) Number of shares sold each day in the stock market.
 ii) Lifetimes of television tubes produced by a company.
 iii) Yearly income of college professors.
 iv) Lengths of 1000 bolts produced in a factory.
- (b) Which things are need to consider when choosing a data collection method for statistical analysis? What are the differences between observational and experimental data collection technique? 4
- (c) Define the followings: 4
 i) Response variable
 ii) Explanatory variable
 iii) Confounding variable
 What is the relation between Response variable and Explanatory variable?
- Q.2 (a) What do you mean by measures of dispersion? Write the advantages and disadvantages of the following measure of dispersion: 5
 i) Range ii) Inter-quartile range iii) Standard deviation.
- (b) Derive the formula to find the skewness and kurtosis of the distribution. 4
- (c) Show graphically the approximate position of mean, median and mode when the distribution is i) negatively skewed, ii) positively skewed and iii) symmetrical. 3
- Q.3 (a) Suppose the marks of 30 students of a subject are as follows – 8
 30 35 45 65 70 39 46 55 30 45 70 40 46 55 38 36 53 43 47 53
 63 65 60 45 55 57 65 45 55 80
- i) Find the five-number summary of data.
 ii) Draw a box-and-whisker diagram.
 iii) Construct an ordered stem-and-leaf displays.
 iv) Find the 90th percentile.
- (b) What do you mean by outlier? How can you find outlier from a set of data? Explain with an example. 4
- Q.4 (a) Define probability. If A and B are any two events, then prove 5

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$
- (b) What do you mean by conditional probability? Explain independent events with example. 3
- (c) Let A and B be two events. 5
 i) If the events A and B are mutually exclusive, are A and B always independent? If the answer is no, can they ever be independent? Explain.
 ii) If $A \subset B$, can A and B ever be independent? Explain

SECTION : B

- Q.5 (a) A continuous random variable X having values only between 0 and 4 has a density function given by $P(X) = \frac{1}{2} - aX$, where a is a constant. 4
 i) Calculate a. $\frac{1}{8}$
 ii) Find $\Pr\{1 < X < 2\}$. $\frac{5}{16}$
- (b) When are events A, B and C called mutually independent? Flip an unbiased coin five independent times; compute the probability of three heads occurring in the five trials. 4
- (c) Let X is the number of the accidents per week in a factory. Let, the pmf of X be 4

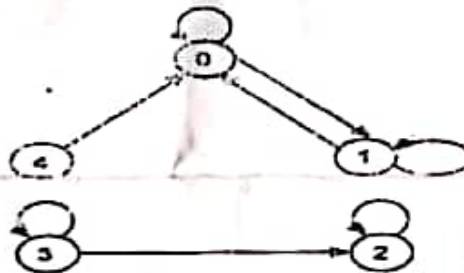
$$f(x) = \frac{1}{(x+1)(x+2)} = \frac{1}{x+1} - \frac{1}{x+2}, \quad x = 0, 1, 2$$

Find the conditional probability of $x \geq 4$, given that $x \geq 1$.

- Q.6. (a) Find the mean and variance for the following distributions: 4
- i) $f(x) = \frac{4!}{x!(4-x)!} \left(\frac{1}{2}\right)^4$, $x = 0, 1, 2, 3$
- ii) $f(x) = \frac{2x-1}{16}$, $x = 1, 2, 3, 4$
- (b) A random variable X has a binomial distribution with mean 6 and variance 3.6. Find $P(X=4)$. 3
- (c) What do you mean by moment generating function? Find the moment generating function of normal distribution and find the mean and variance from the moment generating function. 5

- Q.7. (a) What is stochastic process? Explain each type of stochastic processes with examples. 4
- (b) A meteorologist studying the weather in a region decides to classify each day as simply sunny or cloudy. After analyzing several years of weather records, he finds: 4
- The day after a sunny day is sunny 80% of the time, and cloudy 20% of the time.
 - The day after a cloudy day is sunny 60% of the time, and cloudy 40% of the time.
- Now, setup a Markov chain to model this process. Find the probability that it will still be sunny in 4 days, given that it is sunny today? ✓
- (c) What is memory-less property? What do you mean by transition probability? How can you find 1-step transition probability? 4

- Q.8. (a) Describe the components of a Queuing system. 4
- (b) What are the mitigating effects of long queue? Explain. 4
- (c) What is the transition matrix of the following graph? Find out recurrent class and transient class of the graph. 4



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SECTION : A

- Q.1. (a) Define microprocessor. Describe the architecture of 8086, with neat block diagram. 6
 (b) Explain the significance of the following pins of 8086: 4
 i) INTR, ii) NMI, iii) RESET, iv) TEST 2
 (c) Explain the physical address formation in 8086. 2
- Q.2. (a) A memory location has physical address 80ED2h. In what segment does it have offset BED2h? 3
 (b) How does BIOS load operating system when PC is powered up? 4
 (c) Write down the legal combinations of operands for MOV and XCHG operation. 5
- Q.3. (a) If CS = 1000H, DS = 25A0H, SS = 3210H, ES = 5890H, BX = 43A9H, BP = 3400H, find the physical address of the source data for the following instructions: 4
 i) MOV AL, [BX + 1200H]
 ii) ADD BL, [BP + 05]
 (b) What is PSP? What is the purpose of using it? Explain with example. 3
 (c) Write an assembly language program to convert a 4 digit BCD number into hexadecimal number. 5
- Q.4. (a) With appropriate block diagram discuss the process of solving a DMA request. 5
 (b) Describe the following DMA operations: 5
 i) Cycle stealing
 ii) Block transfer
 (c) Distinguish between minimum and maximum mode of a microprocessor. 2

SEC : B

- Q.5. (a) What is the protected mode of a CPU that uses 8086 microprocessor? 4
 (b) Discuss the purpose of using co-processor. 2
 (c) Draw the block-diagram of 8087 co-processor. 5
 (d) What is the purpose of INTR pin in 8086 microprocessors? 1
- Q.6. (a) Suppose AX, BX contains some set of bits. Write necessary instructions in assembly language to perform multiplication of the contents of AX and BX and store the result into DX. 7
 (b) What will be the content of register AX after following instructions: 5
 MOV AX, F0EH
 MOV CL, 03
 ROR AX, CL
- Q.7. (a) Write an assembly language program that will take a binary number as input and count every pairs of 11 found in the input. 6
 (b) Sketch the content of stack memory indicating the value of SP register before PUSH BX operation and after the PUSH BX operation and POP BX operation. Assume SS = 2500H, BX = 432AH and SP = 1000H. 4
 (c) What is main difference between CISC and RISC architecture? 2
- Q.8. (a) Write a program to find the substring "CSE" from the string "HELLOWCSEUET". 5
 (b) What is the difference between procedure and macro? Write a macro that will find the logical NAND value of two operands. 4
 (c) Explain register indirect addressing mode with example. 3

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SECTION : A

Marks

- Q.1. (a) Define software. Write down the characteristics of software. 4
 (b) What types of changes are encountered during the support phase of software engineering? Explain briefly. 4
 (c) Suppose for share market software, the line of code is 85,000 and the effort in person month is 12. Then find out the duration in months for developing this software using software equation. 4
- Q.2. (a) Consider that you have the responsibility to choose the software process model of a software team. The team must deliver a product within 30-90 days. Which model(s) are you going to choose and why? What are the advantages and disadvantages of the model? 4
 (b) Define test driven development and feature driven development. Write down two advantages and disadvantages of both. 4
 (c) Distinguish between the following terms- 4
 (i) Customer and end user.
 (ii) Software engineering and System engineering.

- Q.3. (a) What is cost of quality? Write down and explain various cost of quality. 4
 (b) Consider the following information where the weighting factors of a particular measurement is marked by underline. 4

Measurement parameters	Count	Weight factor		
		Simple	Average	Complex
Number of inputs	26	<u>03</u>	05	07
Number of outputs	30	<u>04</u>	06	08
Number of inquiries	14	04	<u>05</u>	06
Number of files	08	04	<u>07</u>	10
Number of external files	06	03	07	<u>11</u>

And consider the associated factors with the following values.

Factors	Value
Backup & Recovery	03
Data communication	05
Distributed processing functions	04
Online data entry	05
Critical performance	04

Now estimate the FP for this project. If productivity is 30 FP/person-month, number of defects is 35 and pages of documentation is 438 then find out the required time to complete the project (in month), quality and documentation metrics of this project.

- (c) Write down the possible steps that can be taken to mitigate high staff turnover in a software project. 4

- Q.4. (a) Consider development of a library management software where the number of module and line of code estimation for each module is given below- 4

Module no	Name	Optimistic	Pessimistic	Most likely
		LOC estimation	LOC estimation	LOC estimation
1	User interface	2400	3800	3100
2	Database management	3000	3900	3400
3	Report generation	1800	2800	2300

Now, you want to complete the software development with 5 person-month at a cost of \$1000 per month. Evaluate total estimated LOC along with required productivity and cost per LOC.

- (b) What is reusable software resource? Explain different types of reusable software resources. 4
- (c) What is software scope? State and explain the questions that are used to determine the scope of a software. 4

SECTION : B

- Q.5. (a) How can you tell if a software is testable or not? 5
- (b) What is black box testing and white box testing? 3
- (c) Draw the flow graph notation for the following statements, 4
- If
 - while
 - do...while
 - switch
- Q.6. (a) A software is not a product that is built overnight. Some issues should be considered to implement a software successfully. What are those issues and how they impact development of software? 4
- (b) What is debugging? Discuss different type of debugging approaches. 4
- (c) What is equivalence partitioning? How can you define equivalence classes? 4
- Q.7. (a) What is software quality? Briefly explain from different views. 4
- (b) Briefly explain the following testing strategies- 4
- Smoke testing
 - Regression testing.
- (c) A software development company "RUET CSE IT LTD", gets the contract to implement a software that automates the account section of RUET. After the successful implementation the company thinks of testing the software. What testing strategies should they consider and why? 4
- Q.8. (a) What is pascal case and camel case? 3
- (b) What is system? Discuss the system engineering hierarchy. 3
- (c) Suppose, you are implementing a software using the spiral model for software processing. The different phase requires different testing strategy. Which testing strategy should be used in different steps? Briefly explain to justify your answer. 3
- (d) What are the restraining factors that an engineer should consider while designing a system? 3

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SECTION : A

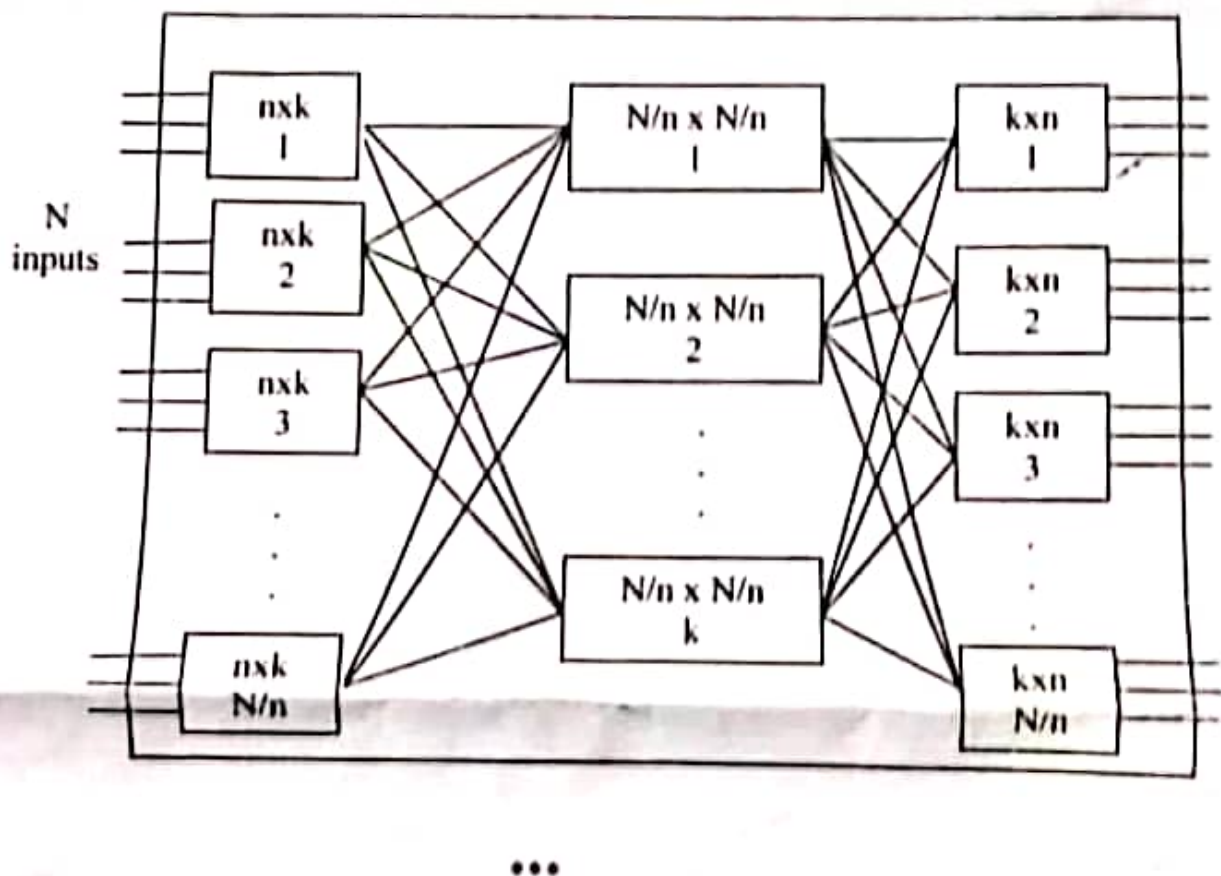
- Q.1. (a) Explain STAR, BUS and RING topologies in detail with examples. 4
 (b) Describe in detail broadband transmission with modulation of digital signal. 4
 (c) Describe different types of transmission impairments that can effect wired transmission. 4
- Q.2. (a) Consider a signal 10101011. Draw timing diagrams for RZ, Manchester and differential Manchester schemes. 3
 (b) If you encode a long series of one's using unipolar signaling, then what type of problems may occur in digital transmission? How this problem can be solved? 6
 (c) A file contains 3 million bytes. How long does it take to download this file using a 100Kbps channel and 10 Mbps channel? 3
- Q.3. (a) What does the Shanon capacity have to do with communication? 4
 (b) A signal has a bandwidth of 10MHz. The signal is sampled, quantized and binary coded to obtain a pulse-code modulation (PCM) signal. The signal is sampled at the Nyquist rate. 8
 (i). What is the Nyquist rate?
 (ii). If the samples are to be encoded into 120 levels, what is the number of binary pulses (bits) required to encode each sample?
 (iii). Based on your answer to part (i) and part (ii), what is the minimum binary pulse rate (bit per second) of the binary coded signal?
 (iv). Using the knowledge that 2 bits can be transmitted per second over a 1 Hz bandwidth, determine the minimum transmission bandwidth B_t that can be used to successfully transmit the signal.
- Q.4. (a) What is the total delay (latency) for a frame of size 10 million bits that is being sent on a link with 15 routers each having a queuing time of $2\mu s$ and processing time of $1\mu s$. The length of the link is 3000 Km. The speed of light inside the link is $2 \times 10^8 \text{ ms}^{-1}$. The link has a bandwidth of 6 Mbps. Which component of the total delay is dominant? Which one is negligible? 4
 (b) Compare and contrast PCM and DM. 4
 (c) Define DC component, baseline wandering and their effect on digital transmission. 4

SECTION : B

- Q.5. (a) Can FDM send digital signal? Justify your answer. 2
 (b) Define spread spectrum and its goal. Describe the two spread spectrum techniques. 4
 (c) Ten sources, seven with a bit rate of 250 Kbps and three with a bit rate of 400 Kbps are to be combined using multilevel TDM with no synchronizing bits. Answer the following questions about the final stage of the multiplexing: 6
 (i). What is the size of a frame in bits?
 (ii). What is the frame rate?
 (iii). What is the duration of a frame?
- Q.6. (a) Name the advantages of optical fiber over twisted-pair and coaxial cable. 4
 (b) Is the transmission medium a part of the physical layer? Why or why not? 2
 (c) What is the form of the signal in twisted-pair cable and coaxial cable? How does this differ from the signal in fiber optic cable? 3
 (d) How does sky propagation differ from line-of-sight propagation? 3
- Q.7. (a) Explain with a diagram, Frequency Shift Keying and obtain the relation for baud and minimum bandwidth. 4
 (b) Explain HDB3 technique with example. 5
 (c) What is the bit rate for each of the following signals? 3
 (i). A signal in which 2 bits lasts 0.001s
 (ii). A signal in which 5 bits lasts 4 ms

(iii). A signal in which 15 bits last 20 μ s

- Q.8. (a) What is the role of the address field in a packet traveling through a virtual circuit network? 2
- (b) Two channel, one with a bit rate of 190 Kbps and another with a bit rate 180 Kbps are to be multiplexed using a pulse stuffing TDM with no synchronization bits. Answer the following questions: 4
- What is the size of a frame in bits?
 - What is the frame rate?
 - What is the duration of a frame?
 - What is the data rate?
- (c) Explain why the switch is called a concentrator when $n > k$. Under what traffic condition is this switch appropriate? 2
- (d) Consider the multistage switch in the following figure with $N = 16$, $n = 4$, $k = 2$. What is the maximum number of connections that can be supported at any given time? Draw the figure. 4



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SECTION : A

- Q.1. (a) What is database management system? Describe at least four differences between a file processing system and a database management system. 4
 (b) Describe the levels of data abstraction in database management system with suitable diagram. 3
 (c) Consider the following database schema: 5
 Student(Roll_No, Name, Dept_Name, CGPA)
 Course(Course_No, Course_Title, Credit)
 Std_Marks(Roll_No, Course_No, Marks)
 Dept(Dept_Name, Office_Telephone, Head_of_Dept)
 Now determine which of the following attribute sets can be specified as super key, primary key, foreign key.
 (i). {Dept_Name} in student relation
 (ii). {Dept_Name, Office_Telephone} in Dept relation
 (iii). {Course_No} in Std_Marks relation
 (iv). {Course_No, Roll_No} in Std_Marks relation
 (v). {Course_Title} in Course relation.

- Q.2. (a) Define ER model. Describe the scenario with appropriate figure for the placement of relationship attribute for one-to-one, one-to-many, many-to-one and many-to-many relationship. 4
 (b) Explain the differences between strong entity set and weak entity set with appropriate examples for each. 4
 (c) Differentiate among the following terms with suitable examples: 4
 (i). Inner join, Left outer join, Right outer join
 (ii). Relation and Tuple

- Q.3. (a) Define the following terms with proper example: 4
 (i). Derived Attribute,
 (ii). Multivalued Attribute
 (iii). Descriptive Attribute
 (b) Consider the following DB schema: 8
 Book(ISBN, Book_Name, Genre, Language)
 Publisher(Publisher_ID, Name, Country)
 Book_Publisher_Relationship(Publisher_ID, ISBN, Price, No_Of_Pages)
 [N.B: ISBN → International Standard Book Number]
 Now represent the following queries in SQL:
 (i). Find the ISBN, name and genre of all the books that are written in Bengali.
 (ii). Find the name and genre of all the books that contain the term "Rahasya" in their name.
 (iii). Find all the book genres and the number of books in each genre.
 (iv). Find the name, genre and price of the most expensive book.
 (v). Find the name, genre and price of the most expensive book in each genre.

- Q.4. (a) Specify the difference between the following terms with proper example: (i) char(50) and varchar(50), (ii) Natural join and outer join. 5
 (b) What are the ACID properties of database transactions? 2
 (c) What do you mean by 'Atomic transaction'? What is the advantage of atomicity in DBMS? 3
 (d) What should be done to ensure atomicity of a transaction? 2

- Q.5. (a) Define transaction. Consider the following schedule. Determine whether they are conflict serializable or not. 4

T ₁	T ₂
read(A); A:=A+10;	read(A);


```

write(A);
read(B);
B:=B-10;
write(B);

```

```

A:=A-100;
write(A);
read(B);

```

```

B:=B+100;
write(B);

```

- (b) What is the difference between serial schedule and serializable schedule? How to determine, if two transactions T_1 and T_2 are conflicting. 4
- (c) Describe the two phase locking protocol with appropriate example. Why is it important? 4

- Q.6. (a) Consider the following DB schema: 8

Author(Author_ID, Author_Name, Birth_Year, Contact_No, No_of_Books, No_of_Awards)

Book(ISBN, Book_Name, Price, No_of_Pages)

Character_from_Book(Character_ID, Character_Name, Age, Address)

AuthorBookRelationship(ISBN, Author_ID)

BookCharacterRelationship(ISBN, Character_ID)

[N.B: ISBN \rightarrow International Standard Book Number]

Now write an expression in relational algebra for each of the following queries:

- Find the birth year and number of books of Rabindranath Thakur.
 - Find the name, age and address of all the book-characters who are not teenagers.
 - Find the number of books written by an author in average.
 - Find the name and price of the most expensive book.
 - Find the name and price of all the books written by satyajit Roy.
- (b) Construct the E-R diagram of the database from this DB schema. 4

- Q.7. (a) Define database trigger. Write down the syntax of creating database trigger. Why is it important? 4
- (b) Describe the advantages of PL/SQL over SQL. Write down a PL/SQL code block for inverting an integer number. 4
- (c) Define stored procedure. Create a stored procedure to check the total deposited amount to an account when the account_id is supplied from outside. 4

- Q.8. (a) What is the significance of view in database system? 2

- (b) Determine which of the following views are not updateable and why: 6

- Create View AuthorView as (Select Author_Name, 2019-Birth_Year as Age, No_of_Books from Author);
- Create View AuthorView2 as (Select Author_Name, Birth_Year, No_of_Books from Author);
- Create View Author_Contact_View as (Select Author_Name, Contact_No, No_of_Books from Author Natural join AuthorContactInfo);
- Create View Group_View as (Select Genre, count(ISBN) from Book group by Genre)

- (c) What do you mean by the following sentences or diagrams: 4

- There exists a many-to-one relationship from city to country
- The relationship set from book to author is many-to-many
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