KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 1st Term Examination, 2019
Department of Computer Science and Engineering
CSE 3101
Theory of Computation

TIME: 3 hours   FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A
(Answer **ANY THREE** questions from this section in Script A)

1. a) Give a comparative discussion about alphabet, language and power of alphabet. (07)
   b) Define the terms with example(s) : (i) Alphabet, (ii) Power of alphabet and (iii) Language. (09)
   c) How does NFA differ from DFA? Write the significances of using extended transition (11)
   function.
   d) Design ε – NFA for accepting decimal numbers. (08)

2. a) Prove that, for any NFA N there is a DFA D, such that $L(D) = L(N)$, and vice versa. (11)
   b) Find the equivalent DFA for the following NFA: (12)
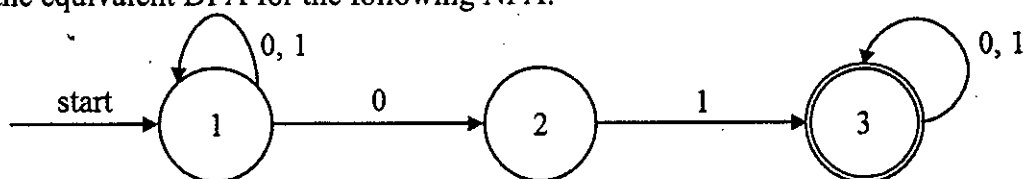
   c) Design a NFA that accepts the language $L = \{w \in \{a,b\} : w$ contains the substring aa$\}$. (12)

3. a) Prove that, "If $L = L(A)$ for some DFA A, then there is a regular expression R such that (10)
   $L = L(R)$ ".
   b) Write regular expression for the following languages: (10)
      i) The set of all strings of 0's and 1's such that no prefix has two more 0's than 1's, not two
      more 1's than 0's.
      ii) The set of all strings of 0's and 1's whose number of 0's is divisible by 5 and number of
      1's is even.
      iii) The set of all strings of 0's and 1's whose 10th symbol from the right end is 1.

   c) Write notes on (i) Homomorphism and (ii) Inverse Homomorphism. (08)
   d) Define ECLOSE. Write inductive definition of ECLOSE. Give example. (07)

4. a) State and explain pumping lemma. Using pumping lemma, show that the following languages (12)
   are not regular.

      i) $\{1^p \mid p$ is a prime number$\}$.

      ii) $\{0^n \mid n$ is a perfect square$\}$.
   b) Showing each step, find the regular expression for the language: (18)
   $$L = \{x1y : x \in \{0\}^* \text{ and } y \in \{0,1\}^*\}.$$
   c) Write down the properties of regular languages. (05)

SECTION B
(Answer **ANY THREE** questions from this section in Script B)

5. a) Given the following ambiguous CFG: (23)
   $$S \rightarrow Ab \mid aaB$$
   $$A \rightarrow a \mid Aa$$
   $$B \rightarrow b$$
      i) Find the string s generated by the grammar that has two leftmost derivations. Show the
      derivations.
      ii) Show the two derivation trees for the string s.
      iii) Find an equivalent unambiguous CFG.
      iv) Give the unique leftmost derivation and derivation tree for the string s generated from
      unambiguous grammar above.

b) Find Context Free Grammar (CFG) for the following languages: (12)

    i) $L(G) = \{a^n b^m c^m d^{2n} \mid n \geq 0, m \geq 0\}$.

    ii) $L(G) = \{a^n b^m \mid 0 \leq n \leq m \leq 2n\}$.

6. a) What is PDA? How does it differ from $\varepsilon - NFA$? (07)

   b) Construct PDA corresponding to the grammar: (10)

$$S \rightarrow aABB \mid aAA$$
$$A \rightarrow aBB \mid a$$
$$B \rightarrow bBB \mid A$$

   c) Define the acceptance of a PDA by empty stack. Is it true that the language accepted by a PDA (08) by empty stack or by that of final state are different languages?

   d) Design PDA to accept the language: $L = \{a^n b^{2n} \mid n \geq 0\}$. (10)

7. a) Consider the following grammar: (25)

$$S \rightarrow aAa \mid bBb \mid \varepsilon$$
$$A \rightarrow C \mid a$$
$$B \rightarrow C \mid b$$
$$C \rightarrow CDE \mid \varepsilon$$
$$D \rightarrow A \mid B \mid ab$$

   i) Are there any useless symbols? Eliminate them if so.
   ii) Eliminate ε – productions.
   iii) Eliminate unit productions.
   iv) Put the grammar into CNF.

   b) Show that the language $L = \{a^n b^j c^k \mid k = jn\}$ on $\Sigma = \{a, b, c\}$ is not context-free. (10)

8. a) Design a Turing Machine (TM) to implement the function "multiplication". Simulate the (14) action for the input 001000.

   b) Explain the halting problem of TM. (07)

   c) Write the differences between single and multi-tape TM. (06)

   d) Calculate left linear and right linear grammar of the regular expression $0(10)^*$. (08)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 1st Term Examination, 2019
Department of Computer Science and Engineering
CSE 3103
Peripherals and Interfacing

TIME: 3 hours   FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
     ii) Figures in the right margin indicate full marks.

SECTION A
(Answer **ANY THREE** questions from this section in Script A)

1. a) What is bus contention? Discuss how bus contention can be avoided.   (07)
   b) Distinguish between memory-mapped I/O and I/O-mapped I/O. Compare the advantages and (09)
      disadvantages of these schemes.
   c) Why is I/O interfacing a severe problem? Explain in brief.   (09)
   d) What are the varieties of synchronous mode of data transfer? Draw the flowcharts for each of (10)
      them. How is the problem of this mode of data transfer solved by asynchronous mode of data
      transfer?

2. a) What is keyboard? Design an interface circuit to realize 4x4 keyboard using row-scanning (09)
      technique.
   b) What is key rollover problem? How is this problem solved?   (08)
   c) Deduce the methodology of cyclic redundancy checking scheme.   (09)
   d) Draw the table of bit definitions of data packet sent by PS/2 mouse and explain how it is used (09)
      to pass the user commands to the system.

3. a) What is raster scan?   (07)
   b) Show how the character 'N' is formed on a CRT screen in 5x7 matrix format.   (08)
   c) How does laser print work? Explain in brief.   (07)
   d) What is sensor? How does ultrasonic sensor work? Write a program to calculate the distance (13)
      of an object using ultrasonic sensor.

4. a) What are the functions of USB host and USB device? Draw a flow diagram to show the (10)
      implementation of USB interface.
   b) What is an I/O port? Distinguish between a programmable and non-programmable I/O port. (06)
   c) Briefly describe operating modes of 8255A with necessary figures.   (07)
   d) Design an interface circuit to read data from an A/D converter using 8255A in the memory- (12)
      mapped I/O. The chip is selected when A_{15} is high. $A_2 - A_{14}$ are don't care lines. The
      following settings are required in this case:
      i) Setup port A to read data.
      ii) Setup bit PC_0 to start conversion and bit PC_7 to read the ready status of the converter.

SECTION B
(Answer **ANY THREE** questions from this section in Script B)

5. a) Define peripheral and interfacing. What are the types of interfacing? Explain with proper (07)
      example.
   b) Why is solid state relay used instead of relay?   (07)
   c) How can a solid state relay be interfaced to a μc to control a heater coil?   (10)
   d) How does the inter-processor communication take place in closely-coupled configuration?   (11)

6. a) Write down the applications of different types of Optocoupler.   (07)
   b) Describe the classification of transducer. What are the desirable properties of transducer? (12)
      Describe a pressure transducer with various configurations.
   c) What are the characteristics of an op-amp?   (06)
   d) How can an op-amp be used as subtractor and differentiator? Explain with proper circuit (10)
      diagram.

7. a) What are the limitations of a switch? Write down the working principle of relay with proper explanation. (11)

   b) What are the differences between zero-cross switching and random switching? How can the demerits of solid-state relay be overcome? (10)

   c) In a typical busy cross road with pedestrian signal, tabulate the sequence in which the lights go ON and OFF and encode the values used in μPU based system to control traffic light. (14)

8. a) What are the importance of IOP? Describe the communication between IOP and CPU with necessary figure. (10)

   b) Write down the applications of Interval timer. Describe the control word register of 8254. (06)

   c) Write short notes on the following modes of operation in 8254: (09)
      i) Interrupt on terminal count.
      ii) Rate generator.
      iii) Square wave generator.

   d) How does successive approximation ADC differ from counter type ADC? Design a 6 bit weighted-resistor network DAC and verify it. (10)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 1st Term Examination, 2019
Department of Computer Science and Engineering
CSE 3109
Database Systems

TIME: 3 hours   FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
   ii) Figures in the right margin indicate full marks.

SECTION A
(Answer **ANY THREE** questions from this section in Script A)

1. a) Define roles of an *E-R* diagram. How can you classify the participation of an entity set in a   (08)
      relationship set? Explain with examples.
   b) Consider two entities E_1 and E_2 having simple and single valued attributes. R_1 and R_2 are   (12)
      two relationships between E_1 and E_2. R_1 is one-to-many and R_2 is many-to-many
      relationship. R_1 and R_2 don't have attributes of their own. Draw an *E-R* diagram.
   c) Consider the following *E-R* diagram: (15)
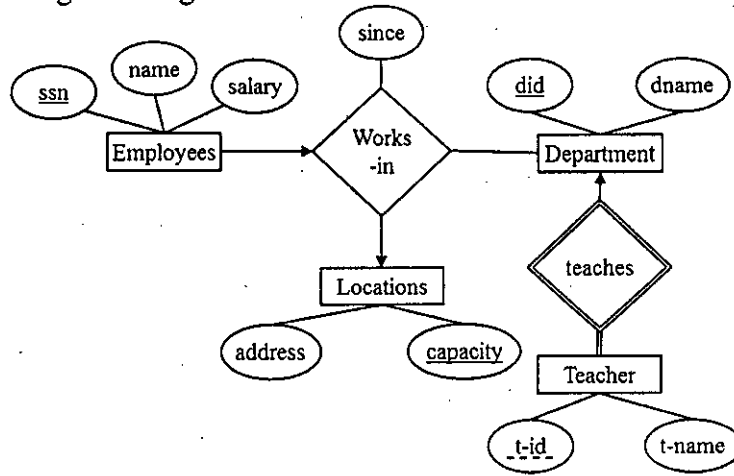
      i) Transform the *E-R* diagram into physical schema.
      ii) Transform into relations.
      iii) Convert the non-binary relationships into binary relationships.

2. a) Differentiate between dense index file and sparse index file.   (08)
   b) Construct a B^+ tree for the following data where $n = 3$.   (13)
                        1, 2, 3, 10, 20, 25, 32, 40.
      (i) Update the tree after inserting 45. (ii) Update the tree after deleting 20.
   c) A B^+ tree has height 22 and max. fan out 50. What is the minimum and maximum number of   (06)
      keys possible in this index structure?
   d) Explain structured, semi-structured and unstructured data with example.   (08)

3. a) What is a lossy decomposition? How it can be solved?   (06)
   b) Consider the following table R: (15)

α	β	γ	δ
x_1	y_1	z_1	w_1
x_2	y_1	z_2	w_1
x_3	y_2	z_1	w_1
x_4	y_2	z_2	w_1
x_5	y_2	z_3	w_1

      i) Find the functional dependencies from R.
      ii) Compute F^+.
      iii) Compute the super keys.
   c) What are the goals of Normalization?   (05)
   d) What is referential integrity? How does it affect database modification?   (09)

4. a) How can you specify XML data with attributes in DTD? Define a DTD for the following   (10)
      schema:
         Children (*name, age, date, country*)
         Birthday (*day, month, year, time*).

b) Given $R = (A, B, C, D, E)$ with functional dependencies (15)
$$F = (A \rightarrow BC, CD \rightarrow E, B \rightarrow D, E \rightarrow A)$$
   i) Find if the relation is in BCNF.

   ii) Apply normalization and decompose the relation until the join is lossless.

c) How can you measure the normalization performances? Give examples. (10)

SECTION B
(Answer **ANY THREE** questions from this section in Script B)

5. a) What is DBMS? How many type of users are there in database? How they use database? (08)

  b) What is join operation? Explain different type of join operations. (10)

  c) Define division operation in terms of basic relational algebra operation with example. Let (05)
    $r(R)$ and $s(S)$ be relations and $S \subseteq R$.

  d) Consider the following schema: (12)

      branch (*branch _ name, branch _ city, asset*)

      customer (*customer _ name, customer _ street, customer _ city*)

      account (*account _ number, branch _ name, balance*)

      loan (*loan _ number, branch _ name, amount*)

      depositor (*customer _ name, account _ number*)

      borrower (*customer _ name, loan _ number*)

  According to the schema, solve the problems given below using relational algebra expression:

   i) Find the loan number for each loan of an amount greater than $1200.

   ii) Find the names of all customers who have a loan at the Perryridge branch.

   iii) Find the largest account balance.

   iv) Find all customers who have an account at all branches located in Brooklyn city.

6. a) What is view? "View makes complex query simple" – justify the statement. (10)

  b) Consider the schema given in question 5(d) and solve the following problem using SQL query: (15)

   i) Find the names of all branches where the average account balance is more than $1200.

   ii) Find all loan numbers for loans made at the Perryridge branch with loan amount greater than $1200.

   iii) Increase all accounts with balances over $10,000 by 6% and all other accounts receive 5%.

   iv) Find the average account balance of those branches where the average account balance is greater than $1200.

   v) Select second highest balance from account table.

  c) Suppose there is a table named Employees in your database. (10)
     Employees (*Employee_ id, Name, Email, Salary, Dept _ id*)

   Write a trigger which will automatically insert the name of the employee in INITCAP format.
   Also generate and insert an email id as "Name_Dept_id_Employee_id@gmail.com".

7. a) Consider the following figure: (12)

T_4	T_5	T_6
Read(A)		
$A = A + 50$		
Read(C)		
Write(A)		
$C = C - 50$		
	Read(B)	
Write(C)		
	Read(A)	
		Read(C)
	$B = B + 50$	
	Write(B)	
		$C = C + 100$
		Read(B)
		Write(C)
	$A = A - 50$	
	Write(A)	
		$B = B - 100$
		Write(B)

Is this schedule conflict Serializable? Justify.

 b) "Every cascadeless schedule is also recoverable" – justify the statement with example. (05)

c) State the rules for schedules S and S' being view equivalent. (06)

d) Explain the working principle of a query processor. (12)

8. a) What is PL/SQL? Discuss the tradeoff between anonymous block and named block in PL/SQL. (08)

b) What are the differences between primary key and unique key? (07)

c) How does lock manager work in concurrency control? (10)

d) Consider the following figure which is a granular tree: (10)
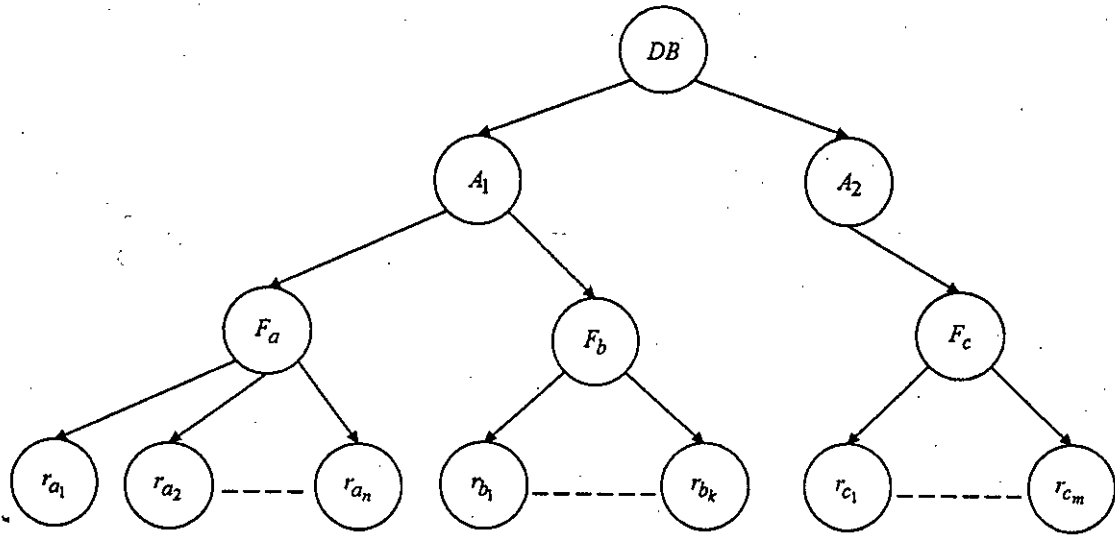
T_1 reads r_{a_2}

T_2 modifies r_{a_9}

T_3 reads F_a

T_4 reads DB

i) Can T_1, T_2 run concurrently?

ii) Can T_1, T_3 run concurrently?

iii) Can T_1, T_3, T_4 run concurrently?

iv) Can the four transactions run concurrently?

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 1st Term Examination, 2019
Department of Computer Science and Engineering
CSE 3119
Software Engineering and Information Systems

TIME: 3 hours   FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
     ii) Figures in the right margin indicate full marks.

SECTION A
(Answer **ANY THREE** questions from this section in Script A)

1. a) What do you mean by DSS? How does DSS help in decision making? Explain it with an example. (12)
    b) What three major questions are focused on feasibility study? (08)
    c) What should be the result of feasibility study? Explain. (08)
    d) Draw the diagram of an organization structure. (07)

2. a) Explain the academic and personal qualification of a good analyst. (12)
    b) Write several reasons why it is difficult to determine user requirements. (12)
    c) What traditional information-gathering tools are available for the analyst? Explain each tool briefly. (11)

3. a) What cost elements are considered in cost/benefit analysis? Which element do you think is the most difficult to estimate? Why? (10)
    b) What do you mean by decision tree? Let us assume the following discount policy: (15)
       Bookstores get a trade discount of 30% for orders from libraries and individuals; 5% allowed on orders of 6-19 copies per book title; 10% on orders for 20-40 copies per book title; 20% on orders for 41 copies or more per book title. For all the cases no-discount for less than 6 copies of book title.
       Now using this discount policy draw a decision tree.
    c) Distinguish between the following: (10)
       i) Direct cost and indirect cost.
       ii) Fixed cost and tangible cost.

4. a) What is the goal of input design and output design? (10)
    b) Write several factors on which the number and nature of errors in a new design are depended. (13)
    c) Why do we test systems? How important is testing? Elaborate. (12)

SECTION B
(Answer **ANY THREE** questions from this section in Script B)

5. a) What is software engineering? Briefly discuss the relationship of stakeholders with software quality. (10)
    b) What are the Standard Programming Style guidelines for a good developer? (12)
    c) How does a server program communicate with two client programs? Graphically describe it. (13)

6. a) What do you mean by "User Centered Design"? (09)
    b) Give some comparative discussion on the following terms: (09)
       i) Sequence diagram.
       ii) Communication diagram.
       iii) Activity diagram.
    c) What is software architecture? Describe it using UML diagrams. (07)
    d) Write the design principle of the Model-View-Controller (MVC) architectural pattern for web architecture. (10)

7. a) What is Use-Case Diagram? Explain it with examples of generalization, extension and inclusion. (10)
    b) Differentiate between system domain model and system model. (08)

c) What is a UML Diagram? What are the essential elements of UML diagram? Discuss the (12) following terms with UML diagrams and proper example:
    i) Generalization.
    ii) Aggregation.
    iii) Propagation.
    iv) Composition.

d) Differentiate between Waterfall Model and Spiral Model. (05)

8. a) Explain critical race condition with proper example. How it can be solved? (09)
  b) Apply the following design patterns to the system shown in Figure 8(b) and compare the (15) results to determine the best one.
    i) Player-Role pattern.
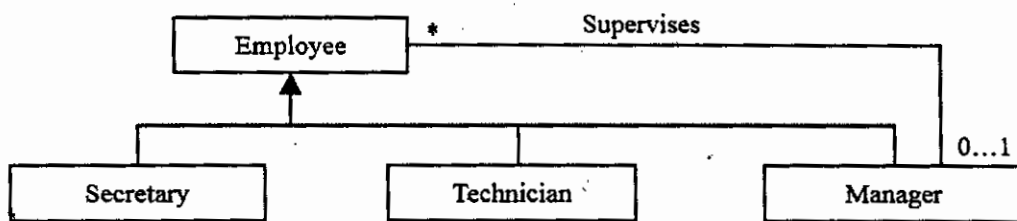   ii) Singleton pattern.
    iii) Observer pattern.

Figure 8(b)

c) What is Flow graph for glass box testing? Explain with examples. (06)
d) What is Gantt Chart? Give an example diagram. (05)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 1st Term Examination, 2019
Department of Computer Science and Engineering
ECE 3115
Data Communication

TIME: 3 hours   FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
    ii) Figures in the right margin indicate full marks.

SECTION A
(Answer **ANY THREE** questions from this section in Script A)

1. a) Briefly explain the simplified data communication model with necessary diagram. (10)
   b) State and explain Shannon's Channel Capacity theorem. What is meant by bandwidth and (12) spectrum?
   c) With the help of Fourier analysis, prove that rectangular pulse consists of infinite number of (13) frequencies.

2. a) What are the functions of core and cladding in optical fiber? Classify optical fiber based on (10) light propagation principle.
   b) Write down the pros and cons of coaxial cable and twisted pair cable. (11)
   c) What are the fundamental elements/blocks of a PCM? Show that, the quantization noise $= \dfrac{S^2}{12}$ (14) , where, S = step size. How can you minimize the quantization noise in a PCM system?

3. a) Explain asynchronous and synchronous data transmission with their frame format. (10)
   b) What is the dynamic range of a PCM system? For a PCM system with the following (20) parameters, determine (a) minimum sample rate, (b) minimum no. of bits used in the PCM code, (c) resolution and (d) quantization error.
      Maximum analog input frequency = 4 kHz
      Maximum decoded voltage at the receiver = ± 2.55 V
      Minimum dynamic range = 46 dB.
   c) What is meant by data and signal? (05)

4. a) What is spread spectrum? Draw the block diagram of frequency hopping spread spectrum (10) system.
   b) Determine the minimum bandwidth, baud and bandwidth efficiency for the following bit rates (10) and modulation schemes BPSK, QPSK, 16-PSK, 8-QAM; (i) f_b = 9600 bps.
   c) Sketch the waveforms for the binary sequence of "1010110010" by using the following line (15) coding techniques: (i) Return Zero (RZ) (ii) Non-RZ (NRZ) (iii) Manchester (iv) Differential Manchester and (v) Bipolar-AMI.

SECTION B
(Answer **ANY THREE** questions from this section in Script B)

5. a) What is data link control protocol? Briefly explain the requirements for effective data (10) communication between transmitting and receiving stations.
   b) "Sliding window flow control is potentially much more efficient than stop and wait flow (10) control" – give your comments about this statement and also give reasons in favor of your comments.
   c) Why break up of a large block of data into smaller blocks is necessary in stop and wait flow (08) control?
   d) Why piggy backing is used in sliding window flow control? (07)

6. a) For error detection using Cyclic Redundancy Check (CRC), prove that $\dfrac{T}{P} = Q$, where symbols (10) have their usual meanings.
   b) Briefly explain different types of stations, link configurations and data transfer modes used in (10) HDLC.
   c) Why bit stuffing is used in HDLC? A source has a data pattern of 1111110011111011, write (10) the data pattern that will be sent using HDLC.
   d) Draw the HDLC frame format. (05)

7. a) Draw the block diagram of FDM and TDM system. (10)
   b) Why synchronous TDM is called synchronous? (07)
   c) In a communication system, there are 11 sources to be multiplexed on a single link. The (10)
      sources are described as follows:

$$S_1, S_3 \quad : \quad \text{Analog, 2 kHz bandwidth}$$
$$S_2 \quad : \quad \text{Analog, 4 kHz}$$
$$S_4 - S_{11} \quad : \quad \text{Digital, 7.2 kbps synchronous}$$

   Design and draw TDM of these analog and digital sources.
   d) Describe the elements and key features of X.25. (08)

8. a) Write down the advantages and disadvantages of frame relay. (08)
   b) Briefly explain the generic architectural components of a PSTN network. (08)
   c) Draw the datagram approach and virtual circuit approach for packet switching. (10)
   d) Compare circuit switching and packet switching method. (09)