KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 1st Term Examination, 2021
Department of Computer Science and Engineering
CSE 3101
Theory of Computation

TIME: 3 hours FULL MARKS: 210

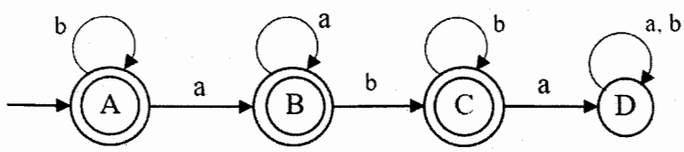
N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

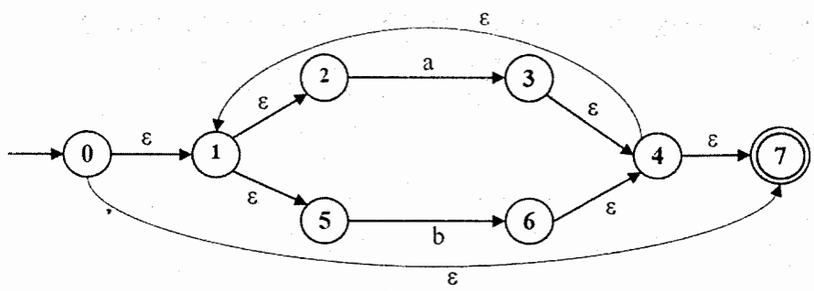
(Answer **ANY THREE** questions from this section in Script A)

1. a) Let $\Sigma = \{a, b\}$ and let $L = \{w \in \Sigma^* \mid w \neq \varepsilon \text{ and the first and last character of } w \text{ are the same}\}$. Design a DFA for L. (09)
   b) Let $\Sigma = \{a, b, c\}$ and let $L = \{w \in \Sigma^* \mid \text{some character in } \Sigma \text{ appears at most twice in } w\}$. Design an NFA for L. (09)
   c) Let $\Sigma = \{a, b\}$ and let $L = \{w \in \Sigma^* \mid w \text{ is a non} - \text{empty string whose characters alternate between } a\text{'s and } b\text{'s}\}$. Design a DFA for L. (09)
   d) How can you verify that a regular language is empty? (08)

2. a) Find regular expression for the following DFA having alphabet {a, b}. [Use Ardens method] (10)

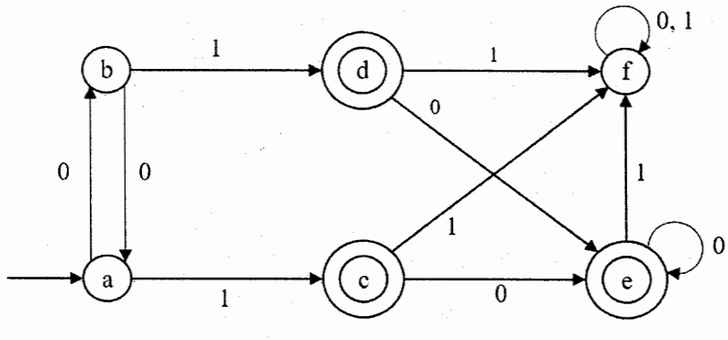


   b) Design a ε-NFA for the regular expression $a(a + b)^*ab$. (05)
   c) Find ECLOSE of each state of the following NFA. (10)



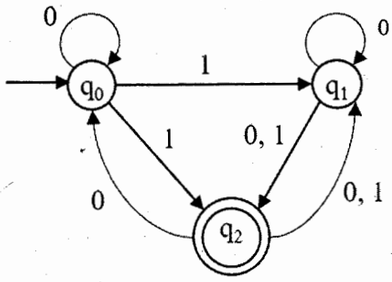
   d) Write a regular expression for the following languages. (10)
      i) The set of all strings of 0's and 1's such that no prefix has two more 0's than 1's, not two more 1's than 0's.
      ii) The set of all strings of 0's and 1's whose number of 0's is divisible by 5 and number of 1's is even.

3. a) Using Pumping lemma, show that the following languages are not regular. (12)
      i) $L = \{0^n\ 1\ 0^n \mid n \geq 1\}$
      ii) $L = \{0^i \mid i \text{ is a perfect square}\}$
   b) Use Table filling algorithm to minimize the following DFA. (12)



   c) What is Kleene closure of a language? Find L^2, L^3 and L^4 of the language, $L = \{0, 10\}$. (11)

4. a) Convert the following NFA to DFA. [Use any method you want] (12)



b) Write a short note on (i). Reversal, (ii) Homomorphisms, (iii) Finiteness test. (12)
c) Prove the three properties of pumping Lemma for regular languages. (11)

SECTION B

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

5. a) Consider the grammar: (25)

$S \rightarrow ASA \mid aB$
$A \rightarrow B \mid S$
$B \rightarrow b \mid \epsilon$

i) Eliminate ϵ productions.
ii) Eliminate unit productions in the resulting grammar from (i).
iii) Eliminate useless productions in the resulting grammar from (ii).
iv) Put the grammar from (iii) in Chomsky Normal Form (CNF).

b) Is Context-free language (CFL) closed under Union and Intersection? Verify your answer. (10)

6. a) Find Context-free grammar for the following languages: (12)
i) $L = \{a^i b^j c^k \mid i, j, k \geq 0 \text{ and } i + j = k\}$
ii) $L = \{a^i b^j \mid i, j \geq 0 \text{ and } i \neq 2j\}$

b) Design Pushdown Automata (PDA) to accept the language: (15)
$D = \{a^i b^j c^k \mid i, j, k \geq 0 \text{ and } i = j \text{ or } j = k\}$.

c) Write short notes on: (08)
i) Post's Correspondence Problem
ii) Circuit Satisfiability Problem

7. a) Write the differences between Multi-track and multitape Turing Machines. (06)
b) What is NP-Complete problem? Prove that "Clique problem is NP-Complete problem". (14)
c) Prove that "PDAs that are accepted by final state and empty stack are equivalent." (15)

8. a) Design a Turing Machine to implement "Multiplication" operation using subroutine copy. Stimulate the action for 000100. (15)

b) Use Pumping Lemma to show the following languages are not Context-free language: (12)
i) $L = \{ww \mid w \text{ is in } \{0,1\}^*\}$
ii) $L = \{a^m b^m c^n \mid m \leq n \leq 2m\}$

c) Explain the halting problem of Turing Machine. (08)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 1st Term Examination, 2021
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.

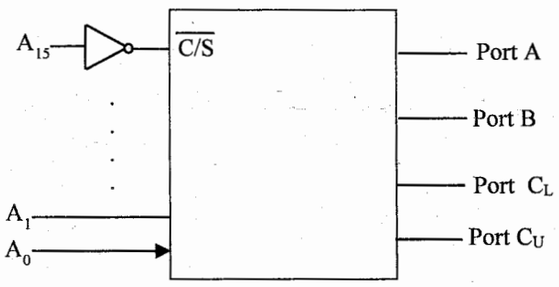
SECTION A

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

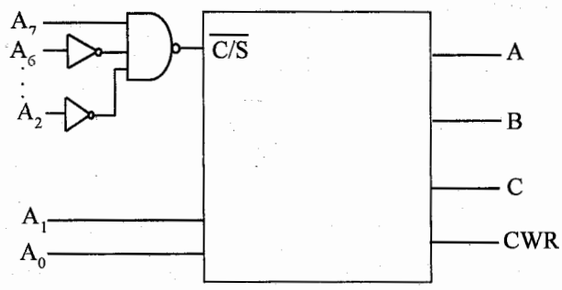
1. a) What is bus contention? If a memory chip has a N MB memory space of 32 bits for each word size, then what is the size of data line and address line? [N = (Last digit of your roll no. %3)+1] (08)
   b) Discuss the advantages and disadvantages of system memory and standard memory. Discuss the problems associated with I/O devices. (10)
   c) How many ways of parallel interfaces are available in 8085? Discuss them using figures and finally differentiate them. (12)
   d) Differentiate between microprocessor and microcontroller. (05)

2. a) Draw the figures of different addressing modes and differentiate them. (10)
   b) Differentiate between synchronous, asynchronous and interrupt-driven data transfer modes. Define Baud rate and Split Bit mode. (10)
   c) Draw the block diagram and flowchart of the DMA mode of data transfer. (15)

3. a) Draw the control word register of 8255A for I/O mode. Identify the port address of the following figure. (10)



   b) Write a program to read the DIP switch and display the reading from Port B at Port A, and Port C_L at Port C_U, respectively. (10)
   c) Write a BSR control word subroutine to set bits PC7 and PC3, and reset them after 10ms. Use the following figure as reference. (10)



   d) What are the trade-offs of choosing between standard and system memories? (05)

4. a) Write short notes on the following modes of operations in 8254: (09)
      i) Interrupt on terminal count.
      ii) Rate generator.
      iii) Square wave generator.
   b) Perform CRC and its validation for m = 30, K = 1101, and P = 4, symbols have their usual meanings. (13)
   c) Write the typical development steps of MDS. (13)

SECTION B

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

5. a) Describe coprocessor configuration. How do the host processor and coprocessor communicate? (12)
   b) What are the machine code formats of ESC instruction? (06)
   c) Suppose you want to monitor the temperature of a system. If the temperature rises above 50°C, the system will shut down automatically. Construct the controller circuit using relay. (12)
   d) Write short notes on sensitivity property of a transducer. (05)

6. a) Show how the character "P" is formed on a CRT screen in 5×7 matrix format. (09)
   b) Describe USB cable. Draw the flow diagram of the implementation of USB interface. (12)
   c) Describe how a 6-bit DAC operates when the input is 110110. How the DAC achieves its equivalent analog output? (14)

7. a) Develop a signal generation circuit for displaying character on CRT screen. (12)
   b) Describe key bouncing problem. Which switch encounters this issue frequently? How can you solve the problem? Define key chattering. (12)
   c) How can an op-amp be used as subtractor and differentiator? Explain with proper circuit diagram. (11)

8. a) Let you have mode a single left-button click on your screen using serial and PS/2 mouse separately that are connected to your computer. What are the bit definitions of data packet sent by the mouses? (14)
   b) Draw the keyboard interface circuit with 4×4 keyboard. (12)
   c) What is optocoupler? Describe slotted and reflective optocoupler in brief. (09)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 1st Term Examination, 2021
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 data model. What are the classifications of data model for a database design? (08)
   b) Let E_1 and E_2 be two entities in an ER model with simple single valued attributes. R_1 and R_2 are two relationships between E_1 and E_2 where R_1 is one to many and R_2 is many to many. R_1 and R_2 have their attributes a_1 and a_2. Draw the ER diagram. What are the minimum number of tables required to represent this situation in the relational model? Justify your answer. (12)
   c) Consider the following concept in ER model (15)
      i) Total and Partial Participation.
      ii) Weak and Strong entity set.
      iii) Generalization and Specialization.
   How are the represented in ER model? Represent the logical model into a physical model.

2. a) What is the role of disk page size for designing a good index? (09)
   b) Explain the classification of index structures for relational database. What is the difference between hashing and indexing? (11)
   c) Explain the node structure of a B+ tree? What are the advantages of B+ tree over B tree. (08)
   d) What are meant by Course→Course No. and Course→→book? Explain with example. (07)

3. a) Define functional dependency. How can you explain functional dependency as a generalization of super key? (10)
   b) What is closure of attributes? How can you calculate the closure of attributes? Given R = (A, B, C, G, H, I) with F = {A→B, A→C, CG→H, CG→I, B→H}. Do you think (AG) and (BG) are the keys of R? (12)
   c) What is the purpose of database normalization? Consider the schema R(a, b, c, d) having functional dependencies F={ac→bd, ad→b}. Is R in BCNF? Or in 3NF? Why or why not? (13)

4. a) Define referential integrity? You have two tables *Customer* and *Branch*. Now explain referential integrity creating these tables using SQL. Assume attributes of the tables as you need. (10)
   b) What is trigger? Why do you need trigger? Given a *Student Report database* where marks of assessment is recorded. Create a trigger so that the total and average of specified marks is automatically inserted whenever a record is inserted. (13)
   c) Define structured, semi-structured and unstructured data with example. Explain tree data model of XML data using your own example. How can you use Xpath expression in tree model? (12)

SECTION B

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

5. a) Define different database query. Mention how they access the database system. (08)
   b) How do a relational database handle null values in case of logical operation? (06)
   c) Consider the relational database given in Fig. 1 (See in page no. 2) where primary keys are underlined. Give an expression in the relational algebra to express each of the following queries. (16)
      i) Find the account number for each account of an amount greater than $2000.
      ii) Find the second largest loan amount.
      iii) Find all customers who have an account in all branches located "khulna".
      iv) Find the name of all customers who have a loan at the perryridge branch.
   d) Explain different types of outer joins. (05)

branch(branch_name, branch_city, asset)
customer(customer_name, customer_streat, customer_city)
account(account_number, branch_name, balance)
loan(loan_number, branch_name, amount)
depositor(customer_name, account_number)
borrower(customer_name, loan_number)

Fig. 1

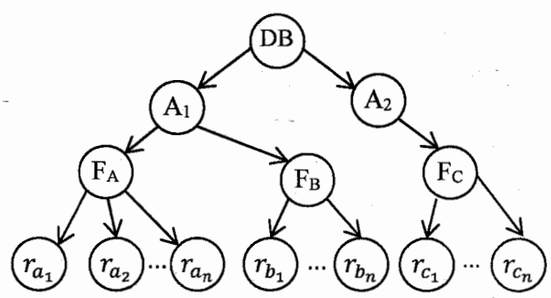
6. a) Write down the advantages of view with example. (10)
   b) Consider the schema given in Fig.1 and solve the following problem using SQL query: (16)
      i) Find the borrower_name with largest loan amount.
      ii) Increase all accounts with balance over $10,00 by 6% and all other accounts receive 5%.
      iii) Add a column customer_state to *customer* table.
      iv) Find the 2nd largest loan_number of each branch.
   c) Write a procedure in PLSQL to calculate the age if the date of birth given. (09)

7. a) "Every cascade less schedule is recoverable" – Justify with example. (06)
   b) Write down the conditions of view serializability. (10)
   c) "If a schedule is conflict serializable then the schedule must be view serializable" – is that true? If true explain. (12)
   d) How starvation occur due to deadlock? (07)

8. a) Does the schedule in the following figure follow Timestamp Based Protocol. (10)

T_{25}	T_{26}
read(B)	
	read(B)
	B:= B – 50
	write(B)
read(A)	
	read(A)
display(A+B)	
	A:= A+50
	write(A)
	display(A+B)

   b) What is Thomas write Rule? Why this rule is necessary? (05)
   c) Consider the following granular tree of the following figure. (16)



   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?
   Explain each of your answer with diagram.
   d) Define strict two phase locking and rigorous two phase locking with example. (04)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 1st Term Examination, 2021
Department of Computer Science and Engineering
ECE 3115
Data Communication

TIME: 3 hours FULL MARKS: 210

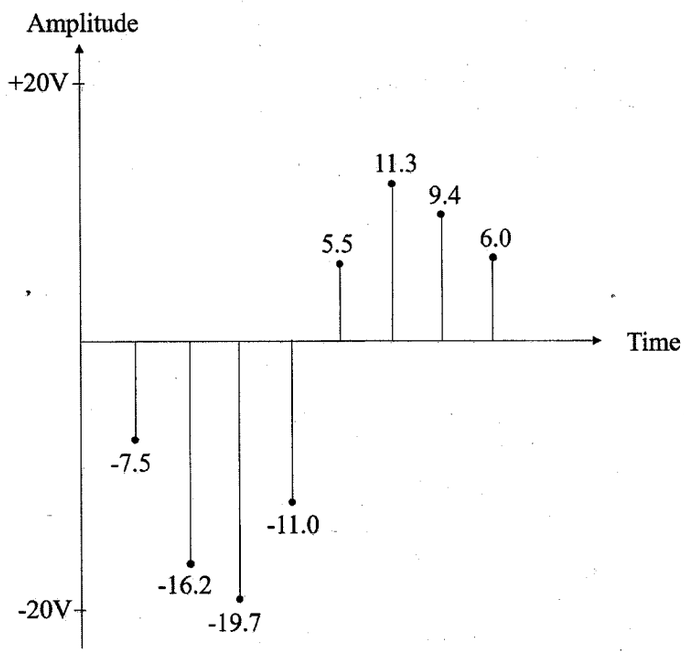
N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

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

1. a) What is meant by bandwidth and throughput? Explain the factors that affect the data rate. (13)
   b) With the help of Fourier analysis, show that a square wave consists of infinite number of sinusoidal waves. (10)
   c) Why digital transmission is preferred over analog transmission? (06)
   d) How many bits can fit on a link with a 2ms delay if the bandwidth of the link is (06)
      i) 1 Mbps?
      ii) 20 Mbps?

2. a) What are the functions of core and cladding in optical fiber? Classify optical fiber based on light propagation principle. (08)
   b) Describe the fundamental blocks of PCM. Hence, show that increasing the number of quantization levels decreases the quantization error. (12)
   c) Convert the following sampled signal as shown in the following figure into digital data using PCM technique. Hence, the sample amplitudes are between -20V and +20V. Use 3 bits for encoding. (15)



3. a) What are the problems of DM? How can ADM overcome these problems? (10)
   b) Explain asynchronous and synchronous data transmission with their frame format. (08)
   c) Describe pulse time modulation with suitable diagram. (09)
   d) For an 8-QAM modulator with an input data rate (f_b) equal to 20 Mbps and a carrier frequency of 100 MHz, determine the minimum double sided Nyquist bandwidth and the baud. (08)

4. a) Suppose the input bit sequence (QIC): 110101110, for an 8-PSK modulator. (12)
      i) Determine the output phases.
      ii) Draw the constellation diagram for obtained symbols.
   b) What are the advantages of QAM? (05)
   c) Sketch the waveforms for the binary sequence of "1010110010" by using the following line coding techniques: (i) Return to zero (RZ), (ii) Non-RZ (NRZ), (iii) Manchester, (iv) Differential Manchester, and (v) Bipolar-AMI. (13)
   d) What are the advantages of scrambling techniques? (05)

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 communication between transmitting and receiving stations. (10)
   b) Why piggy backing is used in sliding window flow control? (09)
   c) Why is break up of large block of data into smaller blocks necessary in stop and wait flow control? (08)
   d) What is the purpose of flow control in a transmission system? (08)

6. a) Briefly explain different types of stations, link configuration and data transfer modes used in HDLC. (10)
   b) For error detection using Cyclic Redundancy Check (CRC), prove that $^{T}/_{P} = Q$, where symbols have their usual meanings. (07)
   c) Why bit stuffing is used in HDLC? A source has a data pattern of 1111110011111011, write the data pattern that will be sent using HDLC. (08)
   d) Draw the diagram of Go back to N ARQ and selective Reject ARQ showing all the possible cases. (10)

7. a) Why synchronous TDM is called synchronous? (09)
   b) In a communication system, there are 11 sources to be multiplexed on a single link. The sources are described as follows: (13)

S_1	:	Analog, 2kHz Bandwidth.
S_2	:	Analog, 4kHz Bandwidth.
S_3	:	Analog, 2kHz Bandwidth.
S_4-S_{11}	:	Digital, 7200 bps synchronous.

   Design and draw TDM system for these analog and digital sources.
   c) What is multiplexing? Draw the block diagram of FDM system and TDM system. (13)

8. a) Draw the datagram approach and virtual circuit approach for packet switching. (10)
   b) Describe the elements and key features of X.25. (08)
   c) Write down the advantages and disadvantages of frame relay. (09)
   d) Compare circuit switching and packet switching. (08)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 1st Term Examination, 2021
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 system concept? Describe the main components of the system concept. (10)
   b) Suppose, you are engaged to update a Banking System, Now, in what and how many stages you can do it? (12)
   c) What do you mean by feasibility study? After feasibility studies what will be the result? Explain. (13)

2. a) Mr. Kamal is leading a project/system. If someone gives a suggestion to do better to him, then he receives it cordially. Now say: (15)
      i) What type of system is it? And write some important characteristic of it.
      ii) Except this type of system, how many systems are there you know? Explain.
   b) Write the difference between "Physical" and "Abstract system". (10)
   c) What do you mean by DSS? In an organization, how is it used? Write down the benefits of it. (10)

3. a) Mr. X who is a chairman of a production company. He collects some information from his factory. Now, suppose you are asked to classify it, then how many categories do you classify it. Explain. (15)
   b) What are the dimensions of planning? Describe it. (10)
   c) There are several reasons why it is difficult to determine user requirements. Now write those reasons. (10)

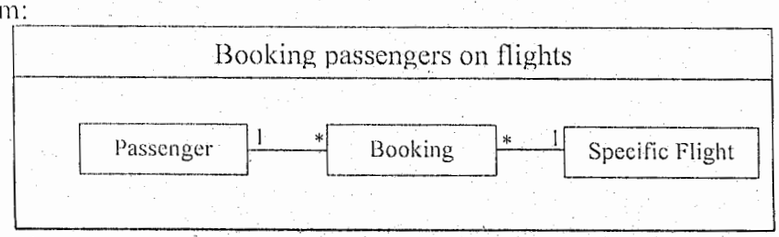
4. a) Suppose you have gone on on-site observation to an organization to gather some information. Now what problems you have to face? (10)
   b) Let us assume the following discount policy: (15)
   Bookstores get a trade discount of 30%; for orders from libraries and individuals, 15% allowed on orders of (6-9) copies per book title; 18% on orders from (10-60) copies per book title; 25% on order for 61 copies or more per book title and on all the cases on order less then 6 copies no discount. Now draw the decision tree from the above information.
   c) What is the goal of input design and output design? (10)

SECTION B

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

5. a) "Software Engineering is process of solving customer's is problem by the systematic development" - justify the statement. (10)
   b) Explain overriding with example and suggest some terminology to solve this issue. (12)
   c) Draw an Object Client Server Framework (OCSF) on the context of "Send Money using bKash App". Also design the activities of client and Server side with help of state diagrams. (13)

6. a) Design an Use Case Diagram for "Online Examination using Google Class room" (12)
   b) Define Aggregation and Composition. Apply Aggregation and Composition. Apply Aggregation and Composition into the following Airline seat reservation system UML Diagram: (15)



   c) Apply (i) Observer Pattern, (ii) Player Role design patterns on the context of "Weather Fore casting". Which pattern would be better for this context explain? (08)

7. a) Differentiate between Usability and Utility. (08)
   b) "Don't rely only on usability guidelines" explain this usability principle. (07)
   c) Explain the following principles of good design: (i) Layer cohesion, (ii) Temporal cohesion, (iii) Content coupling, (iv) Control coupling (12)
   d) "Increase in data coupling decreases stamp coupling" Do you agree with this statement? Explain your opinion. (12)

8. a) Draw the diagram of "Test driven developing" (08)
   b) Define critical rac, How can this problem be solved? (10)
   c) Draw a sequence diagram on the context "Online Programming Contest". (10)
   d) Apply water fall Model to implement the above system. (07)