

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
 B.Sc. Engineering 3rd Year 1st Term Examination, 2017
 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)

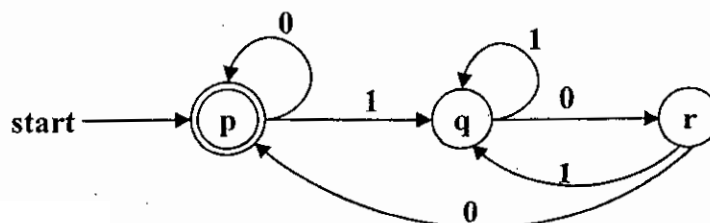
1. a) What is computation? Prove $1 + 4 + 7 + \dots + (3n - 2) = \frac{n(3n - 1)}{2}$ for $n > 0$ using principle of (10) mathematical induction.
 - b) What is Deterministic Finite Automata (DFA)? Give the DFA accepting the languages over (13) the alphabet $\{0, 1\}$ that have the set of all strings whose 10th symbol from the right end is 1.
 - c) If L is accepted by a Nondeterministic Finite Automata (NFA) with ϵ -transition then show (07) that L is accepted by an NFA without ϵ -transition.
 - d) How will you test the membership of a string in NFA? Explain with an example. (05)
2. a) Design a NFA that accepts the language $L = \{w \in \{a, b\}^* : w \text{ contains the substring } aa\}$. Also (12) show the states NFA will be in during the processing of valid input.
 - b) Convert the following NFA to its equivalent DFA. (11)

	0	1
p	{p, q}	{p}
q	{r}	{r}
r	{s}	\emptyset
*s	{s}	{s}

- c) Write regular expression/definition for the following languages: (12)
 - (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 no. of 0's is divisible by 5 and no. 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.
 - (iv) The set of all strings of 0's and 1's such that every pair of adjacent 0's appears before any pair of adjacent 1's.
3. a) Prove that "If $L = L(A)$ for some DFA A , then there is an Regular Expression R such that $L = (10) L(R)$."
 - b) Define ϵ -closure. Compute ϵ -closure of each state and find its equivalent DFA. (12)

	ϵ	a	b	c
$\rightarrow p$	{q}	{p}	\emptyset	\emptyset
q	{r}	\emptyset	{q}	\emptyset
*r	\emptyset	\emptyset	\emptyset	{r}

- c) Construct a regular expression corresponding to the state diagram given in the following (13) figure:



4. a) What are the disadvantages of unambiguous parse tree? Give an example. (06)
- b) Design a Context Free Grammar (CFG) for the language $\{A^x B^y C^z \mid x = y \text{ or } y \neq z, \text{ where } x, y, z \geq 0\}$. (09)
- c) What is ambiguous and unambiguous grammar? Consider the following grammar: (12)
- $$E \rightarrow aE \mid aEbE \mid \epsilon$$
- Is it ambiguous? If yes, give an equivalent unambiguous grammar.
- d) Calculate the left linear and right linear grammar of the regular expression $0(10)^*$. (08)

SECTION B

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

5. a) Define the acceptance of a Push Down Automata (PDA) by empty stack. Is it true that the language accepted by a PDA by empty stack or by that of final state are different languages? (07)
- b) Design PDA to accept the language: $L = \{a^m b^m \mid m \geq 0\}$. (08)
- c) Prove the following theorem: (11)
- “Let L be $L(P_F)$ for some PDA $P_F = (Q, \Sigma, \Gamma, \delta_F, q_0, z_0, F)$ then there is a PDA P_N such that $L = N(P_N)$.”
- d) Use the Context Free Language (CFL) pumping lemma to show each of these languages not to be context free: (09)
- (i) $\{0^i 1^j \mid j = i^2\}$, (ii) $\{a^n b^n c^n \mid n \geq 1\}$.
6. a) Explain how a Turing Machine can be regarded as a computing device to compute integer functions. (08)
- b) Design a Turing Machine to implement “multiplication”. Simulate the action for 001000. (14)
- c) What are the differences between single-tape and multi-tape Turing Machine? (07)
- d) Explain the multi tape Turing Machine mode. Is it more powerful than the basic Turing Machine? Justify your answer. (06)
7. a) Consider the following grammar (25)
- $$\begin{aligned} S &\rightarrow aAa \mid bBb \mid \epsilon \\ A &\rightarrow C \mid a \\ B &\rightarrow C \mid b \\ C &\rightarrow CDE \mid \epsilon \\ D &\rightarrow A \mid B \mid ab \end{aligned}$$
- (i) Are there any useless symbols? Eliminate them if so.
- (ii) Eliminate ϵ -productions.
- (iii) Eliminate unit productions.
- (iv) Put the grammar into Chomsky Normal Form (CNF).
- b) Show that “If a language L and its complement \bar{L} are both recursively enumerable, then both languages are recursive.” (10)
8. a) Explain the halting problem of Turing Machine. (06)
- b) What is unrestricted grammar? Prove that CFLs are closed under (i) Homomorphism and (ii) Reversal. (10)
- c) State the Pumping lemma for CFL's. Convert the following grammar to a PDA that accepts the same language by empty stack. (11)
- $$\begin{aligned} S &\rightarrow aAA \\ A &\rightarrow aS \mid bS \mid a \end{aligned}$$
- d) What is Deterministic PDA (DPDA)? Why does the transition function for DPDA's only work for 1 alphabet symbol and 1 stack symbol? (08)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 1st Term Examination, 2017
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) Define Peripherals and Interfacing. Why is Interfacing necessary? (08)
b) What is bus arbitration problem? Briefly explain bus arbitration resolver schemes. (10)
c) What are the factors that cause I/O interfacing to be so severe? (07)
d) Draw the flowchart of data transfer in DMA mode. (10)
2. a) Briefly explain line reversal technique for keyboard interfacing. Also explain how this method overcomes the limitations of row-scanning technique. (08)
b) In I/O subsystems, how are I/O handled by microprocessor and 8089 I/O processor. Describe with general command and data flow. (13)
c) What is in-circuit emulator? How does the ICE help in software development even before the hardware is ready? (08)
d) What is address space? Which feature of an MPU determines the size of its address space? (06)
3. a) Distinguish between memory-mapped I/O and I/O-mapped I/O. (07)
b) What is fully decoded addressing scheme? Design a fully decoded address decoder circuit for interfacing 4k bytes of RAM using 6116 and 4k bytes of EPROM using 2716. (13)
c) Distinguish between synchronous and asynchronous mode of data transfer. Mention the situation for asynchronous mode of data transfer. (08)
d) List the important features of USB. What are the basic functions of USB devices? (07)
4. a) Define Microprocessor Development Systems. Briefly describe four types of parallel I/O methods. (12)
b) What is a multiprocessing system? Describe the synchronization process between 8086 and its coprocessor. (11)
c) What are closely coupled configurations? How is interprocessor communication through shared memory occurred? Briefly describe. (12)

SECTION B

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

5. a) Define process control system. What are the major operations of a process control system? (08)
b) What are the important characteristics of a transducer? Explain the principle of operation of 2VDT and discuss how it can be used to measure pressure. (12)
c) Discuss the limitations of electromechanical relay. How can the limitations be overcome? (07)
d) Show the necessary hardware design to control the speed of a dc motor. (08)
6. a) Write down some properties of an Op-Amp. How can Op-Amp be used as comparator, summing amplifier and inverter? Explain with proper diagram. (12)
b) Mention some applications of ADC and DAC. Design a 8 bit ADC and discuss the operational principles using a flowchart. (12)
c) Design a microprocessor based system to control the temperature and LED display to show current temperature. (11)
7. a) Describe I/O system of 8086 using proper illustration. (06)
b) What is optocoupler? Describe slotted and reflective optocoupler in brief. (08)
c) Write short notes on stand-alone, real-time, networked and mobile embedded system. (12)
d) What are the applications of DC motor, servo motor and stepper motor in embedded system? (09)

8. a) What is Programmable Interval Timer (PIT)? Write down some uses of PIT. (06)
- b) Design a traffic controlling system of a typical busy cross road and write a program to switch ON and OFF the traffic lights in a proper sequence. (12)
- c) Draw the control word format of 8255 for I/O mode. (05)
- d) Design an interface circuit using the 8255A where the chip is selected when A_{15} is high. In this design: (12)
- i) Identify the port addresses.
 - ii) Identify the mode 0 control word to configure port A and port C_U input ports and port B and port C_L as output ports.
 - iii) Write a program to read the DIP switches and display the reading from port A at port B and from port C_U at port C_L .

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 1st Term Examination, 2017
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 mapping cardinality. Describe the mapping cardinality with respect to a binary relationship. (08)
b) Consider the following concepts in E-R model: (16)
 M:M relationship, total and partial participation, weak and strong entity set, ternary relationship.
 i) Define the above concepts. How are they represented in E-R model? Draw the representation.
 ii) Represent the logical model into a physical model.
c) Suppose you are given the following information for a simple database for Bangladesh Premier League (BPL). (11)
 The BPL has many teams. Each team has a name, city, coach, captain and set of players. Each player belongs to only one team. Each player has a name, position, skill level and injury record. A captain is also a player. A game is played between two teams (referred as Team1 and Team2) and has a date and a score.
 Construct a clean and concise E-R diagram for the BPL database. Show the cardinalities. Hence draw the physical schema.
2. a) What are the purposes to place an index in a database? Mention the metrics that are used to evaluate an index. (07)
b) Give a brief classification of index structures? What is the difference between hashing and indexing? (12)
c) Why do you need multilevel indexing? Briefly describe a typical B⁺ tree node. (10)
d) Suppose a key value is 9 bytes, pointer is 7 bytes and page size is 512 bytes. How many key values you can enter in a leaf and non leaf node of a B⁺ tree? (06)
3. a) What are the differences between integrity constraints and domain constraint? (05)
b) Define trigger. Write a trigger in SQL to carry out the following action: on delete of an account, for each owner of the account, check if the owner has any remaining accounts, and if he does not, delete him from the depositor relation. (11)
c) What are the forms of authorization on parts of a database? (07)
d) Define functional dependency. How can you explain functional dependency as a generalization of superkey? (12)
4. a) Define attribute closure. What are the applications of attribute closure? (05)
b) Define BCNF and 3NF. When do you prefer 3NF over BCNF. Consider the following relation: (15)
 BOOK(title, author_name, author_designation, type, price, publisher)
 Following functional dependencies exist:
 title → publisher, type
 type → price
 author_name → author_designation
 Apply normalization until you cannot decompose the relation further.
c) Explain structured, semi-structured and unstructured data with example. (08)
d) What is DTD? How can you specify an element in DTD? (07)

SECTION B

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

5. a) What do you mean by data abstraction in database system? Explain the levels of data abstraction in database. (11)
- b) Differentiate between physical and logical data independence. (08)
- c) Define data model. Explain the basic structure of a relational model. (08)
- d) Mentions the name of the aggregation functions. How are they handled in relational algebra? (08)

6. a) Consider the following table: (27)

RESULT(*roll*, *sub1*, *sub2*, *sub3*, *gp1*, *gp2*, *gp3*, *CGPA*)

The task of the above table is to calculate the result of the students from *roll* number '1 to 5'. Now create a trigger (before insertion) for the above table to insert the following:

- i) Take the number of the subjects *sub1*, *sub2* and *sub3* from the user and insert into the table.
- ii) Pass the number of the subject *sub1* from (6)(a)(i) as a parameter of a PL/SQL function named 'CAL_GPA()' and return GPA value of the subject and insert into *gp1*. Do this step for *sub2* and *gp2*, *sub3* and *gp3*. To create the PL/SQL function 'CAL_GPA()' use the following condition:

Subject Number (<i>sub</i>)	GPA(<i>gp</i>)
80 ≥	4
60–79	3
< 60	2

- iii) First create a PL/SQL function named 'CGPA_CAL()' that takes the GPA from (6)(a)(ii) and return the CGPA $\left(\frac{gp1+gp2+gp3}{3}\right)$ of the students and then insert into the 'CGPA' column.

- b) What is PL/SQL function and procedure? Consider a relation TABULATION having attributes *student_ID* and *marks*. Write a SQL statement to find the *student_ID* having second highest *marks*. (08)

7. a) Let $R = (A, B)$ and $S = (A, C)$ and let $r(R)$ and $s(S)$ be relations. Using the special constant *null* define the following using tuple-relational-calculus expressions: (08)

(i) $r \bowtie s$ (ii) $r \bowtie \subset s$ (iii) $r \supset \bowtie s$ (iv) $r \supset \subset s$

- b) Since every conflict-serializable schedule is view serializable, why do we emphasize conflict serializability rather than view serializability? Explain with example. (09)
- c) What do you mean by cascading roll-back? How does 2-phase locking avoid cascading roll-back? Explain. (07)
- d) Discuss the working principle of a lock manager in concurrency control scheme. (11)

8. a) Define the lock modes of a multiple granularity scheme. Show the compatibility matrix for all lock modes of a multiple granularity scheme. (08)
- b) What is deadlock? Discuss some strategies to prevent deadlock. (09)
- c) Explain the working principle of a query processor. (11)
- d) Mention the measures needed in determining query cost of a query and then explain the query cost of a nested loop join operation. (07)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 1st Term Examination, 2017
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 model? Discuss, how this model helps analyst to visualize relationships in the system under study. (12)
b) Draw the diagram of the structure of an organization. (10)
c) What are the elements of a system? Describe shortly about them. (13)
2. a) Describe, why a project is terminated? (11)
b) What do you mean by prototyping? Graphically explain it. (11)
c) What are the questions raised/generated in feasibility study? And discuss about the result of feasibility study. (13)
3. a) Explain about the academic and personal qualification of a good analyst. (12)
b) Discuss about the reasons why it is difficult to determine user requirements. (11)
c) What do you mean by information gathering? And write the phases during information gathering. (12)
4. a) What are the properties of structured analysis? (10)
b) What are the steps taken to validate and prepare a system for final implementation? (10)
c) Describe about the criteria for system testing. (10)
d) Write the goal of input data design. (05)

SECTION B

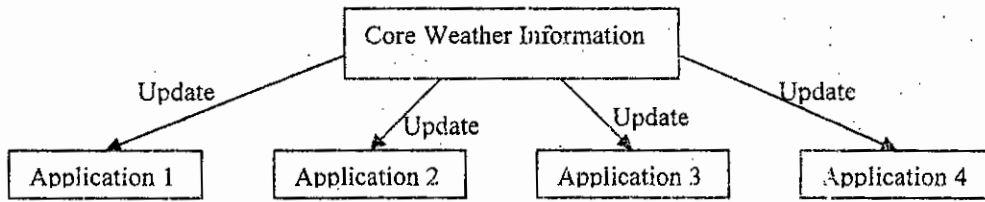
(Answer ANY THREE questions from this section in Script B)

5. a) What is software engineering? What are the differences between software engineering and computer science? (08)
b) What are the qualities of a good software? (04)
c) Differentiate between class variable and instance variable. (06)
d) Briefly discuss the following terms with example: (09)
 i) Dynamic binding
 ii) Java documentation
 iii) Fat client
e) Why do we use abstract classes and methods? Explain with an example. (08)
6. a) What are the purposes of <<hook>> and <<slot>> methods in a framework? Explain with example. (08)
b) Write down the activities of a server and a client. (10)
c) Differentiate between user stories and use cases. (07)
d) What is object diagram? Draw an object diagram from the following UML diagram. (05)



- e) What are the categories of responsibility that are allocated to a class? (05)

7. a) What are the reasons for using design pattern? Why is it hard to develop a design pattern? (06)
- b) Suppose, we have a class named 'Core Weather Information' and weather update is maintained in this class. Four other applications always look for new weather update from that core class as like the following figure. These applications show weather updates to the users. (15)



Now assume that you are going to build this system. Which design pattern should be used for the system? And why? State context, problem, forces and solution (Draw UML diagram and write pseudo code for solution).

- c) Differentiate between usability and utility. (05)
- d) Briefly discuss the following diagrams with example. (09)
- i) Sequence diagram
 - ii) Activity diagram
8. a) What is type use coupling? Explain it with 'List' interface of Java Collection framework. (08)
- b) What is flow graph for glass-box testing? Explain with simple example. (06)
- c) Define equivalence classes. Explain with examples. (06)
- d) Briefly discuss the following software process models: (10)
- i) Waterfall model
 - ii) Spiral model
- e) What is PERT chart? Give an example with diagram. (05)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 1st Term Examination, 2017
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) What is meant by spectrum and bandwidth? Why digital transmission is preferred over analog transmission? (15)
c) What do you mean by frequency domain concepts? By using frequency domain concept prove that rectangular pulse consist of infinite number of frequencies. (10)
2. a) Explain different transmission impairments on digital data. (06)
b) What are the functions of core and cladding in optical fiber? Classify optical fiber based on light propagation principles. (11)
c) Write down the characteristics of satellite point to point link. (08)
d) Given a channel with an intended capacity of 30 Mbps, the bandwidth of the channel is 4 MHz. Assuming white thermal noise, what signal power is required to achieve the capacity at 25°C? (10)
3. a) What is antenna? Explain the role of an antenna for signal transmission and reception. (09)
b) Consider a parabolic reflective antenna with a diameter of 2 m operating at 15 GHz, what is the effective area and the antenna gain? (08)
c) Briefly explain the DM technique. Compare the performance of DM system with PCM system. How can the problems of DM be avoided? (09)
d) What is spread spectrum? Draw the block diagram of frequency-hopping spread spectrum system. (09)
4. a) Briefly explain the QAM technique. Also compare its performance with QPSK. (08)
b) Briefly explain asynchronous and synchronous data transmission with their frame format. (07)
c) Explain the ASK, FSK and PSK using necessary diagrams. (06)
d) What is meant by coherent and non-coherent detection? Sketch the waveforms for the binary sequence 1011000011 using the following methods:
(i) Differential Manchester, (ii) Bipolar-AMI, (iii) B8ZS and (iv) HDB3. (14)

SECTION B

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

5. a) What is OSI? Write down the name of layers of OSI model. (08)
b) What is data link control protocol? Describe stop and wait flow control with necessary diagram. (10)
c) What abilities a receiving device should have to decide and interpret any bit pattern correctly? (10)
d) Write down the advantages of digital time sequence diagram. (07)
6. a) What is piggy backing? Write down the advantages of sliding window flow control compared to stop and wait flow control system. (10)
b) Write down the contingencies those Go-back-N technique takes into account. (13)
c) Give brief description of different types of stations, link configurations and data transfer modes used in HDLC. (12)
7. a) What is HDLC? Write down the significance of address field of HDLC in operation. (10)
b) What is bit stuffing. A transmitter needs to transmit the following information bit using HDLC. Write down the actual bit pattern that will be sent 1101111110011111001. (10)
c) Briefly explain ADSL and HDSL. (07)

- d) Why synchronous TDM is called synchronous? Is link control necessary in TDM system? Why? (08)
8. a) What is multiplexing? Draw the block diagram of FDM system and TDM system. (10)
- b) What are the comparisons between circuit switching and packet switching? Explain the effect of packet size on transmission frame. (10)
- c) Describe the levels on which functionality of X.25 is specified. (07)
- d) Write down the advantages of frame relay over X.25. (08)