

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
 B.Sc. Engineering 3rd Year 1st Term Examination, 2020
 Department of Computer Science and Engineering
 CSE 3101
 Theory of Computation

TIME: 1.5 hours

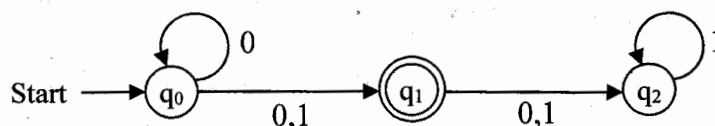
FULL MARKS: 120

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

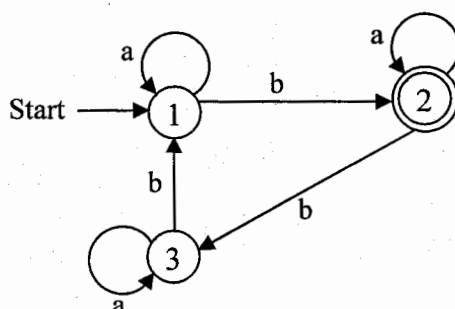
SECTION A

(Answer ANY TWO questions from this section in Script A)

1. a) Give a comparative discussion about alphabet, language, and power on alphabet. (09)
- b) Design a Deterministic Finite Automata (DFA) for the set of string over $\{a, b\}$ such that the length of the string $|\omega| = 2$ i.e., length of the string is exactly 2. (13)
- c) How can you verify whether a regular language is empty or not? (08)
2. a) Write regular expressions/definitions for the following languages: (09)
 - i) All strings containing no more than three a 's over alphabet $\{a, b, c\}$.
 - ii) The set of strings of 0's and 1's whose number of 0's is divisible by three and whose number of 1's is odd.
 - iii) All string of digits with at most one repeated digit.
- b) Convert the following NFA to DFA. (14)



- c) Sketch a brief argument for why any regular language can be recognized by an NFA. (07)
3. a) Let M be the DFA having alphabet $\{a, b\}$ and the following transition diagram. (15)



Give a regular expression for $L(M)$. Use any method you want.

- b) Design a NFA that accepts set of all strings of a 's and b 's such that there are two a 's separated by a number of positions that is divisible by 3. Also validate the NFA of valid input. (15)

SECTION B

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

4. a) Given the following ambiguous CFG: (13)

$$S \rightarrow 0A|1B$$

$$A \rightarrow 0AA|1S|1$$

$$B \rightarrow 1BB|0S|0$$
 - i) Find the string S generated by the grammar that has two leftmost derivations. Show the derivations.
 - ii) Find an equivalent unambiguous CFG.
- b) Define Context Free Grammar (CFG). Design a CFG for the language $L = \{0^i 1^j 2^j \mid i, j \geq 0\}$. (13)
- c) Define NP Hard and NP Complete problems. (04)

5. a) Construct a PDA that accepts the set of palindromes over $\{a,b\}$. (11)
b) Design a Turing Machine to implement "multiplication." Simulate the action for 001000. (15)
c) What do you mean by Recursive Languages and Recursively Enumerable Languages? (04)
6. a) Consider the following grammar: (20)

$$S \rightarrow ABCd$$

$$A \rightarrow BC$$

$$B \rightarrow bB \mid \varepsilon$$

$$C \rightarrow cC \mid \varepsilon$$

- i) Eliminate ε -productions.
ii) Eliminate unit productions.
iii) Put the grammar into Chomsky Normal Form (CNF).
- b) Using pumping lemma, show that the following language is not context-free. (10)

$$L = \{a^i b^j c^k \mid i < j < k\}$$

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
 B.Sc. Engineering 3rd Year 1st Term Examination, 2020
 Department of Computer Science and Engineering
 CSE 3103

Peripherals and Interfacing

TIME: 1.5 hours

FULL MARKS: 120

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

SECTION A

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

1. a) How the character 'N' is formed on a CRT screen in 5×7 matrix format? (10)
 b) Draw a flow diagram to show the implementation of USB interface. (12)
 c) What is address space? Which feature of an MPU determines the size of its address space? (08)
2. a) Draw the flowchart of data transfer in DMA mode. (10)
 b) Draw a block diagram of the circuit used for the speed control of DC motor and write the steps for its software design. (13)
 c) Write the basic working principle of a laser printer. (07)
3. a) Give a comparison among daisy chaining polling and independent requesting schemes. (10)
 b) Describe the synchronization process between 8086 and its coprocessor. (07)
 c) What is MDS? Briefly explain MDS software systems. (13)

SECTION B

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

4. a) Design a programmable timer using an 8254 and an 8086. For this purpose, interface the 8254 at an address 'X'0H for counter 0, where 'X' is the last digit of your 'Roll Number'. Here, the 8086 and 8254 run at 4MHz and 250KHz respectively. (24)
 - i) Complete the Figure 4(a) and draw a table with necessary memory addresses for the desired interfacing.
 - ii) Write an assembly language program to generate a square wave of period 'X' ms, where 'X' represents the last three digits of your 'Roll Number'. Any leading zero can be excluded from the three digit 'Roll Number'. The format of expected output is depicted in the Figure 4(b).

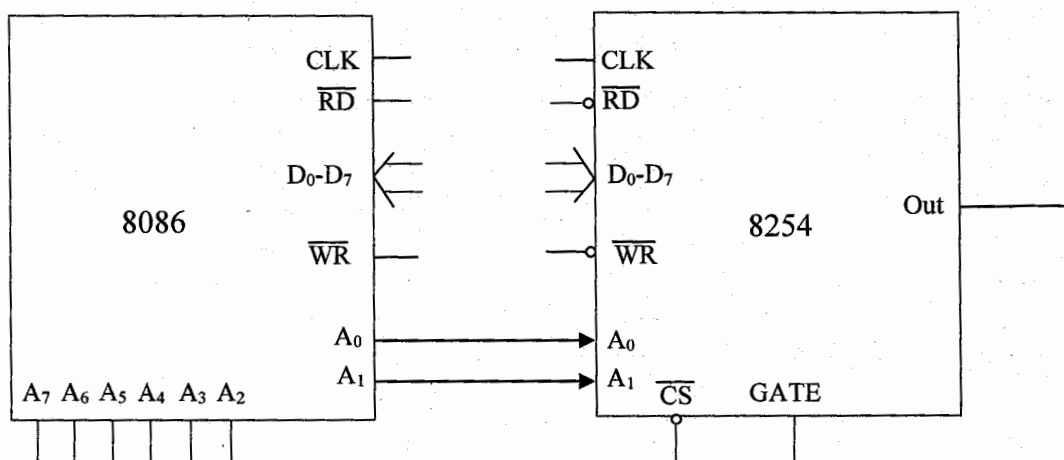


Fig. 4(a): Incomplete interfacing between an 8086 and an 8254.

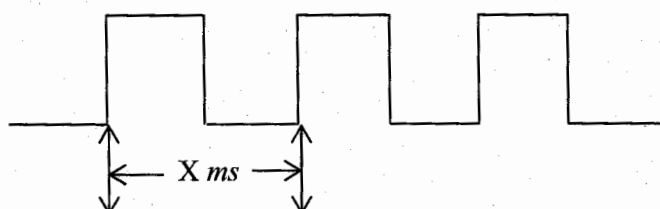


Fig. 4(b): Expected output using Mode 3 square wave generator.

- b) What are the major operations of a process control system? (06)
5. a) Write down some characteristics of an Op-Amp. How can Op-Amp be used as inverter, summing amplifier and differentiator. Explain with proper diagram. (15)
- b) What is the largest value of output voltage from an 8-bit DAC that produces 'X'V for a digital input of 10110010, where 'X' represents the last three digits of your 'Roll Number'? Any leading zero can be excluded from the three-digit 'Roll Number'. (09)
- c) What are the differences between zero-cross switching and random switching? (06)
6. a) Figure 6(a) shows on incomplete interfacing between an 8086 microprocessor and an 8255A. Interface the 8255A at an address 'X'0H for port A, where 'X' represents the last digit of your 'Roll Number'. (24)

- i) Complete the figure 6(a) and draw a table with necessary port addresses for the desired interfacing.
- ii) Identify the Mode 0 control word to configure port A and C_U as output ports, and port B and port C_L as input ports. For this purpose, the control word format is given below.

D7	D6	D5	D4	D3	D2	D1	D0
Mode Set Flag	Mode Selection A		Port A I/O	Port C_U I/O	Mode Selection B	Port B I/O	Port C_L I/O

- iii) Write an assembly language program to read the DIP switches and display the reading at port A from port B, and at port C_U from port C_L .
- iv) Extend the assembly program written for 6(a)-III to send the last three digits for your 'Roll Number' to port A. For example, if you want to send 128, then you should send 10000000 B in binary and therefore, 80H in hexadecimal.

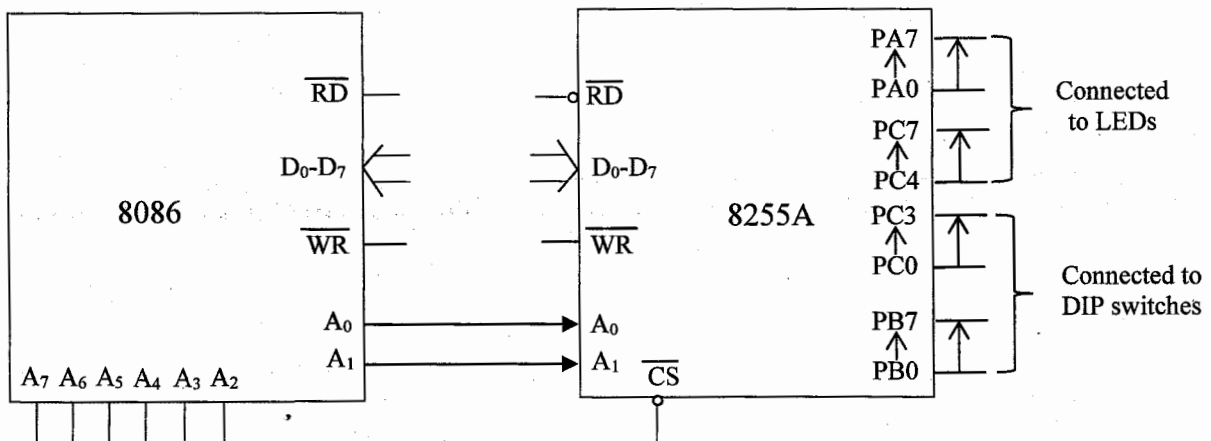


Fig. 6(a) Incomplete interfacing between an 8086 and an 8255A.

- b) What is a transducer? What are the desirable properties of a transducer? (06)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
 B.Sc. Engineering 3rd Year 1st Term Examination, 2020
 Department of Computer Science and Engineering
 CSE 3109
 Database Systems

TIME: 1.5 hours

FULL MARKS: 120

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

SECTION A

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

1. a) How can you represent (i) Total and Partial Participation (ii) Generalization and Specialization in a E- (10)
 R model?
 b) Transform the following ERD into a relational schema and hence write the SQL statement to create (12)
 the schema.



- c) How page/block size helps to design a sparse index? (08)
2. a) Construct a B^+ tree for random integer data for $n = 3$. *and h=3* (10)
 b) "Functional dependency is the generalization of super key" – Explain the statement with your own (10)
 example.
 c) Consider the following schema $PDB(Pat_No, Pat_Name, App_No, Time, Doctor)$ and functional (10)
 dependency F .

$F = \{ Pat_No \rightarrow Pat_Name$
 $Pat_No\ App_No \rightarrow Time\ Doctor$
 $Time \rightarrow App_No \}$

Find the suitable super key of the schema.

3. a) What is lossy decomposition? How can it be solved? (08)
 b) Given a Student Record Database (SRD). The marks of 5 courses are stored there. Create a trigger so (10)
 that the total and average field of the SRD is automatically calculated and inserted whenever a record
 is inserted.
 c) How can you specify the attributes in a DTD? Define a DTD for Banking schema using (12)
 $Account(Account_No, Branch_Name, Balance)$ and
 $Customer(Customer_ID, Customer_Name, Customer_City)$

SECTION B

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

4. a) Explain division operation in terms of basic relational algebra operation with your own example. (08)
 b) Explain the working principle of a query processor. (08)
 c) Consider the following relational database where the primary keys are underlined. (14)

$Branch(\underline{Branch_id}, Branch_Name, Branch_city)$
 $Customer(\underline{Customer_id}, Customer_name, Customer_city)$
 $Loan(\underline{Loan_number}, Branch_id, Amount)$
 $Borrower(Customer_id, Loan_number)$
 $Account(\underline{Account_number}, Branch_id, Balance)$
 $Depositor(Customer_id, Account_number)$

Write SQL query for each of the following relational algebra expressions given below:

- i) $\Pi_{Loan_number} (\sigma_{Amount > 1200} (Loan))$
- ii) $\Pi_{Customer_name} (\sigma_{Branch_name = "Perryridge"} (\sigma_{Borrower.Loan_number = Loan.Loan_number} (Borrower \times Loan))) - \Pi_{Customer_name} (Depositor)$
- iii) $\Pi_{Balance} (Account) - \Pi_{Account.balance} (\sigma_{Account.Balance < d.Balance} (Account \times \rho_d (Account)))$
- iv) $\Pi_{Customer_name} (Borrower) \cup \Pi_{Customer_name} (Depositor)$

- 5. a) What is view? "View makes complex query simple" – Justify the statement. (10)
- b) Describe the ACID property of transaction with proper example. (10)
- c) What is cascading rollback? Explain with an example. Why cascading rollback is needed? Explain the problems of cascading rollback. (10)

- 6. a) "Every cascadeless schedule is recoverable" – Justify the statement with example. (07)
- b) Suppose there is a table named Employee in your database. (10)
 - Employees(Employee_id, name, email, salary)*
 - Write a PL/SQL block which will show the employee name and email of all employees as output using cursor.
- c) Why two-phase locking protocol causes deadlock? How graph-based protocol solve this issue? Show this with an example. (13)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 1st Term Examination, 2020
Department of Computer Science and Engineering
ECE 3115
Data Communication

TIME: 1.5 hours

FULL MARKS: 120

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

SECTION A

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

1. a) Why and how does the channel bandwidth limit the data rate? (07)
- b) What is the total delay for a frame of size 5 million bits that is sent on a link with 10 routers each having a queuing time of $2 \mu s$ and a processing time of $1 \mu s$. The length of the link is 2000 Km. The speed of light inside the link is 2×10^8 m/s. The link has a bandwidth of 5 Mbps. Which component of the total delay is dominant? Which one is negligible? (13)
- c) Draw the frequency spectrum of the following signals. (i) $\frac{1}{4} + A \sin(4\pi ft)$, (10)
(ii) $A \sin(2\pi ft) + \frac{1}{4} A \sin(8\pi ft)$.
2. a) Write down the differences between coaxial cable and optical fiber. (06)
- b) For an QPSK modulator with an input data rate (f_b) equal to 20 Mbps and a carrier frequency of 100 MHz, (14)
 - i) Determine the minimum double sided Nyquist bandwidth and the baud.
 - ii) Calculate the minimum double sided Nyquist bandwidth for 8-PSK.
 - iii) Analyze how multilevel signaling effects the bandwidth requirements.
- c) For a tritbit input of $Q=1$, $I=0$, and $C=1$, determine the output amplitude and phase for the 8-QAM transmitter. (10)
3. a) Briefly explain synchronous and asynchronous data transmission with their frame formats. (10)
- b) What are the advantages of scrambling techniques? What is the result of scrambling the sequence 11100000000000 using one of the following scrambling techniques? Assume that the last non-zero signal level has been positive. (20)
 - i) B8ZS
 - ii) HDB3 (The number of non-zero pulse is odd after last substitution).

SECTION B

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

4. a) What is ARQ? Briefly describe the go-back-N ARQ for different contingencies. (10)
- b) Why is break up of a large block of data into smaller blocks necessary in stop and wait flow control? (10)
- c) What is piggy backing? Write down the advantages of sliding window flow control compared to stop and wait flow control system. (10)
5. a) In a communication system, there are 10 sources to be multiplexed on a single link. The sources are described as follows: (12)
 S_1, S_3 : Analog, 2 KHz bandwidth.
 S_2 : Analog, 4 KHz bandwidth.
 $S_4 - S_{10}$: Digital, 7*2 Kbps synchronous.
Design and draw TDM of these analog and digital sources.
- b) A source has a data pattern of 111111001111101. Write the data pattern that will be sent using HDLC. (10)
- c) Why synchronous TDM is called synchronous? (08)
6. a) What is multiplexing? Draw the block diagram of FDM system. (10)
- b) Briefly explain the generic architectural components of a PSTN network. (10)
- c) Draw the block diagram of datagram approach and virtual circuit approach for packet switching. (10)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 3rd Year 1st Term Examination, 2020
Department of Computer Science and Engineering
CSE 3119
Software Engineering and Information Systems

TIME: 1.5 hours

FULL MARKS: 120

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

SECTION A

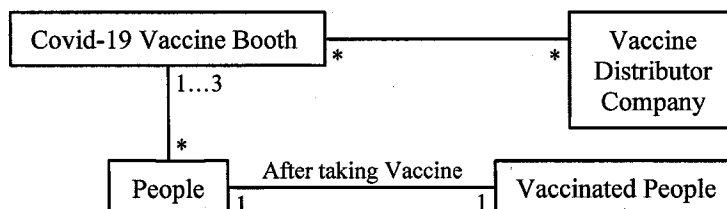
(Answer ANY TWO questions from this section in Script A)

1. a) Define the system concept and describe the characteristics of a system. (15)
b) What are the stages of the System Development Life Cycle? Explain it shortly. (15)
2. a) What does an analyst need to consider for system analysis? Describe academic and personal qualifications of an analyst? (15)
b) Write the dimensions of planning. Also explain several reasons why it is difficult to determine user requirements. (15)
3. a) What are the phases during information gathering tools? Describe them shortly. (10)
b) Write the steps in feasibility analysis. (10)
c) How can you plan user training? Explain. (10)

SECTION B

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

4. a) Define framework. 'A framework is intrinsically incomplete' – Explain. (10)
b) Consider a Client-Server architecture for 'Online Term Final Examination'. Now describe this architecture with necessary diagrams. (15)
c) What is design pattern? What could be the alternate of design patterns? Explain. (05)
5. a) Explain the principle of the Model-View-Controller (MVC) architectural pattern considering the concept of 'Online meetings on Zoom platform'. (10)
b) What is object diagram? Draw an object diagram from the following UML diagram. (15)



- c) Differentiate between Sequence diagram and Activity diagram. (05)
6. a) Explain generalization, extension, inclusion of Use-Case diagram on the context of 'Social Media Applications'. (10)
b) Define critical races. How critical races can be prevented? Explain with examples. (13)
c) Differentiate between system domain model and system model. (07)