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**Bangabandhu Sheikh Mujibur Rahman Science and Technology University  
Sheikh Hasina Institute of I.C.T.**

**Department of Computer Science and Engineering  
3rd Year 1st Semester B.Sc.Engg. Midterm Examination-2021**

**Course Code : CSE307**

**Course Title : Compiler Design**

**Marks: 20**

**Time: 1 hour**

**N.B. Answer 4(Four) questions**

- Q1. What is a compiler? What are the differences between Compiler and Interpreter? Can you provide an example of a hybrid compiler with explanation? 1+2+2
- Q2. Define and explain the terms Assembler and Linker. What roles are played by Lexical Analyzer? 3+2
- Q3. Write regular definition for the following language:  
*"All strings of a's and b's which contain just three b's"*  
And also draw the transition diagram. 3+2
- Q4. Explain the term 'Lexeme' and 'Token' with example. What are the advantages of a compiler over an interpreter ? 3+2

Course Code: CSE 305 Course Title: Computer Architecture and Organization

Total marks: 20

Note: Answer **2(TWO)** questions taking any **3(THREE)** questions.

- |    |   |         |
|----|---|---------|
| Q1 | (a) What is data path? Describe single bus organization of a Central Processing Unit(CPU) with necessary figures.   | 1+4     |
|    | (b) What is Interrupt? Why It is better than programmed control I/O?Explain with an example.  | 1+4     |
| Q2 | (a) Write a assembly program that takes a line of characters one by one as input and show them in any output device.  | 5       |
|    | (b) Write down overall operation of a computer and major tasks of the components of functional unit.  | 2+3     |
| Q3 | (a) Describe how memory is accessed showing connection between memory and Central Processing Unit(CPU) and write short note on the registers involved in memory access. | 3.5+2.5 |
|    | (b) Draw block diagram of a 1-bit register. Write down the different techniques of accessing I/O device by a CPU.   | 1.5+2.5 |

**Bangabandhu Sheikh Mujibur Rahman Science and Technology University**  
**Department of Computer Science & Engineering**  
**B.Sc. Engineering Mid-term Examination-2021**

Course No.: CSE303

Course Title: Operating System and System Programming

Full marks: 20

Time: 01 hour

1. (a) What is an Operating system? What is the difference between multiprogramming and multiprocessing? 4
- (b) Describe multiprogramming and time sharing operating systems. 4
- (c) Define process and program. 2
2. (a) Define context switch. Give an example of context switching with the application of PCB. 4
- (b) What do you mean by thread? Is there any advantage of thread over process? 3
- (c) Draw the process state diagram. 3

Time: 01 Hour

Marks:20

Answer any two (2) from the following three (3) questions including 3.

1. a) What is DBMS? What are the advantages in using the DBMS over the traditional file system? Explain briefly. 1+4  
b) What does the query processor component include in the database system? Show the query processing technique with a diagram. 2+3
2. a) What is meant by the primary key of a relation? How do you select a primary key? 1+2  
b)  
*employee (employee.ID, person\_name, street, city)*  
*works (employee.ID, company\_name, salary)*  
Consider the relational database in the figure given above. An employee may work more than one company. Give an expression in the relational algebra to express each of the following queries:  
i. Find the names and street address of all employees who live in “Dhaka” city. 1  
ii. Find the names of all employees who work for “Agrani Bank Limited” and earn more than \$100,000. 3  
iii. Find the names of all employees <sup>work</sup> currently working in “Agrani Bank Limited” who never worked in “Sonali Bank Limited”. Use set operation. 3
3. a) In a university, a student enrolls in Courses. A student must be assigned to at least one or more Courses. Each course is taught by a single Professor. To maintain instruction quality, a Professor can deliver only one course.  
Construct an E-R diagram for the above example. Assume the proper attributes for each entity set. 5  
b) Perform E-R to Relational Model mapping and construct appropriate tables for the above example stated in 3(a). 5

Bangabandhu Sheikh Mujibur Rahman Science and Technology University  
Department of Computer Science & Engineering(CT)  
Semester B.Sc. Engineering Examination-2021

Course : CSE301 System Analysis and Design      Full Marks: 60 Time: 03 hours  
**N.B.** Answer SIX questions, taking any THREE from each section.

- Q.1 (a) What is system analysis, and what are the key steps involved in the process? 4  
(b) Describe some common tools and techniques used in system analysis, such as data flow diagrams and use cases 3  
(c) Define functional and non-functional requirements and explain the difference between them. 3
- ✓ Q.2 (a) Describe some common methods for identifying requirements, such as interviews and surveys. 3  
(b) What is data modeling, and how is it used in system analysis? 3  
(c) What is the systems development life cycle (SDLC), and how is it used in system analysis? 4
- ✓ Q.3 (a) Describe how the SDLC is used in system analysis to ensure the successful development of a new system. 3  
(b) Define system testing and explain its purpose 3  
(c) Identify the different types of system testing, such as unit testing, integration testing , and acceptance testing. 4
- ✓ Q.4 (a) Define a use case diagram and explain its purpose in system analysis. 4  
(b) Identify the different components of a use case diagram, such as actors, use cases, and 3  
(c) What is the role of the system analyst as (i) Change Agent and (ii) Investigator and Monitor? 3

**Section B**

- Q.5 ✓(a) Draw a system following all process in System analysis and design. 10  
Q.6 ✓(a) Define system and system analysis. Describe briefly the characteristics of a system. 4  
(b) Distinguish between  
i) Open and Closed system.  
ii) Deterministic or Probabilistic System 4  
(c) Write short note on the concept of Decision Support System. 2
- Q.7 (a) What traditional information-gathering tools are available for the analyst? Explain each tool briefly. 4  
(b) In what respect is interviewing an art? Explain. 3  
(c) Write the procedure for questionnaire construction. 3
- Q.8 (a) What is structured analysis? List the attributes of it. 3  
(b) What is level DFD? Write down the advantages of level DFD. 3  
(c) Create Level -1 DFD for result preparation automation system of B.Sc. courses of BSMRSTU. Describe the working of the system clearly. Also mention all assumptions made by you. 4

**Bangabandhu Sheikh Mujibur Rahman Science and Technology University**  
**Department of Computer Science & Engineering (ICT)**  
3rd Year 1st Semester B.Sc. Engineering Examination-2021

Course Code: CSE303 Course Title: Operating System and System Programming

Time: 03 hours

Full Marks: 60

N.B. i) Answer six questions, taking no more than three from each section.

ii) All parts (a, b, c, ...) of a question must be answered sequentially.

**Section A (30 marks)**

- |     |   |   |
|-----|---|---|
| Q.1 | (a) Define OS. What is the purpose of an operating system?                        | 4 |
|     | (b) What is the difference between multiprogramming and multiprocesssing?         | 3 |
|     | (c) Explain "Operating system is a manager of hardware and software".             | 3 |
| Q.2 | (a) What do you mean by job and process?  | 2 |
|     | (b) Draw a process control block.   | 3 |
|     | (c) Draw the process state diagram and explain it.                                | 5 |
| Q.3 | (a) Explain the life cycle of a process. Describe PCB.                            | 4 |
|     | (b) What do you mean by thread? Is there any advantage of thread over process?    | 4 |
|     | (c) What do you mean by preemptive and non-preemptive process?                    | 2 |
| Q.4 | (a) Briefly write the direct and indirect method for inter process communication. | 4 |
|     | (b) What is Starvation? How the system can deal with starvation.                  | 3 |
|     | (c) Explain logical address and physical address.                                 | 3 |

### Section B (30 marks)

Q.5 (a) Compare FCFS and Round Robin CPU scheduling algorithms 3

(b) 4

Process	Arrival Time	Burst Time	Priority
P0	7	7	3
P1	3	8	1
P2	6	12	2

Calculate the waiting time, turn-around time, average waiting time, and average turn-around time using the Priority CPU scheduling algorithm.

(c) Define the following: i) Throughput ii) CPU utilization and iii) Response time 3

Q.6 (a) What is semaphore? Explain how semaphore can be implemented. 6

(b) Explain all three requirements to solve the critical section problem. 4

Q.7 (a) What do you mean by deadlock? Explain the necessary conditions for deadlock. 5

(b) Define different types of resource allocation graphs. 3

(c) What is the meaning of the term busy waiting. 3

Q.8 (a) What do you mean by virtual memory technique? What are the advantages of it? 2

(b) What is a shell? Explain how it enables users to interact with an operating system. 4

(c) Write a directory format. 2

Course No: CSE309

Course Title: Database Management Systems

Full Marks: 60

Time: 03 hours

N.B. i) Answer SIX questions, taking any THREE from each section.

ii) All parts (a, b, c, ...) of a question must be answered sequentially.

### SECTION – A (30 Marks)

1. a) Define database management system. What are the main differences between file processing and DBMS? 4  
 b) Define attributes. What are the responsibilities of DBA? 4  
 c) Define data redundancy and inconsistency with examples. 2

2. a) Define relation schema and relation instance. 2  
 b) Can you use a phone number of a student as a primary key instead of his student id? Justify your answer. 2  
 c) Consider the following relational schema of the student database, where the primary keys are underlined.

*student (student-id, student-name, department, street, city)*

*course (course-id, title, credit)*

*registered (student-id, course-id, year, semester)*

Secu

Write down relational algebra for the following queries:

- i. Find the names, street address, and cities of all students in the CSE department. 2  
 ii. Find the names of first year and first semester students and their registered course titles. 2  
 iii. Find the set of all courses (only course ID) registered in the first and second semester of a student with ID CSE101. Use set operation. 2

3. a) Distinguish between natural join and inner join operation in SQL. 2  
 b) Consider the following relational schema of instructor database:

*instructor (instructor-id, name, salary, department)*

*course (course-id, course-title)*

*taken (instructor-id, course-id)*

Write down SQL for the following queries:

- i. Insert the information in the database specifying that a new instructor named Selim Mahmud in the CSE department with ID 1102 and salary 120000, has taken the course Database Management System with course id: CSE309. 2  
 ii. Find the instructor's name of the EEE department and the courses (only title) they have taken. List the records in alphabetical order according to the names of the instructors. 2  
 iii. Find the average salary of instructors in each department. 2  
 iv. Increase salaries of instructors whose salary is over 100,000 by 5%, and all others by 8%. 2

4. a) Draw an ER diagram for the following situations- 4

"In an organization, several projects are undertaken. Each project can employ one or more employees. Each employee can work on one or more projects. Each project is undertaken on the requirements of the client. A client can request for several projects. Each project has only one client. A project can use a number of items and an item may be used by several projects."

- b) What do you understand about the Super key, Candidate key and Primary key? 3  
 c) What is RAID? List various RAID levels. 3

instructor id, cid, et

## SECTION-B (30 Marks)

5. a) Show that the following decomposition of the schema R under functional dependencies F is  
 (i) lossless decomposition and (ii) dependency preserving. 2  
 $R = (A, B, C) \quad F = \{A \rightarrow B, B \rightarrow C\}$  2  
 $R1 = (A, B), \quad R2 = (A, C)$

- b) What is normalization? What are the aims of normalization? 2  
 c) What is the third normal form (3NF)? Apply 3NF normalization on the following relation. 1  
 +

Course-id	Instructor-id	Instructor	Course-topic
CSE101	001	MKB	ML
CSE208	002	SA	Database
CSE305	003	MNH	NLP
CSE109	004	MMA	DL

6. a) List the uses of the closure set of an attribute. 2  
 b) Consider the set of functional dependencies:  $F = (A \rightarrow BC, B \rightarrow AC, C \rightarrow AB)$  for the relational schema  $R = (A, B, C)$ . 3  
 i. Find the candidate keys for R 3  
 ii. Compute the canonical cover  $F_c$  of R. 3  
 (a) How can the union rule be inferred from Armstrong's axioms? - 2

7. a) Suppose a relation order contains four attributes i.e. order ID, order date, description and customer ID, where order ID is the primary key and customer ID is the foreign key, comes from the relation customer. Now create a table for this relation and then delete this using SQL command. 4  
 b) Differentiate between dense and sparse indexes in three points. 2  
 c) Explain the condition for lossless-join decomposition. Explain why the allocation of records to blocks affects database-system performance significantly. 4

8. a) List the ACID properties of the transaction. 2  
 b) During its execution, a transaction passes through several states. Draw the state diagram of the transaction and define each of them briefly. 3  
 c) Given a schedule below, justify whether the schedule is conflict serializable or not. 3

$T_1$	$T_2$
read(A) write(A)	read(A) write(A)
read(B) write(B)	read(B) write(B)

- (d) When does a cascading rollback happen for a schedule? Give an example of it. 2

**Bangabandhu Sheikh Mujibur Rahman Science and Technology University**  
Department of Computer Science & Engineering, ICT  
3rd Year 1st Semester B.Sc. Engineering Examination-2020

**Course Title:** Compiler Design  
**Full Marks:** 60

**Course No:** CSE307  
**Time:** 3 hours

**N.B.**

- i) Answer any THREE (3) questions from each Section.
- ii) All questions are of equal values.

**Section – A**

- Q.1 (a) Define and explain the terms compiler, assembler and linker. For C/C++ programs, elaborate the relationship of these with (i) header files, (ii) libraries. 4
- (b) Draw the block diagram of different phases of the compiler (interfaces between them). 4
- (c) Explain the scenario in lexical analysis where we need to look ahead at least one additional character. 2
- ✓ Q.2 (a) Explain clearly the difference among the following regular expressions in the context of Lex lexical analyzer generator. 4
- (i) {ictcese}
  - (ii) [ictcese]
  - (iii) (ictcese)+
  - (iv) ictcese +
- (b) Define tokens, patterns and lexemes with proper examples. 3
- (c) Write a regular expression for each of the following sets of binary strings. 3
- (i) Binary strings with no consecutive 0's or 1's
  - (ii) Binary strings which are divisible by 2
- ✓ Q.3 (a) Explain the ambiguous grammar G: 4
- $$E \rightarrow E + E \mid E - E \mid E * E \mid E / E \mid a \mid b$$
- for the sequence a + b \* a + b
- (b) Eliminate left recursion from the following grammar: 4
- $$\begin{aligned} S &\rightarrow Aa \mid Bb \\ A &\rightarrow Aa \mid Abc \mid c \mid Sb \\ B &\rightarrow dA \mid bb \end{aligned}$$
- (c) Explain the differences between top-down parsing and bottom-up parsing. 2
- Q.4 (a) Given the following expression: ((a-b)-((a - b) \* (a + b))+(a - b) \* (a + b)) 4
- i. Construct the DAG
  - ii. Construct three address code for DAG

Assume the following grammar for this question.

$$E \rightarrow E + T \mid E - T$$

$$T \rightarrow T * F \mid T / F$$

$$F \rightarrow (E) \mid id$$

- (b) What is the difference between quadruples and triples representations of three-address codes? Illustrate with an example three-address code. 4

- (c) Write a short note on three-address instructions.

### Section - B

- Q.5 (a)  $a^*b \text{ printf}( "1" );$   
 $(ab)^*b \text{ printf}( "2" );$

$c^* \text{ printf}( "3" );$   
 We have the above snippet, with patterns and their associated actions, from a Lex code.  
 Show the output, with detailed explanations, that is produced when this scanner is run over  
 the following strings:

- (i) aaabccabbb  
 (ii) cbbbbabc  
 (iii) cbabc

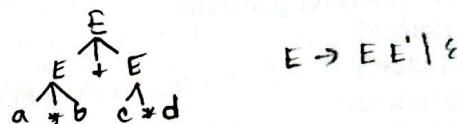
- (b) Differentiate with example between-

- (i) Syntax tree and directed acyclic graph (DAG)  
 (ii) S-attributed definitions and L-attributed definitions.

- (c) What are the differences between compiler and interpreter?

- Q.6 (a) Compute FIRST and FOLLOW sets for the following grammar:

$$\begin{aligned} E &\rightarrow E + T \mid E - T \\ T &\rightarrow T * F \\ F &\rightarrow (E) \mid id \end{aligned}$$



$$E \rightarrow E E' | \epsilon$$

- (b) Construct LL(1) parsing table for the following grammar.

$$\begin{aligned} S &\rightarrow pB \mid pC \mid Su \mid Sv \\ B &\rightarrow qBr \mid w \\ C &\rightarrow x \end{aligned}$$

Is it LL(1) grammar? Justify your answer.

- Q.7 (a) Construct DAG for the following assignment statement  
 $b[i] = a + (a+a+(a+a+a+(a+a+a+a)))$

- (b) The following grammar generates binary numbers with a decimal point.

$$\begin{aligned} A &\rightarrow L \cdot L \mid L \\ L &\rightarrow LB \mid B \\ B &\rightarrow 0 \mid 1 \end{aligned}$$

(i) Design an SDT (Syntax-directed translation scheme) that computes the value of binary numbers generated from the above grammar.

(ii) The translation of string 110.101 should be the decimal number 6.625. Draw the annotated parse tree for this translation.

- (c) Give an example of a SDD which is not L-attributed.

- Q.8 (a) Differentiate with example between –

- I. Syntax-directed definition and syntax-directed translation.
- II. Static and dynamic storage allocation in a run-time environment.
- III. Syntax tree and directed acyclic graph (DAG)
- IV. S-attributed definitions and L-attributed definitions.

- (b) Define L-attributed SDD (Syntax-Directed Definition). Give an example of an SDD which is not L-attributed.