

INTERNATIONAL ISLAMIC UNIVERSITY CHITTAGONG

Department of Computer Science & Engineering (CSE)

BSc in CSE, Mid-Term Examination, Spring 2025

Course Code: CSE-3527 Course Title: Compiler

Full Marks: 30 Time: 1 Hour 30 minutes

[Answer all the following questions. Some questions may have an option.  
(Figures at right margin illustrate the marks (M), course objectives (COs), and bloom's taxonomy (DL))]

No.	Questions	M	COs	DL
1. a)	Define the compiler with a block diagram that illustrating its front-end and back-end phases. Elucidate the analysis of the source program with its compiling phases.	4 (2+2)	CO1	U
	<b>Or</b>			
	How is an executable target program generated from a given source program? Explain it using a language processing system with an appropriate diagram. What basic tools are needed for compiler construction in a language processing system?	4 (1+2+1)	CO1	An
b)	Translate the following C programming statement step by step through the compiler phases. Draw the diagram of the compiler's phases with output translating annotations at each phase and generate the symbol table for the following statement. $a = x + y * r - w / 4;$ [where the values of <b>a</b> , <b>r</b> , and <b>w</b> are fractional]	6 (2+3+1)	CO1	An
2. a)	Write is the purpose of context-free grammar (CFG) in compiler design. Define and emphasize the concept of ambiguity in CFG. How does it impact a compiler design? Consider the following CFG G <sub>1</sub> : $\begin{aligned} Exp &\rightarrow Exp Op Exp \\ Exp &\rightarrow (Exp) \\ Op &\rightarrow +   -   *   / \\ Exp &\rightarrow int \end{aligned}$ Whether the above grammar is ambiguous or not. Justify your answer using its input string " <b>int * (int + int)</b> ". Construct the syntax tree for the input string " <b>int + int * (int / int)</b> ".	6 (3+3)	CO2	Ap
	<b>Or</b>			
	Define synthesized attributes? Consider the following CFG G <sub>2</sub> : and G <sub>3</sub> G <sub>2</sub> : $\begin{aligned} S &\rightarrow Ab   aB \\ A &\rightarrow aA   \epsilon \\ B &\rightarrow Bb   \epsilon \end{aligned}$ G <sub>3</sub> : $\begin{aligned} Seq &\rightarrow Seq Instr   \textit{begin} \\ Instr &\rightarrow \textit{east}   \textit{north}   \textit{west}   \textit{south} \end{aligned}$	6 (1+2+3)	CO2	An
i)	Write the language definition of the above grammar G <sub>2</sub> with $\Sigma = \{a, b\}$ and generate the leftmost and rightmost derivation for the input string " <b>aaab</b> ".			
ii)	For a robot position tracking system CFG G <sub>3</sub> , suppose a robot can instructed to move east, north, west, or south from the current position. Position can be marked by a coordinate pair (x, y) with an initial position (0,0) at the <b>beginning</b> . Draw the tracking position of the robot and give the leftmost derivation and parse tree for the input string " <b>begin west south east east north north</b> ".			

- b) Describe the roles of lexical analyzer and parser in a compiler with the appropriate block diagram. Identify the tokens, lexemes and patterns of the following C programming code segment in a table [please avoid the redundant entry of tokens]:

```
int c, n=5, fact = 1;
printf("Enter a integer number\n");
for(c = 1; c <= n; c++)
    fact = fact * c;
printf("Factorial of %d = %d\n", n, fact);
```

4 CO2 U  
(2+2)

3. a) Write the regular expression and draw the nondeterministic finite automata (NFA) transition diagram to define the number of C programming language including fractional and exponential parts. Construct the  $\epsilon$  - NFA for regular expression "(0|1)\*011" and convert it into the deterministic finite automata (DFA) using  $\epsilon$ -closure.

6 CO2 An  
(2+4)

- b) Define the different types of grammar with emphasizing the basic production rules of the grammar. Identify the regular grammars, right-linear grammars, left-linear grammars, context free grammars, context sensitive grammars and useless non-terminals in the following grammars. [Some grammar may fit more than one category].

4 CO2 Ap  
(2+2)

<b>G4:</b>	<b>G5:</b>	<b>G6:</b>	<b>G7:</b>
$S \rightarrow baB$	$S \rightarrow aX   bY$	$S \rightarrow aA   \epsilon$	$S \rightarrow Ma   Mb$
$aB \rightarrow aA$	$X \rightarrow aY$	$A \rightarrow Ab   a$	$M \rightarrow Nb   d$
$A \rightarrow bA   b$	$Y \rightarrow b$	$C \rightarrow c$	$N \rightarrow c$

END

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