National University of Computer and Emerging Sciences, Lahore Campus

	Course Name:	**Compiler**	**Course Code:**	
	Degree Program:	**BS (CS)**	**Semester:**	**Fall 2020**
	Exam Duration:	**90 min**	**Total Marks:**	**40**
	Paper Date:	**20-Oct-2020**	**Weight**	
	Section:		**Page(s):**	**4**
	Exam Type:	**Mid-1**		

No separate answer sheets required. Rough sheet are allowed, however. Do not attach additional sheets with this question paper. All the questions carry equal marks

Question 1

α) Match the entries in the first column with the corresponding description in the second:

a) Lexical analyzer	i. Convert words into sentences
b) Parser	ii. Type checking
c) Semantic analyzer	iii. Translator
d) Intermediate code generator	iv. Execute program
e) Interpreter	v. Identify words

β) Answer the following MCQ's:

i. Compiler provides
   a) Fast execution
   b) Portability (platform independence)
   c) Better debugging
   d) Source code protection
   e) Both (a) and (d)

ii. Interpreter provides
   a) Fast execution
   b) Portability
   c) Better debugging
   d) Source code protection
   e) Both (b) and (c)

iii. Hybrid system provides
   a) Portability
   b) Better debugging
   c) Source code protection
   d) Better execution time
   e) All of above

iv. Following phases populate the symbol table
   a) Lexical analyzer
   b) Syntax analyzer
   c) Semantic Analyzer
   d) Both (a) and (b)
   e) Both (a) and (c)

v. A regular expression cannot include
   a) Kleene star
   b) Operator or
   c) Concatenation
   d) Parenthesis
   e) Recursion

Question 2

a) A cell phone user needs to dial a service code to access a particular service. Following are few example codes:

*234*6214532*500# *234*5274339*1000# *234*7318562*200#

Here, the code "234" is fixed. Afterwards there is a seven-digit phone number. Finally the user writes an amount between 100 and 1000. Only multiples of 100 are allowed: 572 is not allowed for example.

Give a regular definition for such service codes.

b) Give a DFA for the odd-odd language - odd number of a's and odd number of b's.

Question 3

a) Give a CFG for the C++ if-else statement. Note the else part is optional.
Hint: following is a CFG for the while loop:

```
S -> while ( E ) S
```

b) Set precedence and associativity in the following CFG:

```
E -> E + E | E - E | E * E | E / E | id | num
```

Assume the precedence of + is higher than all the other operators. Rest of the operators has the same precedence. Also assume the associativity is right to left.

Question 4

a) Remove left recursion from the following CFG:

```
S -> S a | S b | x | y
```

b) Remove left recursion from the following CFG:

```
S -> E =: id
E -> num + E | num | S
```