(26) 00046

The Open University of Sri Lanka
Faculty of Engineering Technology
Department of Electrical and Computer Engineering

Study Programme	: Bachelor of Technology Honours in Engineering
Name of the Examination	: Final Examination
Course Code and Title	**: EEX6535/ECX6235 Compiler Design**
Academic Year	: 2017/18
Date	: 08th February 2019
Time	: 0930-1230hrs
Duration	: **3 hours**

General Instructions

1. Read all instructions carefully before answering the questions.

2. This question paper contains three (3) questions in SECTION A and three (3) questions in SECTION B on three (3) pages.

3. Answer ALL questions in SECTION A. [60 Marks], and answer any TWO questions from SECTION B. [40 Marks]

4. The answer to each question should commence from a new page.

5. This is a Closed Book Test (CBT).

6. Answers should be in clear handwriting.

7. Do not use Red colour pen, and clearly state assumptions if any

Section A – Answer all questions

The following section presents a brief description of the Grammar (*G*) of the DJ Music Center case study.

DJ Music Center consists of a music and customer database. The music database contains information on all music CD label and category (Rock, Reggae, etc.) currently on file, and the user (customer) database contains information on all current members of the DJ Music Center, as well as all music CDs currently rented by each customer. A customer can walk into the DJ Music Center and either rent a music CD or become a member of the DJ Music Center. The customer is served by the owner of the store (or an employee).

1. MusicCenter → MUSICS CUSTOMERS | CUSTOMERS MUSICS | MUSICS | CUSTOMERS
2. MUSICS → MUSICS MUSIC | MUSIC
3. MUSIC → label category RENTALS2
4. RENTALS2 → RENTALS2 RENTAL2 | RENTAL2
5. RENTAL2 → CUSTOMER1
6. CUSTOMER1 → name days
7. CUSTOMERS → CUSTOMERS CUSTOMER | CUSTOMER
8. CUSTOMER → name days RENTALS
9. RENTALS → RENTALS RENTAL | RENTAL
10. RENTAL → MUSIC1
11. MUSIC1 → label category

[Q1] (a) Define the grammar (**G**) for the above scenario (Clearly show the Terminals and Non-Terminals.) [05 Marks]

(b) Write LEX implementation syntax for the given grammar (**G**). [10 Marks]

[Q2] (a) Write an example string (expression), if you wish to rent three rock CDs for 30 days and two reggae CDs for 15 days from the DJ Music Center. [10 Marks]

(b) Validate the string written in Q2 (a) using the grammar (**G**) in Q1 (a). [10 Marks]

[Q3] (a) Draw a parse tree for the string in Q2 (a). [05 Marks]

(b) Write C type declarations for an abstract syntax tree structure for the **G**. [05 Marks]

(c) Draw the abstract syntax tree for the given string Q2 (a) that would result from the C type declarations of Q3 (b). [05 Marks]

(d) Draw the NDFA and DFA for the given string Q2 (a). [10 Marks]

Section B – Answer ANY TWO questions

[Q4] The FDL grammar rules define as follows (FDL, FDEF, FEXP, FLIST, are non-terminals and others are terminals).

FDL → FDEF FDL | ε
FDEF → #feature #: FEXP
FEXP → #op #(FLIST #)
FLIST → FEXP #, FEXP | #feature

(a) Draw a derivation tree for the following string.
#feature #: #op #(#op #(#feature #)#, #op #(#feature #)#) [03 Marks]

(b) Draw a NFA for the string: {#feature #: #op #(#feature #)}* [05 Marks]

(c) Draw a DFA equivalent to NFA in Q4 (b) [12 Marks]

[Q5] Consider the grammar rules given below (DESK, EXPR, CONST, DEFS, DEF are non-terminals, and others are terminals).

DESK → print EXPR CONST
EXPR → EXPR + id | id
CONST → where DEFS
DEFS → DEFS DEF | ε
DEF → id = int

(a) Derive the string: print id + id where id = int [03 Marks]

(b) Define the Chomsky Normal Form (CNF) for CFGs. [03 Marks]

(c) Convert the given grammar into CNF. [12 Marks]

(d) Derive the above string in (a) using new grammar in (c) [02 Marks]

[Q6] Consider the grammar rules given below (VEHICLES is a non-terminal and others are terminals).

VEHICLES → car VEHICLES jeep | car jeep

(a) Find the LR(1) sets of items. [08 Marks]

(b) Compute the LR(1) parsing table (Action – Goto) for the corresponding shift-reduce parse engine. [08 Marks]

(c) Show the parsing steps (Input – Action) of the string: **car car jeep jeep** [04 Marks]