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Compiler Design/ CS3002/CSE&IT/6th/2017

## Mid-Semester Examination, Spring, 2017

School of Computer Engineering

KIIT University, Bhubaneswar-24

Time: 2hrs

Full Mark: 25

(Answer Any five Questions including Q.No.1)

Q1) Answer all questions.

[1×5]

(a) Define a Compiler. Contrast its features with an interpreter.

(b) Count the number of tokens in the followings:

(i) `printf("i = %d, &i = %x", i, &i);`

(ii) `void main()  
{  
    printf("Whats up %d", ++&&***a); /* abc */  
}`

(c) Given the following expression grammar:

$E \rightarrow E * F \mid F + E \mid F$

$F \rightarrow id - F \mid id$

What is the precedence and associativity of the operators  $*$ ,  $+$  and  $-$ ?

(d) Draw a transition diagram to recognize an e-mail address.

(e) Left factor the following grammar.

$repr \rightarrow repr + rterm \mid rterm$

$rterm \rightarrow rterm rfactor \mid rfactor$

$rfactor \rightarrow rfactor^* \mid rprimary$

$rprimary \rightarrow a \mid b$

Q2)(a) Explain each phase of compiler for the expression  $a := b + c * 50$ .

[2]

(b) Consider the following Grammar with start symbol A.

[1.5×2]

$A \rightarrow (C) \mid o$

$C \rightarrow C, A \mid A$

(i) Construct a parse tree for  $(o, o)$  and  $(o, (o, o))$ .

(ii) Construct a leftmost and rightmost derivation for the string  $(o, (o, o))$ .

Q3)(a) Justify the followings.

[1×2]

(i) Lexical Analysis should be separated from syntax analysis

(ii) Various phases of compiler are grouped into passes as backend and front end.

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(b) What are regular definitions? Write regular definitions for the followings: [1+1+1]

(i) All identifiers with `_` as the first symbol.

(ii) All real numbers with optional fractional part

Q4)(a) Why input buffering is required in lexical analysis? How a sentinel is handled in processing lexemes during lexical analysis? [2]

(b) Convert the following regular expression  $(a^*|b^*)^*$  into deterministic finite automata. [3]

Q5) (a) Construct a DFA for the relational operators in C language by clearly mentioning the return functions at the final states of the DFA. [2]

(b) Consider the following grammar [3]

$A \rightarrow aBe \mid cBd \mid C$

$B \rightarrow bB \mid e$

$C \rightarrow f$

Write down the procedures for the non terminals of the grammar to make a recursive descent parser.

Q6. Given the grammar [1.5+1.5+2]

$E \rightarrow E+E \mid E-E \mid E * E \mid E \uparrow E \mid E/E \mid (E) \mid d$

(a) Convert above grammar to unambiguous grammar.

(b) If result of 6(a) is left recursive, make it non left recursive.

(c) Find the first and follow sets of the result of 6(b).

(Here the operators  $*$ ,  $-$ ,  $+$ , and  $/$  have their usual meanings and  $2 \uparrow 3 = 8$  and has highest precedence and is right associative)

Q7.(a) Write a LEX Program to count the number of *if* and *printf* statements from a code written in a file. [2]

(b) Find FIRST and FOLLOW Set for the following Grammar. [1.5×2]

(i)  $S \rightarrow T;S \mid \epsilon$

$T \rightarrow UR$

$R \rightarrow .T \mid \epsilon$

$U \rightarrow x \mid y \mid [S]$

(ii)  $S \rightarrow aAbB \mid bAaB \mid cAbC \mid \epsilon$

$A \rightarrow S$

$B \rightarrow S$

$C \rightarrow S$