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06CS63

Sixth Semester B.E. Degree Examination, May/June 2010
Compiler Design

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain, with a neat diagram, the phases of a compiler. **(10 Marks)**

b. Construct a transition diagram for recognizing unsigned numbers. Sketch the program segment to implement it, showing the first two states and one final state. **(10 Marks)**

2 a. Explain the left recursion and show how it is eliminated. Describe the algorithm used for eliminating the left recursion. **(06 Marks)**

b. Eliminate left recursion from the grammar:

$S \rightarrow aB \mid aC \mid Sd \mid Se$

$B \rightarrow bBc \mid f$

$C \rightarrow g$ **(02 Marks)**

c. Given the grammar

$S \rightarrow (L) \mid a$

$L \rightarrow L, S \mid S$

i) Make necessary changes to make it suitable for LL(1) parsing.

ii) Construct FIRST and FOLLOW sets

iii) Construct the predictive parsing table

iv) Show the moves made by the predictive parser on the input (a, (a, a)) **(12 Marks)**

3 a. Obtain a set of canonical LR(0) items for the grammar: **(08 Marks)**

$S \rightarrow L = R$

$S \rightarrow R$

$L \rightarrow *R$

$L \rightarrow id$

$R \rightarrow L$

b. Is the grammar in Q3(a) SLR(1)? Give reasons. **(04 Marks)**

c. What is handle pruning? Explain with the help of the grammar $S \rightarrow SS + |SS*|a$ and input string aaa*a++. Give a bottom-up parse of the given input string. **(08 Marks)**

4 a. Given the grammar :

$S \rightarrow AA$

$A \rightarrow Aa \mid b$

i) Construct sets of LR(1) items

ii) Construct canonical LR(1) parsing table. **(12 Marks)**

b. Write a note on the Parser generator – Yacc. **(04 Marks)**

c. Write the Yacc specification of a simple desk calculator with the following grammar for arithmetic expressions,

$E \rightarrow E + T \mid T$

$T \rightarrow T * F \mid F$

$F \rightarrow (E) \mid digit$

Where, the token digit is a single digit between 0 and 9. **(04 Marks)**

PART – B

5 a. Explain the concept of syntax-directed definition. **(04 Marks)**

b. Consider the context-free grammar given below: **(08 Marks)**

$S \rightarrow EN$

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

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

$F \rightarrow (E) \mid \text{digit}$

$N \rightarrow ;$

i) Obtain the SDD for the above grammar.

ii) Construct the parse tree, syntax tree and annotated parse tree for the input string 5*6 + 7;

c. Obtain the post-fix SDT for the grammar in Q.5(b) and illustrate the corresponding parser stack implementation. **(08 Marks)**

6 a. Obtain the directed acyclic graph for the expression a + a * (b – c) + (b – c) * d. Also give the sequence of steps for constructing the same. **(06 Marks)**

b. Translate the arithmetic expression a + –(b + c) into quadruples, triples and indirect triples. **(06 Marks)**

c. Explain the syntax-directed translation of switch-statements. **(08 Marks)**

7 a. Describe the general structure of an activation record. Explain the purpose of each item in the activation record. **(06 Marks)**

b. Explain in detail, the strategy for reducing fragmentation in heap memory. **(08 Marks)**

c. Explain briefly the performance metrics to be considered while designing a garbage collector. **(06 Marks)**

8 a. Discuss the issues in the design of a code generator. **(10 Marks)**

b. What are basic blocks and how do you partition a three-address-code into basic blocks? **(05 Marks)**

c. Write the three-address code and construct the basic blocks for the following program segment.

```
Sum = 0;
for (i = 0 ; i <= 10 ; i++)
  Sum = sum + a [i]
```

(05 Marks)

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