Compiler Design VTU Question Paper Set 2017

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10CS63

Sixth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Compiler Design

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the various phases of a compiler with the help of neat diagram. **(08 Marks)**

b. Write the transition diagram along with program code to recognize the token below.
i) Relop (relational operator) ii) Unsigned number **(12 Marks)**

2 a. Give the rules for constructing FIRST and FOLLOW sets. **(08 Marks)**

b. Construct the predictive parsing table by making necessary changes to the grammar given below and show the parsing of string
id + id * id (LL parsing)
$E \rightarrow E + T \mid T$
$T \rightarrow T^* F \mid F$
$F \rightarrow (E) \mid id$ **(12 Marks)**

3 a. What is shift reduce parser? Explain its actions and conflicts by taking an example. **(10 Marks)**

b. Design SLR parser for the following grammar by computing LR(0) items and show the parsing of string ((a))
$A \rightarrow (A) \mid a$ **(10 Marks)**

4 a. Construct CLR parser by finding LR(1) items for the following grammar
$S \rightarrow AA$
$A \rightarrow aA \mid b$ **(12 Marks)**

b. Construct LALR parser for the grammar of Q4(a) using LR(1) items. **(08 Marks)**

PART – B

5 a. Define inherited and synthesized attributes. Give examples. **(06 Marks)**

b. Give the SDD for simple desk Calculator and draw Annotated parse Tree for expression (3+4) * (5+6). **(10 Marks)**

c. Define syntax directed definition for a simple type declaration. **(04 Marks)**

6 a. Construct DAG and three address code for the following expression :
a + a * (b – c) + (b – c) * d **(08 Marks)**

b. Explain the following with an example: i) Quadruples ii) Triples. **(08 Marks)**

c. Generate three address code to the following statement :

```
Switch (ch)
{
 case 1 : C = a + b ; break ;
 case 2 : C = a – b ; break ;
}
```

(04 Marks)

7 a. With a neat diagram, describe the general structure of an activation record. **(06 Marks)**

b. Explain the strategies for reducing fragmentation in heap memory. **(08 Marks)**

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

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

b. For the following program segment :

```
for  i  = 1 to 10 do
for   j = 1 to 10 do
    a[i, j] = 0.0
for i = 1 to 10 to
a [ i, j] = 1.0
```

Generate intermediate code and identify basic blocks. **(10 Marks)**

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10CS63

Sixth Semester B.E. Degree Examination, June/July 2015
Compiler Design

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain with a diagram, the phases of complier. **(08 Marks)**

b. Write regular definitions for the following using extended regular expression notation :
i) identifier
ii) unsigned number. **(06 Marks)**

c. Write a program for look ahead code with sentinels. **(06 Marks)**

2 a. Define left – recursive grammer. Eliminate left recursion from the following grammer :
$E \rightarrow E + T \mid T$
$T \rightarrow T * F \mid F$
$F \rightarrow (E) \mid id.$ **(05 Marks)**

b. Given the grammer :
$S \rightarrow AaAb \mid BbBa$
$A \rightarrow \in$
$B \rightarrow \in$
i) compute FIRST( ) and FOLLOW( ) functions
ii) construct predictive parsing table
iii) parse the input string w = ab. **(09 Marks)**

c. Show that the following grammer is ambigious $E \rightarrow E + E \mid E * E \mid (E) \mid id$, write an equivalent un-ambigious grammer for the same. **(06 Marks)**

3 a. What is meant by handle pruning? construct Bottom – up parse tree for the input string w = aaa * a ++. Using the grammer :
$S \rightarrow SS + \mid SS * \mid a.$ **(06 Marks)**

b. Explain the working of shift reduce parser. Parse the input string id * id. Using the grammer of question no, 2(a). **(08 Marks)**

c. With a diagram, explain the model of an LR parser. **(06 Marks)**

4 a. Write an algorithm to construct LALR parsing table. **(06 Marks)**

b. Construct the parsing table for LALR(1) parser using the grammer :
$S \rightarrow CC$
$C \rightarrow aC$
$C \rightarrow d.$ **(10 Marks)**

c. Compare LALR and canonical LR parsers. **(04 Marks)**

PART – B

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

b. Consider the context free grammer given below :

$S \rightarrow EN$

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

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

$F \rightarrow (E) \mid digit$

$N \rightarrow ;$

i) Obtain SDD for the above grammer

ii) Annotated parse tree for the input string $5 * 6 + 7$. **(10 Marks)**

c. Define :

i) Synthesized attribute

ii) Inherited attribute. **(06 Marks)**

6 a. Construct DAG and three address code for the following expression :

$a + a * (b - c) + (b - c) * d$. **(08 Marks)**

b. Explain the following with an example : i) quadruples ii) triples. **(08 Marks)**

c. Generate three address code for the following statement :

```
switch (ch)
{ case 1 : c = a + b ; break ;
  case 2 : c = a – b ; break ;
}
```

(04 Marks)

7 a. With a neat diagram, describe the general structure of an activation record. **(06 Marks)**

b. Explain in 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 various issues in the design of a code generator. **(10 Marks)**

b. What are basic blocks and flow graphs? Write an algorithm to partition the three address instructions into basic blocks. **(06 Marks)**

c. List the characteristics of a peephole optimization. **(04 Marks)**

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10CS63

Sixth Semester B.E. Degree Examination, Dec.2014/Jan.2015
Compiler Design

Time: 3 hrs. Max. Marks:100

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

PART – A

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

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

2 a. Briefly explain the problems associated with top down parser. **(03 Marks)**

b. Show that following grammar is ambiguous: $S \rightarrow S + S \mid S * S \mid id$. Give an unambiguous grammar for the above grammar such that '+' has highest priority and * has less priority and both are left associative. **(07 Marks)**

c. Given the grammar $A \rightarrow (A) / a$

i) Construct predictive parser table.

ii) Check the grammar is LL(1) or not.

iii) Show the parser steps for the input ((a)). **(10 Marks)**

3 a. Obtain LR(0) items for the following grammar:

$S \rightarrow L = R \mid R \quad L \rightarrow * R \mid id \quad R \rightarrow L.$ **(08 Marks)**

b. Obtain FIRST and FALLOW sets for the grammar shown in Q.3(a) and obtain SLR parsing table. Is the grammar SLR? **(12 Marks)**

4 a. Given the grammar:

$A \rightarrow CC \qquad C \rightarrow aC \mid b$

i) Construct sets of LR(1) items.

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

b. Write a note on the parse generator – YACC. **(03 Marks)**

c. Write the YACC specification of a simple desk calculator with following grammar for arithmetic expression:

$E \rightarrow E + T \mid T$

$T \rightarrow T * F \mid F$

$F \rightarrow (E) \mid digit$ where digit between 0 to 9. **(05 Marks)**

PART – B

5 a. Explain type of attributes for non terminal with example. **(04 Marks)**

b. Write annotated parse tree for expression 5 + 4 * 3n where grammar is

$L \rightarrow En$

$E \rightarrow E + T \mid T$

$T \rightarrow T * F \mid F$

$F \rightarrow (E) \mid digit$ **(06 Marks)**

c. How different classes of SDD's that guarantee evaluation order? **(06 Marks)**

d. Obtain postfix SDT for simple desk calculator. **(04 Marks)**

6 a. Obtain the directed acyclic graph for the expression x + x * (y + z) + (y + z) * w. **(06 Marks)**

b. Explain the following with example:
i) Quadraples ii) Triples iii) Indirect triples. **(06 Marks)**

c. Explain SDT of switch statement. **(08 Marks)**

7 a. What is activation record? Explain structure and purpose of each field in the activation record. **(06 Marks)**

b. Explain tasks of caller and callee when procedure called and exit. **(08 Marks)**

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

8 a. Write intermediate code for the following source code:

```
for i from 1 to 10 do
for j from 1 to 10 do
    a [i, j] = 0.0;
for i from 1 to 10 do
    a [i, i] = 1.0;
```

and identify basic blocks. **(10 Marks)**

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

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10CS63

Sixth Semester B.E. Degree Examination, June / July 2014
Compiler Design

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the various phases of a compiler with the help of neat diagram. **(08 Marks)**

b. Give the formal definations of operations on languages with notations. **(04 Marks)**

c. Write the transition diagram to recognize the token below:
i) relop (relational operations)
ii) unsigned number. **(08 Marks)**

2 a. Give the rules for constructing FIRST and FOLLOW sets. **(06 Marks)**

b. Construct the predictive parsing table by making necessary changes to the grammar given below:
$E \rightarrow E + T \mid T$
$T \rightarrow T * F \mid F$
$F \rightarrow (E) \mid id$ **(10 Marks)**

c. Give the formal defination of CFG with an example. **(04 Marks)**

3 a. What is a shift-reduce parser? Explain the conflicts that may occur during shift-reduce parsing. List the actions of shift-reduce parser. **(06 Marks)**

b. Form the Action / Goto table for the following grammar:
$S \rightarrow Aa \mid bAc \mid Ba \mid bBa$
$A \rightarrow d$
$B \rightarrow d$
Justify whether the grammar is LR(0) or not. **(14 Marks)**

4 a. Construct the canonical LR(1) Item sets for the following grammar:
$S \rightarrow AA$
$A \rightarrow aA \mid b$ **(10 Marks)**

b. Construct LALR parsing table for the grammar shown in Q4 (a) using LR(1) items. **(10 Marks)**

PART – B

5 a. Define inherited and synthesized attributes. Give examples. **(06 Marks)**

b. Give the SDD for simple desk calculator and draw dependency graph for expression, $1*2*3*(4+5)n$ **(10 Marks)**

c. Write SDD that generates either a basic type or an array type. **(04 Marks)**

6 a. Draw the DAG for the expression, $a + a*(b-c) + (b-c)*d$. Show the steps for constructing the same. **(10 Marks)**

b. Explain the following with examples: i) Quadraples ii) Triples. **(06 Marks)**

c. Write the three address code for the expression:
$a + a*(b-c) + (b-c)*d$ **(04 Marks)**

7 a. Give the general structure of an activation record. Explain the purpose of each component. **(08 Marks)**

b. Explain the performance metrics that must be considered while designing garbage collector. **(08 Marks)**

c. Give the memory hierarchy configurations of modern computer highlighting size and access times. **(04 Marks)**

8 a. Explain the main issues in code generation. **(10 Marks)**

b. For the following program segment:

```
for i = 1 to 10 do
    for j = 1 to 10 do
        a[i, j] = 0 . 0
    for i = 1 to 10 do
    a[i, i] = 1.0
```

Generate intermediate code and identify basic blocks. **(10 Marks)**

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10CS63

Sixth Semester B.E. Degree Examination, Dec. 2013/Jan. 2014
Complier Design

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Explain the various phases of complier. Show the translations for an assignment statement. Position = initial + rate * 60, clearly indicate the output of each phase. **(12 Marks)**

b. Write the regular definition for an unsigned number. Also write the transition diagram. **(06 Marks)**

c. What is printed by the following C code?

```
# define a (x + 1)
  int x = 2 ;
  void b( ) {int x = 1; printf("%d ln", a)'}
  void c( ){printf("%d ln", a); }
  void main( ) {b( ) ; c( );}.
```

(02 Marks)

2 a. Describe an algorithm used for eliminating the left recursion. Eliminate left recursion from the grammar :

$S \rightarrow Aa \mid b \quad A \rightarrow Ac \mid Sd \mid a.$ **(06 Marks)**

b. Show that the following grammar is ambiguous :

$E \rightarrow E + E \mid E * E \mid (E) \mid id.$ Write an equivalent unambiguous grammar for the same. **(06 Marks)**

c. What are the key problems with top down parse? Write a recursive descent parser for the grammar :

$S \rightarrow cAd \quad A \rightarrow ab \mid a.$ **(08 Marks)**

3 a. Given the grammer :

$S \rightarrow aABb$

$A \rightarrow c \mid \varepsilon$

$B \rightarrow d \mid \varepsilon$

i) Compute FIRST and FOLLOW sets

ii) Construct the predictive parsing table

iii) Show the moves made by predictive parser on the input ; acdb. **(10 Marks)**

b. Explain with a neat diagram, the model of a table driven predictive parser. **(05 Marks)**

c. What is handle pruning? Give a bottom – up parse for the input : aaa * a++ and grammar :

$S \rightarrow SS + \mid SS * \mid a.$ **(05 Marks)**

4 a. Given the grammar :

$S \rightarrow CC$

$C \rightarrow cC \mid d$

i) Obtain the sets of canonical collection of sets of valid LR(0) items

ii) Design SLR parsing table. **(10 Marks)**

b. Write an algorithm used to compute LR (1) sets of items. **(06 Marks)**

c. Write a note on the parser Generator – Yacc. **(04 Marks)**

PART – B

5 a. Explain the concept of syntax – directed definition. **(05 Marks)**

b. The SDD to translate binary integer number into decimal is shown below :

Productions	Semantic rules
$BN \rightarrow L$	BN.val= L. val
$L \rightarrow L_1 B$	L. val =2 $\times L_1$.val + B. val
$L \rightarrow B$	L. val = B .val
$B \rightarrow 0$	B. val = 0
$B \rightarrow 1$	B. val = 1

Construct the parse tree and annotated parse tree for the input string : 11001. **(05 Marks)**

c. Give a SDT for desktop calculator and show its parser stack implementation. **(10 Marks)**

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

b. Give a semantic action for : $S \rightarrow$ if (B) S_1 else S_2. **(06 Marks)**

c. Develop SDD to produce directed a cyclic graph for an expression. Show the steps for constructing the directed acyclic graph for the expression : a + a * (b – c) + (b – c) * d. **(08 Marks)**

7 a. Describe the general structure of an activation record. Explain the purpose of each field in the activation record. **(08 Marks)**

b. A C – code to compute Fibonacci numbers recursively is shown below :

```
int f(int n)
 { int t, s ;
   if(n < = 2) return 1 ;
    s = f(n -1) ;
    t = f(n -2) ;
    return (s + t);
 }
```

i) Draw the activation tree for the call : f(5)

ii) What is the largest number of activation records that ever appear together on the stack? **(06 Marks)**

c. Explain 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. Write the tree 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)

c. Give the code generation process for operations. **(05 Marks)**

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10CS63

Sixth Semester B.E. Degree Examination, June/July 2013

Compiler Design

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain three types of software productivity tools. **(06 Marks)**

b. Define sentinels. Give lookahead code with sentinels. **(04 Marks)**

c. Enlist algebraic laws for regular expressions. **(07 Marks)**

d. Give transition diagram for unsigned numbers. **(03 Marks)**

2 a. Write an algorithm to eliminate left recursion from a grammar, also give the syntax of the production. **(05 Marks)**

b. Consider the production:

$S \rightarrow aAb$

$A \rightarrow cd/C.$

Show that recursive-descent parsing fails for the input string "acdb", also explain recursive descent algorithm. **(07 Marks)**

c. Find First and Follow for the given grammars:

i) stmt_sequence → stmt stmt_sequence'
stmt_sequence' → ; stmt_sequence/∈
stmt → s

ii) S → ,GH;
G → aF
F → bF/∈
H → KL
K → m/∈
L → n/∈ **(08 Marks)**

3 a. What are two types of conflicts during shift reduce parsing? Give examples. **(04 Marks)**

b. For the given grammar E → E + n/n. Construct parsing table of LL(1). Verify 3 + 4 + 5 and show each step of verification with reference to parsing table. **(08 Marks)**

c. How to verify whether grammar is LL(1) or not? Show that:

$S \rightarrow AaAb/BbBa$

$A \rightarrow \in$

$B \rightarrow \in$

is LL (1), without constructing any table. **(08 Marks)**

4 a. Construct the DFA of LR(0) items and SLR parsing table for the grammar:

Stmt_sequence → stmt_sequence; stmt/stmt
Stmt → S

Identify Kernel and non Kernal items in state I_4. **(12 Marks)**

b. Discuss the behaviour of the LR parser. **(04 Marks)**

c. For the grammar A → (A)/a, construct LR(1) set of items. **(04 Marks)**

PART – B

5 a. Write annotated parse tree for 3*5 + 4n using Top down approach. Write semantic rules for each step. **(08 Marks)**

b. Discuss S-attributes and L-attributes with respect to SDD (Syntax Directed Definition). **(04 Marks)**

c. By considering an array type int[3][3], write syntax directed translation with semantic rules. **(08 Marks)**

6 a. Enlist any four common three address instruction forms. **(04 Marks)**

b. Define quandruples, triples and static single assignment form. **(06 Marks)**

c. Write syntax directed definition for flow of control statements. **(10 Marks)**

7 a. Write a version of quick sort, in ML style using the nested functions. Give any four additional features of ML. **(08 Marks)**

b. "Most programs exhibit a high degree of locality", explain the statement. **(05 Marks)**

c. "Garbage collection is seldom used in real time applications", justify the statement. How language design affects the characteristics of memory usage. **(07 Marks)**

8 a. How register allocation and evaluation order plays an important role in a code generation? Discuss. **(06 Marks)**

b. Write an intermediate code to set a 10 × 10 matrix to an identity matrix. **(10 Marks)**

c. Define flow graph. How it is constructed? **(04 Marks)**

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