Writing Assignment III

Released: Sunday, 02/09/99

Due: Sunday, 16/09/99 at 11:59pm

This assignment covers lecture notes 6-9. You can discuss and work out this assignment with other students. However, your write-up must be your own individual work. A PDF format of the solution (with your full name and student number) should be uploaded in the course page in Quera before 11:59 PM, Sunday 16/09/99 (https://quera.ir/course/6364/). Submissions with more than 50 hours delay will not be graded. Submissions with less than 50 hours delay will be penalized by the following rule:

Penalized mark = M * (100 - 2 * D) / 100

Where M = the mark achieved from your solution and D is number of hours passed the deadline.

1. The following pseudo code segment is akin to Pascal programs in which we can have nested definitions of procedures. Show the state of symbol table and scope stack at the compile time of lines 9 and 13, respectively. Also, show the address of each variable in the symbol table (i.e., the attribute of token ID) for these two statements.

```pascal
1 Program P()
2 Var b[1..5] real
3 Procedure Q(m: integer)
4   Var a[1..10] integer
5   Function R(n: real): integer
6     Procedure S()
7       Var j integer
8       Var b real
9       b := x + a (2 )
10     End S
11   Procedure T()
12     Var c[1..3] integer
13     c(3) := j + b (1)
14   End T
15   End R
16   End Q
17 End P
```

2. Consider the following grammar, which is a subset of the C-minus grammar in Section 3 of PA2 for defining switch statements (Note that rules 15 and 16 are not in the original grammar. They have been added to the grammar only for this assignment for the sake of simplifying the original grammar. Therefore, these two rules should not be used in the programming assignments). In these ’switch’ statements, in the absence of a ’break’ statement, subsequent case statements with a satisfied condition will be executed, too (note that this different from switch statements in the standard C, where subsequent case statements will be executed regardless of their conditions in the absence of ’break’. Here, we may also have duplicate labels, which is again different from the standard C). Add the necessary action symbols to the production rules 6 to 12 and write the associated semantic routines so that the three address codes can be generated for this type of switch statements. Semantic routines of #assign and #pid were given on page 13 of Lecture Note 6 and that of #pnum is very similar to #pid for inserting the lexeme of token NUM onto the semantic stack (you don’t need to write semantic routines of these three action symbols). In this
assignment, you can only use the semantic stack for saving the required information (similar to the semantic routines in Lecture Note 6). Also, you can only use functions, (such as 'gettemp' and 'findaddr') and the three address codes that have been used in semantic routines of Lecture Note 6.

1) Statement -> ExpressionStmt
2) Statement -> SwitchStmt
3) StatementList -> Statement StatementList
4) StatementList -> ε
5) ExpressionStmt -> Expression ;
6) ExpressionStmt -> break ;
7) SwitchStmt -> switch ( Expression ) { CaseStmts DefaultStmt }
8) CaseStmts -> CaseStmt CaseStmts
9) CaseStmts -> ε
10) CaseStmt -> case NUM : StatementList
11) DefaultStmt -> default : StatementList
12) DefaultStmt -> ε
13) Expression -> #pid ID B
14) B -> = Expression #assign
15) Expression -> #pnum NUM
16) Expression -> #pid ID

3. Generate three address codes for the following code segment using the semantic routines of question 2.

```plaintext
switch(x){
    case 0:
        a = 0;
    case 1:
        a = 1;
        break;
    case 3:
        a = 3;
    default:
        a = 4;
}
```

4. Consider the following grammar. Draw the SLR(1) transition diagram for this grammar. Note that the $S \rightarrow S$ production has already been added. Then, show the sequence of stack, input, and action configurations that occur during an SLR(1) parsing of string: 'a b b d e $'.

```plaintext
0       S' \rightarrow S
1       S \rightarrow A C
2-3     C \rightarrow e \mid ε
4-5     A \rightarrow a B C d \mid B Q
6-7     B \rightarrow b B \mid ε
8-9     Q \rightarrow q \mid ε
```

5. Draw the LR(1) transition diagram and LALR parsing table for the grammar in question 4.

Good Luck!
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