INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

Date: Oct 27, 2022 **Time: 1 Hrs** **Full Marks: 20**

Deptt: Computer Science & Engineering

Class Test 2

Sub No: CS31003 **Subject Name: Compilers** **3rd Year B. Tech**

Answer all the questions. Take and state suitable assumptions, if needed

1. Consider the CFG below, where P is the start symbol

P → D
D→ T **id**; D
T→ B C
B→ **int**
B→ **float**
C→ €
D→ €
C→ [**num**] C1

(a) Add suitable semantic actions at the suitable places, such that the syntax directed translation (SDT) enables the grammar to (i) Derive the type expressions for all the variables, (ii) to compute the relative address of all the variables, and to (iii) populate the symbol table. Assume that the symbol table contains the following fields. (variable name, data type, relative address).
You may consider the availability of the function ST.update(), which you may invoke to insert/update the symbols table entries.
(b) Consider the declaration statements of a piece of source code bellow

int x;
float [10]a;
float y;

Apply your developed SDT and demonstrate how does this code fragment populate the symbol table entries. In this process, suitably annotate the relevant parse tree.

[2.5+2.5]

2. Consider the following grammar, where S is the start symbol.

S → **id**=E | L=E
E → E+E | **id** | L
L → **id** [E] | L [E]

(a) Design a syntax directed translator to generate three address code for the array references.

(b) Using your SDT, translate the following statement to a three-address code. Show the annotated parse tree in the process.

A[i][j] = c

[2.5+2.5]

3. Consider the following CFG, where P is the start symbol

P→ S
S→ **if** (B) S1 **else** S2
S→ **id**=E;
E→ E1+E2
E->**id**
B→ E1 **rel** E2
B→ (B)
B→ B1 **&&** B2
B→ B1 || B2
B→ **true**
B→ **false**
Note that, the **rel** indicates the relational operators, such as <, > etc

(a) Design a syntax directed translator (SDT) to generate three address code for the following if-else statement. Note that your semantic actions/rules should drop the redundant jumps and labels.

(b) Apply the developed SDT to translate the following statement to a three-address code. In this process, suitably annotate the relevant parse tree.

```
if (a>b && c<d || p>100)
        x=0;
else
        x=1;
```

[4+6]