School of Mathematical and Computational Sciences

Indian Association for the Cultivation of Science

Compiler Construction: COM 5202

Tutorial VIII (19 March, 2025)

M. Sc Semester IV: 2024-2025 *Instructor:* Goutam Biswas

Exercise 1.

(a) *Consider the following grammar of all strings over* $\Sigma = \{0, 1\}$.

$$\begin{array}{rlcl} 1: & N & \to & L \\ 2: & L & \to & L\ B \\ 3: & L & \to & B \\ 4: & B & \to & 0 \\ 5: & B & \to & 1 \end{array}$$

Define appropriate attributes of non-terminals and give an attribute grammar to interpret the string as 2's complement numeral.

(b) *Draw the parse tree for "11011", and decorate it with the values of attributes at every node.*

Exercise 2. *Consider the grammar* $G = (\{i, f, v\}, \{D, ID, FD, IS, FS, IV, FV\}, P, D)$, *where the production rules are the following:*

$$\begin{array}{rrcl} 1: & D & \to & ID \\ 2: & D & \to & FD \\ 3: & ID & \to & IS\ i \\ 4: & FD & \to & FS\ f \\ 5: & IS & \to & IS\ IV \\ 6: & IS & \to & IV \\ 7: & FS & \to & FS\ FV \\ 8: & FS & \to & FV \\ 9: & IV & \to & v \\ 10: & FV & \to & v \end{array}$$

(a) *Show that the grammar is not* $LR(1)$.

(b) *Is it* $LR(k)$ *for any* $k \in \mathbb{N}$?

(c) *Can you modify the grammar to an equivalent* $LALR(1)$ *grammar that is not* $LR(0)$?

(d) *Is there an equivalent* $LR(0)$ *grammar?*

Exercise 3. *Consider the following grammar of Boolean expressions.*

$$BE \to BE\ or\ BE \mid BE\ and\ BE \mid not\ BE \mid E\ relOp\ E$$

The non-terminal BE has three attributes, code, a synthesized attribute. tru, the jump label when BE is evaluated to true. fls, the jump label when BE is evaluated to false. Both of them are inherited attributes. Each statement has an inherited attribute next. How do you create and pass them? Work with the following example:

```
if (a > 0 or a == b) a = a-1;
else a = a+1;
```