

1. The syntax-directed definition to be used by Shelley is,
[We maintain an additional attribute len]

$$S \rightarrow .F \quad \triangleright \quad S.val = F.val / (2^{**} F.len)$$

$$S \rightarrow I. \quad \triangleright \quad S.val = I.val$$

$$S \rightarrow I.F \quad \triangleright \quad S.val = I.val + F.val / (2^{**} F.len)$$

$$I \rightarrow B \quad \triangleright \quad \begin{aligned} I.val &= B.val \\ I.len &= 1 \end{aligned}$$

$$I \rightarrow I'B \quad \triangleright \quad \begin{aligned} I.val &= 2 * I'.val + B.val \\ I.len &= I'.len + 1 \end{aligned}$$

$$F \rightarrow B \quad \triangleright \quad \begin{aligned} F.val &= B.val \\ F.len &= 1 \end{aligned}$$

$$F \rightarrow BF' \quad \triangleright \quad \begin{aligned} F.val &= F'.val + (2^{**} F'.len) * B.val \\ F.len &= 1 + F'.len \end{aligned}$$

$$B \rightarrow 0 \quad \triangleright \quad B.val = 0$$

$$B \rightarrow 1 \quad \triangleright \quad B.val = 1$$

2. The syntax definition to be followed by Dolly are:

[we maintain an additional attribute len]

$$S \rightarrow .F \quad \triangleright \quad S.val = F.val / (2^{**} F.len)$$

$$S \rightarrow I. \quad \triangleright \quad S.val = I.val$$

$$S \rightarrow I.F \quad \triangleright \quad S.val = I.val + (F.val) / (2^{**} F.len)$$

$$I \rightarrow B \quad \triangleright \quad I.val = B.val \\ I.len = 1$$

$$I \rightarrow BI' \quad \triangleright \quad I.val = I'.val + (2^{**} I'.len) * B.val \\ I.len = I'.len + 1.$$

$$F \rightarrow B \quad \triangleright \quad F.val = B.val \\ F.len = 1$$

$$F \rightarrow F'B \quad \triangleright \quad F.val = 2 * F'.val + B.val \\ F.len = F'.len + 1$$

$$B \rightarrow 0 \quad \triangleright \quad B.val = 0$$

$$B \rightarrow 1 \quad \triangleright \quad B.val = 1$$