Exercise 4

$G = (N, T, P, S)$. The terminals T are given by $T = \{\text{number}, \text{variable}, +, -, \cdot, /\}$, the non-terminals are given by $N = \{\text{Term}, \text{Factor}, S, A\}$. we have the following production rules P:

$$S \longrightarrow \text{Term} \ | \ \text{Term addExpression } S$$
$$\text{Term} \longrightarrow \text{Factor} \ | \ \text{Factor multExpression Factor}$$
$$\text{Factor} \longrightarrow \text{number} \ | \ \text{variable}$$

$$\text{addExpression} \longrightarrow + \ | \ -$$
$$\text{multExpression} \longrightarrow \cdot \ | \ /$$

The fact that the start symbol S only allows Terms but not Factors as following non-terminals, ensures that the multiplication/division are parsed as nodes *within* terms. One could also understand it as first splitting the nodes at the +'s in order to not wrongly split factors.

example

- The only matching parse tree for $1 + 2 \cdot a + b$ is: