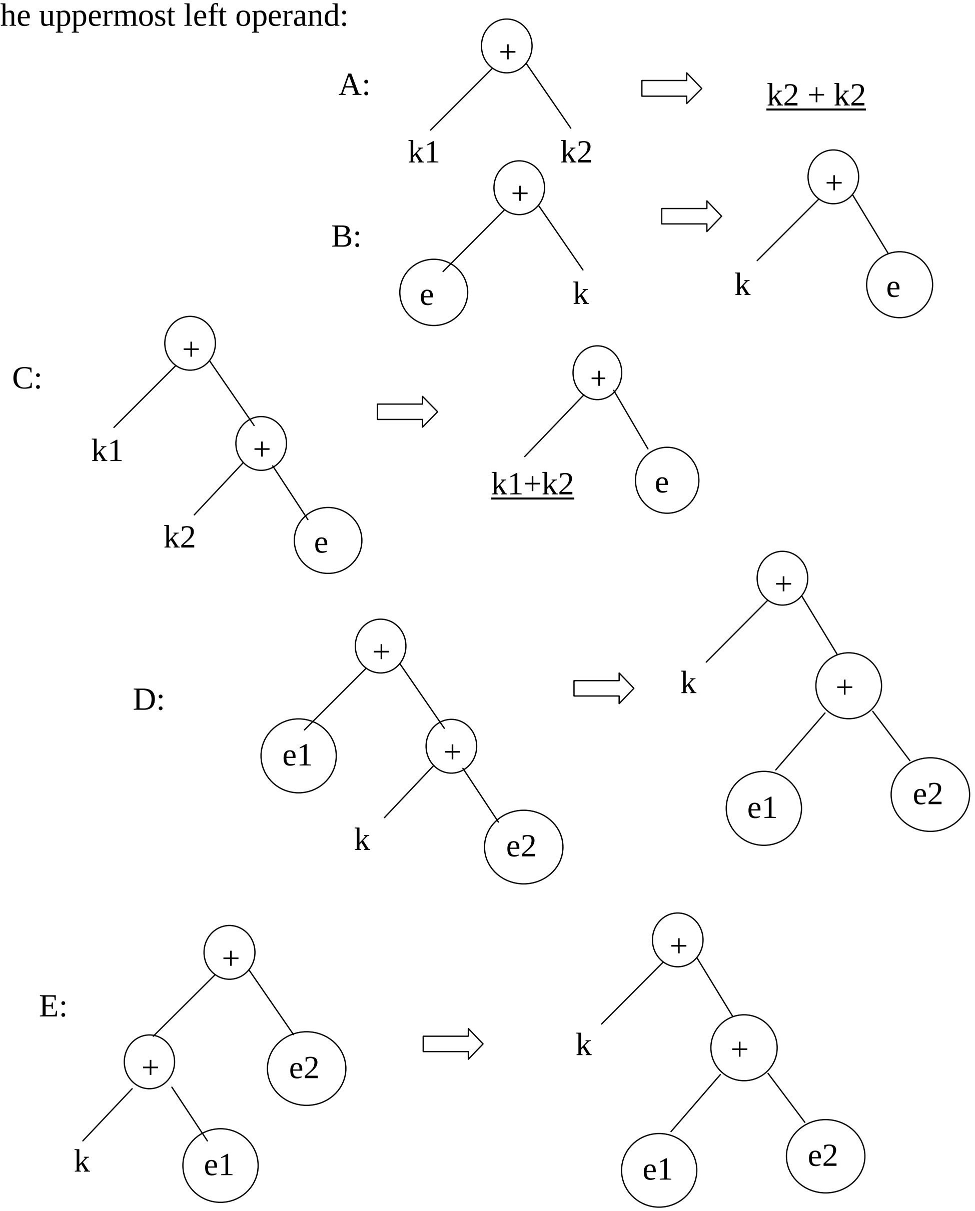
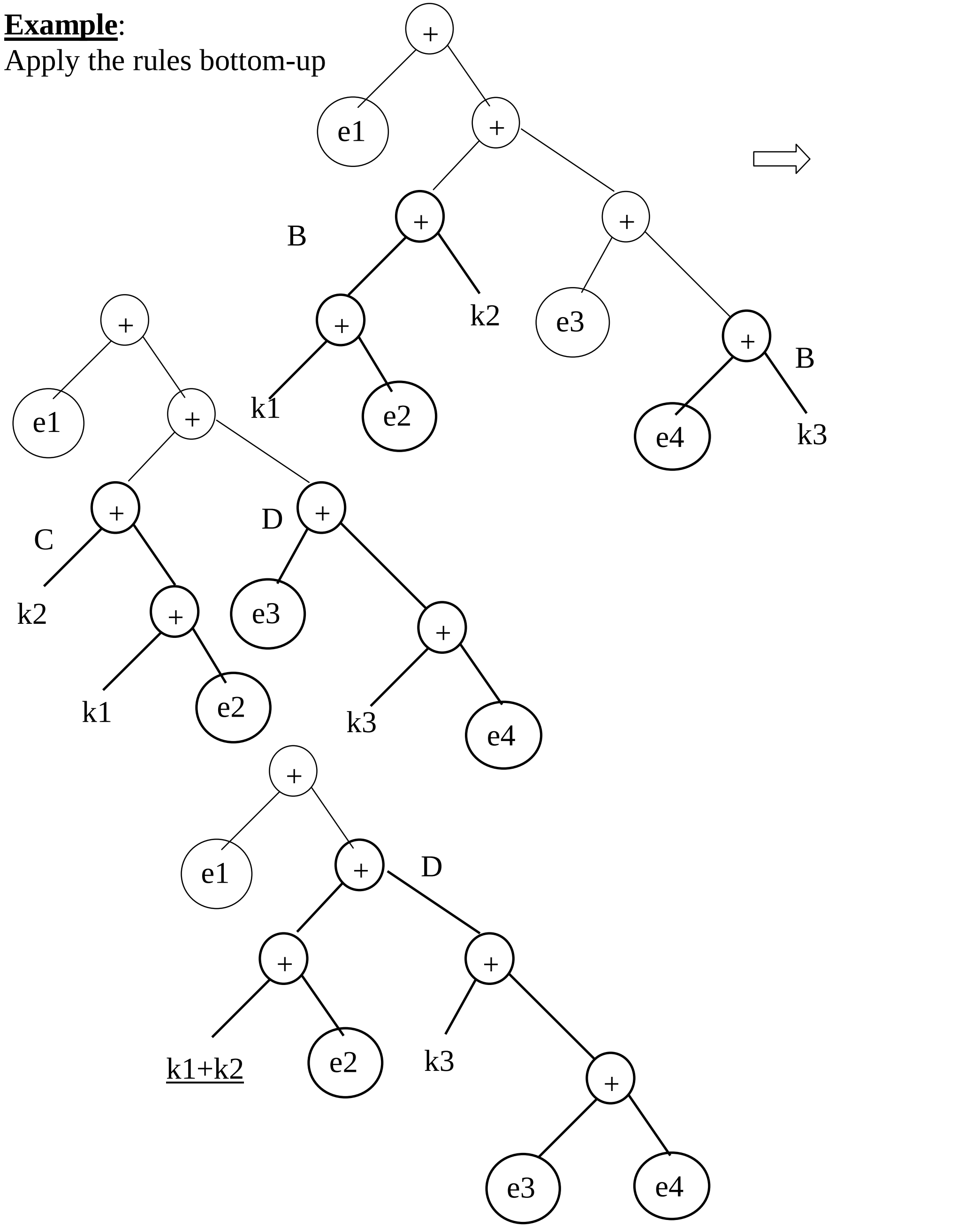
Simplifying Expressions by Tree-Rewriting

Rewrite-rules exploiting commutative and associative rule for + to compute addition of constants; strategy: move constants to the left/ move constants to the uppermost left operand:



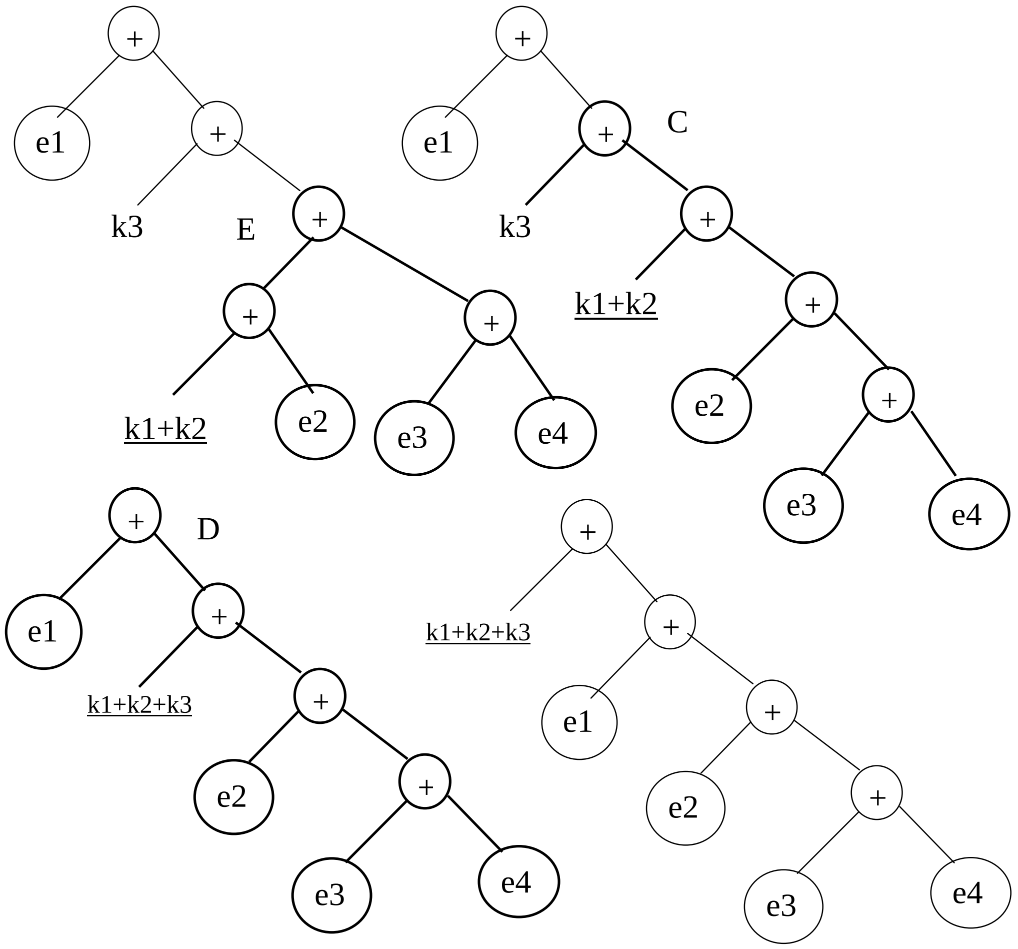
Simplifying Expressions by Tree-Rewriting

Example:
Apply the rules bottom-up



Simplifying Expressions by Tree-Rewriting

Example: Apply the rules bottom-up



Simplifying Expressions/Folding Bin-Expressions

This is an outline of a proposal for simplifying binary expressions. The idea is at each (+,-) level and (∗,/) level to move all constants to the left.

Splitting

Operator +, - : ⊕:   e1 ⊕ e2

split each operand e1 and e2 into a triple: [constant, operator, optional expr]

operand	triple
c ⊕ e	[c, ⊕,e]
c	[c, + , nil]
e (all other expr's)	[0,+,e]

Splitting depends on the context operator

Operator *, / : ⊗:   e1 ⊗ e2

split each operand e1 and e1 into a triple: [constant, operator, optional expr]

operand	triple
c ⊗ e	[c, ⊗,e]
c	[c, ∗ , nil]
e (all other expr's)	[1,∗,e]

Folding

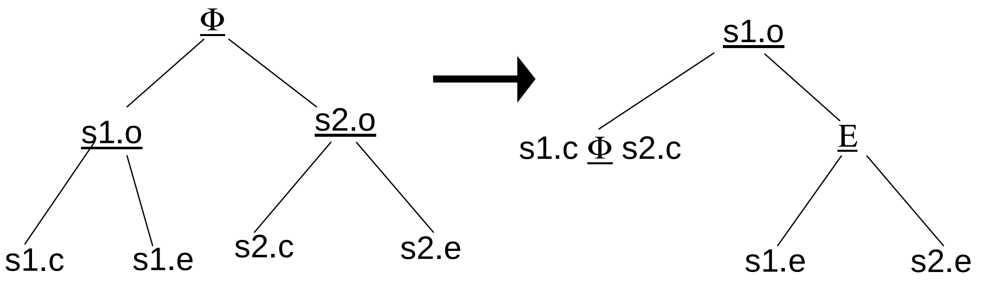
Simplify/Fold BinExpr(oprt,e1,e2) , oprt∈ {+,-,∗,/}:

I) fold subexpressions: s1= e1.fold() , s2= e2.fold()

II) split folded subexpressions
    [s1.c, s1.o, s1.e]= split(oprt) s1, [s2.c, s2.o, s2.e]= split(oprt) s2

Then construct the simplified/folded expression as shown below for s1.e and s2.e being non-nil expressions.

Fold BinExpr



$(s1.c\ \ \underline{s1.o}\ \ s1.e)\ \ \underline{\Phi}\ \ (s2.c\ \ \underline{s2.o}\ \ s2.e)\ \Rightarrow$

$(s1.c\ \ \underline{\Phi}\ \ s2.c)\quad \underline{s1o}\ \ (s1.e\ \ \underline{E}\ \ s2.e)$

where

$\underline{s1.o}$, $\underline{s2.o}$, $\underline{\Phi}$, $\underline{E} \in$ {Plus, Minus} $\vee$
$\underline{s1.o}$, $\underline{s2.o}$, $\underline{\Phi}$, $\underline{E} \in$ {Mult, Div}

$\underline{s1.o}$	$\underline{\Phi}$	$\underline{s2.o}$	$\underline{E}$
+	+	+	+
+	+	-	-
+	-	+	-
+	-	-	+
-	+	+	-
-	+	-	+
-	-	+	+
-	-	-	-

Application of the rules 0+e=e and 1∗e=e is not shown.