Compiler Construction

Describe an efficient tree pattern-matching algorithm that could be used to find a cheapest covering of an abstract syntax tree by pattern templates with given costs. Illustrate your algorithm using the following templates:

- #1 \( R \leftarrow k \) cost: 1
- #2 \( R \leftarrow f(R, k) \) cost: 2
- #3 \( R \leftarrow f(R, R) \) cost: 2
- #4 \( R \leftarrow f(R, f(R, k)) \) cost: 3
- #5 \( R \leftarrow f(f(R, k), R) \) cost: 4

and the following tree:

\[ f(f(k, k), f(k, k)) \]