1995 Paper 11 Question 4

Compiler Construction

Outline how minimum cost code can be compiled from a parse tree using rules that consist of tree template replacements, costs and corresponding code. Illustrate your answer by considering the translation of the expression

<div align="center">

`Add(Add(K1, K2), Add(K3, K4))`

</div>

using the following rules:

```
#1  Ri  <-  Add(Ri, Rj)              cost: 2   code: ADDR  Ri,Rj

#2  Ri  <-  Add(Ri, Kc)              cost: 3   code: ADDI  Ri,c

#3  Ri  <-  Kc                       cost: 2   code: LOADI Ri,c

#4  Ri  <-  Add(Ri, Add(Rj, Kc))     cost: 4   code: ADDRI Ri,Rj,c
```

In your answer you should derive the finite state machine needed for the efficient matching of these four rules, and you should also give the cost and resulting translation of the given example expression.   [15 marks]

Briefly discuss in what ways this algorithm may fail to generate optimum code when used in a compiler.   [5 marks]