

## 1995 Paper 8 Question 7

### Optimising Compilers

Explain what is meant when a token  $\alpha$  is said to be *live* at some point in a flow graph. [4 marks]

Carefully describe an algorithm to compute the live sets from the *gen*, *kill* and *null* sets at each point in a flow graph, and discuss its efficiency in terms of the number of nodes in the flow graph. [6 marks]

Describe an algorithm to calculate the sets of tokens  $C_x(n)$  and  $J(n)$  where

$$\begin{aligned}\alpha \in C_x(n) &\iff P(n; \alpha) \equiv x\rho + \rho' \\ \alpha \in J(n) &\iff P(n; \alpha) \equiv \rho + 1\end{aligned}$$

assuming that  $x$ ,  $y$  and  $z$  are some permutation of the actions  $d$ ,  $r$  and  $u$  (denoting definition, reference and undefinition). [5 marks]

Show how to calculate the set  $B_x(n)$  from  $C_x(n)$ ,  $C_y(n)$ ,  $C_z(n)$  and  $J(n)$  where

$$\alpha \in B_x(n) \iff P(n; \alpha) \equiv x\rho + 1 \quad [5 \text{ marks}]$$