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

\[
\alpha \in C_x(n) \iff P(n; \alpha) \equiv x\rho + \rho' \\
\alpha \in J(n) \iff P(n; \alpha) \equiv \rho + 1
\]

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

\[
\alpha \in B_x(n) \iff P(n; \alpha) \equiv x\rho + 1
\] [5 marks]