COMPUTER SCIENCE TRIPOS Part II – 2013 – Paper 9

9   Optimising Compilers (AM)

(*a*) "Register allocation and transformation to SSA form are inverses as both use live ranges." Discuss this statement.   [5 marks]

(*b*) Explain the problems which can arise in classical dataflow analysis when some variables may hold the addresses of other variables. Indicate the connection, if any, of this problem to that of constructing a call graph for a program which contains higher-order functions.   [5 marks]

(*c*) There are two ways to formalise points-to analysis: one is a dataflow analysis (which you need not formulate except for indicating whether the analysis is forward or backward) in which the dataflow values ascribed to each program point are sets of pairs (pointer, pointee); the other is Andersen's analysis. Distinguish these analyses, comparing the precision of their results using an example (it suffices merely to state the analysis results for your example rather than explicitly solving equations). When might the less precise analysis be preferred?   [5 marks]

(*d*) What are strictness functions and how do they differ in expressiveness from a list of parameters which a function may receive by value? Give, if possible, source language functions which have $\lambda(x, y).x \wedge y$, $\lambda(x, y).x \vee y$, $\lambda(x, y).x$ and $\lambda(x, y).\neg x$ as strictness functions.   [5 marks]