

## COMPUTER SCIENCE TRIPOS Part IB – 2018 – Paper 4

### 3 Compiler Construction (TGG)

This question covers a wide variety of topics in the interdisciplinary subject of Compiler Construction.

- (a) What is the difference between lexical analysis and parsing? [2 marks]
- (b) Give an example of an ambiguous context-free grammar together with a demonstration that it is indeed ambiguous. [3 marks]
- (c) In the context of functional programming, describe the concept of a *closure* and how it is used. [3 marks]
- (d) Can any recursive function be transformed into a tail-recursive function? Briefly explain your answer. [3 marks]
- (e) Describe one advantage and one disadvantage for using *reference counting* as a technique for memory management. [2 marks]
- (f) For what kinds of programming languages might you employ *static links* on the stack? Explain your answer. [3 marks]
- (g) Consider an optimisation that replaces any expression of the form

$$0 \times e$$

with 0, where  $e$  is an arbitrary expression. Why might this rule be useful in a compiler's optimisation phase? Is it always correct? [4 marks]