

4 Compiler Construction (TGG)

- (a) Consider a programming language with nested function declarations that allows only *first-order* functions. That is, functions are not treated as values and can neither be passed as arguments nor returned by functions.

*Lambda lifting* and *static links* are two common methods of implementing such a language using a run-time stack. Describe these methods and discuss their advantages and disadvantages. [6 marks]

- (b) Now suppose we are dealing with a programming language that supports higher-order functions that can be passed as arguments and returned as results. Give an example, in ML-like pseudo-code, where the techniques that you have described in (a) can no longer be used. Justify your answer. [6 marks]

- (c) Carefully explain the techniques you might use to compile the example that you presented in (b). [8 marks]