Compiler Construction

(a) Describe how a stack is used to implement procedures and functions. [6 marks]

(b) Suppose a language allows the creation of pointers. How does this complicate the use of stacks as described in part (a)? [2 marks]

(c) How does the Java language deal with the problem described in part (b)? [2 marks]

(d) Consider the following ML-like program containing the function g that returns a function as a result.

\[
\begin{align*}
\text{let } a &= 17 \text{ in} \\
\text{let } g \ b &= (\text{let } h \ c = a + b + c \text{ in } h) \text{ in} \\
\text{let } f1 &= g \ 21 \text{ in} \\
\text{let } f2 &= g \ 33 \text{ in} \\
\text{let } v &= f1(3) + f2(57) \text{ in} \\
\ldots \\
\ldots 
\end{align*}
\]

Explain carefully how such a program can be compiled. In particular, pay special attention to how the code for the body of the function h can access the values of a, b, and c. [10 marks]