2004 Paper 5 Question 7

Compiler Construction

You have been provided with the description of a programming language, J, intended for scripting applications. Its syntax is similar to a cut-down version of Java in that it consists of function definitions which have bodies containing if-then-else, while-do, assignments and (typed) declarations of variables. Only one statement or keyword may occur on a line so that it is sufficient to describe the start of a loop iteration with its line number. You need to explain to your boss the alternatives for implementing this so that a decision may be made as to the best implementation strategy.

The choice is between:

(*a*) compiling J to machine code;

(*b*) compiling J to "interpreted byte code", and then interpreting this;

(*c*) parsing J to a syntax tree representation and then interpreting this using a function which walks the tree;

(*d*) keeping J in a text file and then interpreting it by reading each line (and acting on it) as and when the line is required.

For *each* of (*a*)–(*d*), (*i*) summarise the main phases of work that are done *before* execution in each case, giving a brief explanation of the main actions of the main interpreter loop (if any) *during* execution, and (*ii*) for each of the following possible erroneous forms, explain whether the error would be found before or during execution: malformed syntax, undeclared variable, type error, division by zero.

[5 marks each]

You are not expected to argue for or against any of the alternatives.