SOLUTION NOTES

Compiler Construction 2001 Paper 4 Question 4 (AM)

This is the file as submitted to the Examiners in January 2001.

(a) Terminals: *eof, id*, '=', ';', {, }, **if**, **then**, **else**, **repeatwhile**. Non-Terminals: E, C, S. S is the *start symbol*.

Various choices, but the most natural is:

$$
\begin{aligned}
E &\rightarrow id \\
C3 &\rightarrow E = E; \\
C3 &\rightarrow \{B\} \\
C2 &\rightarrow C3 \,|\, C2 \text{ \textbf{repeatwhile} } E \\
C1 &\rightarrow \textbf{if } E \textbf{ then } C1 \\
C1 &\rightarrow \textbf{if } E \textbf{ then } C \textbf{ else } C1 \\
C1 &\rightarrow C2 \\
C &\rightarrow C1 \,|\, C \; C1 \\
B &\rightarrow B \; C \\
B &\rightarrow C \\
S &\rightarrow C \textbf{ eof}
\end{aligned}
$$

(c) ML:

```
datatype E = ass of string * string    (not nec for answer).
datatype C = ass of E*E | seq of C list |
             ifthen of E*C*C | cond of E*C*C | rwhile of C*E;
```

(b) Something like:

```
bool match(tok) { if (token == tok) { lex(); return true; }
                  else return false; }
void checkfor(tok) { if (!(match(tok))) raise error; }
rdE() { checkfor(id); }
rdC3() { if (match('{')) {
          rdC(); while (!match('}')) rdC();
        }
        else {
          rdE(); checkfor('='); rdE(); checkfor(';');
        }
      }
rdC2() { rdC3(); while (match('repeatwhile')) rdE(); }
```

```
rdC1() { if (token=='if') {
          lex(); rdE(); checkfor('then');
          rdC1(); if (match('else')) rdC1();
        }
        else rdC2();
      }
rdC() { rdC1(); if (token != eof) rdC(); }
rdS() { rdC(); checkfor(eof); }
```