

# COMPILERS COMPREHENSIVE EXAM

## Autumn 2002

**This is a 30 minute, closed book exam. Please mark your answers in the blue book.**

1) Give a context free grammar that will describe the set of strings that are palindromes over the alphabet  $\{0, 1, \dots, 9\}$  (2 pts)

2) Given the following code:

```
1: #include <stdio.h>
2:
3: int main () {
4:   int foo [10];
5:   foo++;
6:   printf ("Hello world!");
7:   return 7
8: }
```

Clearly this code has some errors in it. Assuming each error in the code would be reported by the compiler (and that one error would not affect the next), what lines would cause the compiler to error and which stage of compilation would detect the error (lexing, syntax or semantic analysis)? Justify your responses. (4 pts)

3) Is the following grammar LL(1)? If not, can the language that it describes be expressed with an LL(1) grammar? Justify your response. (7 pts)

```
S --> Tu | wx
T --> Sq | vvS
```

4) In one or two sentences only, briefly describe why the class of LR(1) grammars can describe more languages than the class of LL(1) grammars. (8 pts)

5) Sometimes the basic compiler optimizations can actually slow down the code being compiled. Write a snippet of code that demonstrates how the application of simple compiler optimizations may cause the generated code to be slower than the "unoptimized" version. Justify your response. (9 pts)