UNIVERSITY OF YORK

BA Degree Examinations 2005-2006

DEPARTMENT OF LANGUAGE AND LINGUISTIC SCIENCE

L334: Computational Syntax and Semantics

Time allowed: ONE hour

Answer ALL questions

(1) Given the following grammar,

$S \rightarrow NP\ VP$	*Sandy* : NP
$NP \rightarrow D\ N$	*the* : D
$VP \rightarrow V\ NP$	*sheep* : N
$PP \rightarrow P\ NP$	*in* : P
$VP \rightarrow VP\ PP$	*field* : N
	saw : V

a. Provide a top-down, left-to-right derivation for the string *Sandy saw the sheep in the field*. (9 marks)

b. State what kind of derivation it is. (1 mark)

c. What problem would a top-down parser encounter in parsing the string *Sandy saw the sheep in the field* as defined by the above grammar, and why? (5 marks)

d. Would a top-down, left-to-right *recogniser* encounter the same problem? Briefly explain your answer. (4 marks)

(2) What kind of parsers encounter problems with rules of the following kind: $NP \rightarrow \epsilon$? Briefly explain why. (4 marks)

(3) a. What kind of language is $a^n b^n c^n$? (1 mark)

b. How is this class of languages defined? (3 marks)

c. Define a context-free phrase structure grammar (CF-PSG) (3 marks)

(4) a. Explain what it means to say that the time complexity of CF-PSG recognition is $O(n^3)$. (4 marks)

b. What the time complexity of CF-PSG *parsing*? (2 marks)

(5) Outline the operation of a shift-reduce parser and show the states of the stack and buffer during a parse of the string *saw the sheep in the field* using the grammar in question (1) above.

(6) Immediately below is the Prolog code for a top-down, depth-first left-to-right recogniser. Compile the parser over the grammar in question (1) above. (10 marks)

```
td_parse(Cat,[Word|RestofString],RestofString) :-
   (Cat===> [Word]).

td_parse(Mother, S0,S) :-
    (Mother ---> Daughters),
   td_parse_dtrs(Daughters,  S0, S).

td_parse_dtrs([],S, S).

td_parse_dtrs([Cat|Cats], S0, S) :-
   td_parse(Cat, S0, S1),
   td_parse_dtrs(Cats, S1, S).
```

(7) a. How does a Definite Clause Grammar (DCG) differ from a CF-PSG? (2 marks)

b. What is the weak generative capacity of DCGs? (2 marks)

Total marks: 60

End of examination