## Programming Language Translation

## Practical 4 Handin

### Task 2 Palindromes [4 marks] – for tutor marking

Does grammar 1 describe palindromes? If not, why not?

No. The grammar 1 cannot derive to terminals.

Is it an LL(1) grammar? If not, why not?

Does grammar 2 describe palindromes? If not, why not?

No. “a” and “b” are the start of multiple alternatives. Hence the grammar can not end and no palindrome can be described.

Is it an LL(1) grammar? If not, why not?

No. “a” and “b” are both the start of multiple alternatives. Palin2 can start with “a” in two cases and “b” in two cases.

Does grammar 3 describe palindromes? If not, why not?

Yes. Palindromes “a”, “aa”, “b” and “bb”.

Is it an LL(1) grammar? If not, why not?

No. “a” and “b” are the start & successor of a deletable structure. The parser cannot determine if the Palin3 is followed by “a” or “b”

Does grammar 4 describe palindromes? If not, why not?

Yes. Palindromes “a”, “aa”, “b” and “bb”.

Is it an LL(1) grammar? If not, why not?

No, “a” and “b” are the start & successor of a deletable structure and “a” and “b” are the start of several alternatives.

Can you find a better grammar to describe palindromes? If so, give it, if not, explain why not.

No, it is not possible to describe palindromes using EBNF only BNF. Since we have LL(1) warnings that “a” and “b” are the start of several alternatives no palindrome can be determined.

### Task 3 Thinking about ambiguity [4 marks]

Which of the following statements are true? Justify your answers.

(a) An LL(1) grammar cannot be ambiguous. True.

(b) A non-LL(1) grammar must be ambiguous.

(c) An ambiguous language cannot be described by an LL(1) grammar.

(d) It is possible to find an LL(1) grammar to describe any non-ambiguous language.

### Task 4 RPN [6 marks] - for tutor marking

Are the given grammars equivalent?

Is either (or both) ambiguous?

Do either or both conform to the LL(1) conditions? If not, explain clearly where the rules are broken, and come up with an LL(1) grammar that describes RPN notation, or else explain why it might be necessary to modify the language itself to overcome any problems you have uncovered.