Semantics of Programming Languages
Exercise Sheet 5

General homework instructions

All proofs in the homework must be carried out in Isar style.

Homework 5.1 Rule Inversion

Submission until Tuesday, November 21, 10:00am.

We define a grammar for palindromes consisting of the two symbols $a$ and $b$:

```isar
datatype ab = a | b

inductive S :: "ab list ⇒ bool" where
  a: "S w ⇒ S (a # w @ [a])" 
  b: "S w ⇒ S (b # w @ [b])" 
  nil: "S []"
```

Prove that if $xux$ (where $x$ is a symbol and $u$ is a word) is a word in the language, then $u$ is also a word in the language:

```isar
lemma
  assumes "S (x # u @ [x])"
  shows "S u"
proof
  — proof goes here
qed
```

Also prove that there are no words $aub$ in the language:

```isar
lemma "¬ S (a # u @ [b])"
proof
  — proof goes here
qed
```