

Exam details

- 2.5 hours

- You may have a $8\frac{1}{2} \times 11$, double-sided crib sheet
 - Handwritten or typed

Exam topics

- General knowledge / trivia (focus is mostly on post-midterm)
- Grammars (not attribute grammars)
- Formal semantics
- Inductive datatype (Agda-like syntax)
- Prolog

Draft practice

(Covering grammars, formal semantics, and inductive datatypes)

Consider the language from assignment 1,
with both additions (variables/substitution and booleans).

That is, the language generated by the grammar:

$\langle \text{expr} \rangle ::= \text{const int} \mid \text{ident string} \mid \text{neg } \langle \text{expr} \rangle \mid \text{abs } \langle \text{expr} \rangle$
 $\mid \text{plus } \langle \text{expr} \rangle \langle \text{expr} \rangle \mid \text{times } \langle \text{expr} \rangle \langle \text{expr} \rangle$
 $\mid \text{exp } \langle \text{expr} \rangle \langle \text{expr} \rangle \mid \text{minus } \langle \text{expr} \rangle \langle \text{expr} \rangle$

cont

$$\langle \text{expr} \rangle ::= \text{subst string expr expr}$$

$$| \text{true} | \text{false} | \text{and } \langle \text{expr} \rangle \langle \text{expr} \rangle$$

$$| \text{or } \langle \text{expr} \rangle \langle \text{expr} \rangle | \text{not } \langle \text{expr} \rangle$$

Several possible exercises using this grammar:

- 1) Give a formal semantics of this language (add a production such as $\langle \text{expr} \rangle ::= \text{error}$).
 - No need for environment or state here.
 - Make use of substitution on expressions, i.e. $E_1[x := E_2]$.
- 2) Improve this grammar.
 - Disallow type errors, for instance.
- 3) Give an inductive datatype for this language.
- 4) Allow for a global state (so your semantics reason about Expression, State pairs).
- 5) Give a grammar with infix operators instead of prefix ones, and enforce associativity and precedence.
- 5a) Give an Agda inductive type for this.