

## CSE 6341, Written Assignment 2

Due Thursday, February 8, 11:59 pm (8 points)

Your submissions should be uploaded via Carmen. Create your answers using a text editor and upload the file (e.g., plain text, Word, PDF). Alternatively, you can write your answers by hand and take a photo (or scan), but please ensure that (1) your handwriting is *clear and legible*, and (2) your photo or scan has *high resolution*, to allow the grader to read and understand your submission.

**Q1** (3 points): We discussed two attribute grammars for language  $\{a^n b^n c^n \mid n \geq 1\}$ . Consider the second grammar, shown on slide 42. For that grammar, show the parse tree for string **aaabbbccc**. For ease of explanation, label the inner nodes A1, A2, ..., C3 (see slide 51 for an example). At each inner node, show the name of the corresponding attribute. Ignore the conditions *Cond: [...]*

Next, show the dependence graph for these attributes (see slide 51 for an example). Then show at least one topological sort of the dependence graph (i.e., at least one valid evaluation order; see slide 52 for an example).

**Q2** (3 points): Consider an example described in the lecture notes, slide 51.

```
float x = 5.0; float y = x + 1.0; int z = x + y;
```

Show the parse tree for this code, together with the values of attributes *tbl* and *type* at all applicable nodes. Show where the boolean condition(s) in the parse tree are violated. Use the attribute grammar defined on slides 58-69.

**Q3** (2 points): Consider the following grammar for hexadecimal constant, loosely based on the context-free grammar for the C language. (If you are interested in the corresponding C syntax, check Section 6.4.4.1 of the ISO/IEC 9899:201x standard; but this is not necessary for solving this problem.)

```
<hexconst> ::= 0x <hexdigit> | <hexconst> <hexdigit>  
<hexdigit> ::= 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F
```

The goal is to define an attribute grammar to compute the value of a hexadecimal constant. For example, for string **0xF3B**, the value should be 3899.

Use an attribute `<hexconst>.val` such that the value of this attribute at the root node is equal to the value of the hexadecimal constant. Also use a convenience attribute `<hexdigit>.val`. *Do not use any other attributes in your solution.*

Show the evaluation rules for these two attributes. Illustrate your solution by showing the parse tree for **0xA4D**. Show the values of all attributes at all applicable nodes in the parse tree.