

CSC 461
Homework #2
Due: October 7, 2015

1. Python EBNF:

```

< expr > → < term > | < literal > | < functionCall > | < expr >
< literal > → < intLiteral > | < floatLiteral >
< intLiteral > → { < digit > }
< floatLiteral > → < decimalLiteral > | < scientificNotationLiteral >
< decimalLiteral > → < intLiteral > . < intLiteral >
< scientificNotationLiteral > → < intLiteral > (e|E) < intLiteral >
< identifier > → < letter > { < digit > | < letter > }
< index > → < identifier > "[" (< identifier > | < intLiteral > "]"
< slice > → < identifier > "[" [ (< identifier > | < intLiteral > ) ] : [ (< identifier >
| < identifier > ) ] [ : (< identifier > | < intLiteral > ) ] "]"
< letter > → a|b|c|d|e|f|g|h|i|j|k|l|m|n|o|p|q|r|s|t|u|v|w|x|y|z
|A|B|C|D|E|F|G|H|I|J|K|L|M|N|O|P|Q|R|S|T|U|V|W|X|Y|Z
< digit > → 0|1|2|3|4|5|6|7|8|9
< term > → < term > < addsub > < expr > | < mult >
< mult > → < mult > < multdiv > < expr > | < pow >
< pow > → < expr > ** < pow > | < comparison >
< comparison > → < comparison > < comparisonOp > < expr > | < parenthesized >
< parenthesized > → "(" < expr > ")"
< addsub > → +|-
< multdiv > → *|/|//|%
< comparisonOp > → ==|!=|<|>|<=|>=
< functionCall > → < identifier > "(" (< identifier > | < literal > | < functionCalls > ), ")"

```

2. Turtle:

- a) Semantics
- b) Context-free
- c) Context-sensitive

- d) Context-free
- e) Semantics
- f) Semantics
- g) Context-free
- h) Context-free
- i) Context-free
- j) Semantics
- k) Context-free
- l) Semantics
- m) Context-sensitive
- n) Semantics
- o) Semantics
- p) Context-free
- q) Semantics
- r) Semantics

EBNF Grammar:

$\langle \text{program} \rangle \rightarrow \text{turtle} \langle \text{statement} \rangle \text{endturtle}$
 $\langle \text{statement} \rangle \rightarrow \langle \text{assign} \rangle \mid \langle \text{method} \rangle \mid \langle \text{delete} \rangle$
 $\langle \text{assign} \rangle \rightarrow \langle \text{var} \rangle = \langle \text{expr} \rangle$
 $\langle \text{expr} \rangle \rightarrow \langle \text{constant} \rangle \mid \langle \text{var} \rangle \mid \langle \text{new} \rangle$
 $\langle \text{constant} \rangle \rightarrow \text{nullturtle}$
 $\langle \text{var} \rangle \rightarrow \langle \text{letter} \rangle \langle \text{letter} \rangle$
 $\langle \text{letter} \rangle \rightarrow a|b|c|d|e|f|g|h|i|j|k|l|m|n|o|p|q|r|s|t|u|v|w|x|y|z$
 $\langle \text{method} \rangle \rightarrow \langle \text{new} \rangle \mid \langle \text{delete} \rangle \mid \langle \text{pen} \rangle$
 $\langle \text{pen} \rangle \rightarrow \text{pen}'(\text{'up'})'| \text{pen}'(\text{'down'})'| \text{pen}'(\langle \text{float} \rangle, \langle \text{float} \rangle, \langle \text{float} \rangle)'$
 $\langle \text{new} \rangle \rightarrow \text{new} \langle \text{object} \rangle$
 $\langle \text{delete} \rangle \rightarrow \text{delete} \langle \text{object} \rangle$
 $\langle \text{object} \rangle \rightarrow \langle \text{var} \rangle$
 $\langle \text{float} \rangle \rightarrow 0. \langle \text{digit} \rangle \langle \text{digit} \rangle$
 $\langle \text{digit} \rangle \rightarrow 1|2|3|4|5|6|7|8|9$