**CSE304 Principles of Programming Languages Fall 2018, Hw#1 Due Date: Oct.30, 2018; on paper, handwritten**

When someone says, "I want a programming language in which I need only say what I want done," give him a lollipop. *-- Alan Perlis*

**1.** Compute the weakest preconditions for the following statements. All variables are of integer type.

* 1. **a.** if i=j then i=i-j else i=j; {i=0}
  2. **b.** x=x+1; y=y\*z; {y=z\*x}
  3. **c.** a=3\*(2\*b+a); b = 2\*a-1; {b>5}
  4. **2. Prove that the following grammar is ambiguous. <S> is the starting symbol.**

<S> <A><B> | aa<B>

<A> a | <A>a

<B> 🡪**b**

S-> aa<B>

B->b

s-> aab

S->AB

A->Aa

S->AaB

A->a

S->aaB

B->b

S->aab

* 1. **3. Consider the following grammar:**

Y🡪pYrQ|P|q

P🡪rP | r

Q🡪s|P

Which of the following strings are generated by the above context free grammar?

* 1. **a. pqrs**
  2. Y-> pYrQ
  3. Y=q
  4. Y->pqrQ
  5. Q->s
  6. Y-> pqrs
  7. **b. prs**
  8. **Y->pYrQ**
  9. **Y->&**
  10. **Y->prQ**
  11. **Q->s**
  12. **Y->prs**
  13. **c. prrrqrrr**

Cannot be generated.

**4.** Write an attribute grammar whose BNF and language (static semantics) rules are as follows:

BNF:

<assign><var> = <expr>

<expr><var> + <var> | <var>

<var>A|B|C

Static semantics rules: Data types cannot be mixed in expressions, but assignment statements need not have the same types on both sides of the assignment operator.