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

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

**a.** `if i=j then i=i-j else i=j; {i=0}`

**b.** `x=x+1; y=y*z; {y=z*x}`

**c.** `a=3*(2*b+a) ; b = 2*a-1; {b>5}`

**2.** Prove that the following grammar is ambiguous. <S> is the starting symbol.

```
<S> → <A><B> | aa<B>
<A> → a | <A>a
<B> → b
```

**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?

**a.** pqrs
**b.** prs
**c.** prrrqrrr

**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.