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Fall 2012 (121)  
King Fahd University of Petroleum and Minerals  
Information and Computer Science Department

ICS 410-01: Quiz #2 Key Solution

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**Q1.** Describe briefly the difference between:

(a) a **sentence** and a **sentential form** in a grammar.

A sentence is a sentential form that has only terminal symbols

(b) an **intrinsic attribute** and a **synthesized attribute** in an attribute grammar.

An intrinsic attribute is a synthesized attribute whose value is not computed from the parse tree, but is instead taken from outside the parse tree.

**Q2.** Given the following context-free grammar (where S, A and B are non-terminals):

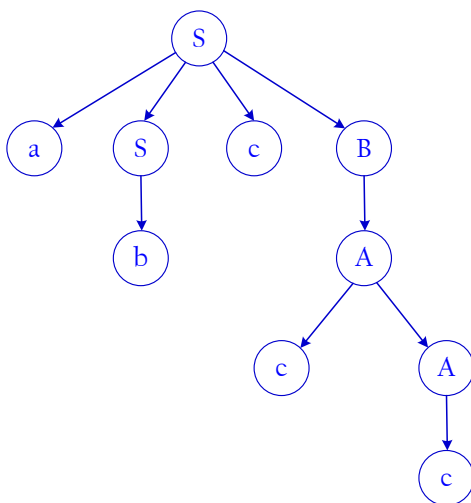
$$S \rightarrow aScB \mid A \mid b$$

$$A \rightarrow cA \mid c$$

$$B \rightarrow d \mid A$$

(a) Is the grammar ambiguous (Yes or No only)? **Yes** (e.g. consider the sentence acccc.)

(b) Give a **parse tree** and a **right-most derivation** for the sentence abccc in this grammar.



$$S \Rightarrow aScB \Rightarrow aScA \Rightarrow aSc cA \Rightarrow aSc c c \Rightarrow abccc$$

**Q3.** Compute the weakest precondition for the following program and the post-condition  $\{z = x \cdot y\}$ :

The loop invariant is  $z = x \cdot a$ . Computation of the weakest precondition is shown below:

```
{ 0 == 0 }

a = 0;
  { 0 = x a }

z = 0;
  { z = x a }

while (a != y) {

    { z = x a /\ a != y }
    { z + x = x (a + 1) }

    z = z + x;
      { z = x (a + 1) }

    a = a + 1;
      { z = x a }

}

{ z = x a /\ a == y }
{ z = x y }
```

Therefore, the weakest precondition is "True".