

## Group Assignment #9 (April 4, 2002)

1. Write a grammar for a language  $S$  that includes the following expressions. Each expression consists of a number with or without a symbol.

$S = 22!, 36?, 73!, 42?, 33, \text{etc.}$

2. Add semantic rules to the above grammar  $S$  to make it into an attribute grammar for the language  $S$ , where the value of expressions is illustrated by the following examples.

Expression	Value
22!	9
36?	17
73!	26
42?	17
33	9



3. Consider the following language:-

$G = \{T, N, S, P\}$

terminals = {John, Mary, runs, swims, drinks, black, green, tea,  
coffee}

non-terminals = {sentence, proper\_noun, intrans\_verb, trans\_verb,  
noun\_phrase, adjective, common\_noun}

distinguished\_non\_terminals = sentence

productions = {  
  sentence ::= proper\_noun intrans\_verb  
              | proper\_noun trans\_verb noun\_phrase  
  
  proper\_noun ::= john | mary  
  intrans\_verb ::= runs | swims  
  trans\_verb ::= drinks  
  noun\_phrase ::= adjective common\_noun  
  adjective ::= green | black  
  common\_noun ::= tea | coffee  
              }

NOTE:

Both John and Mary runs, but John swims and Mary dives.  
John drinks black coffee and Mary drinks green tea only.

- a. Write 5 valid (permissible by the grammar but not necessarily true) sentences generated by the language of this grammar. Your five should contain at least three which use transitive verbs.
- b. Write the attribute grammar for the above language to evaluate your five sentences in (a).

$G = \{T, N, S, P\}$   
 terminals = {John, Mary, runs, swims, dives, drinks, black, green, tea, coffee}  
 meaning of john = {PERSON 1, GENDER MALE}  
 meaning of mary = {PERSON 2, GENDER FEMALE}  
 meaning of runs = {SET\_OF\_PEOPLE {1,2}}  
 meaning of swims = {SET\_OF\_PEOPLE {1}}  
 meaning of dives = {SET\_OF\_PEOPLE {2}}  
 meaning of drinks = {SET\_OF\_PEOPLE {1,2}}  
 meaning of black = {COLOUR BLACK}  
 meaning of green = {COLOUR GREEN}  
 meaning of coffee = {SET\_OF\_PEOPLE {1}, COLOUR BLACK}  
 meaning of tea = {SET\_OF\_PEOPLE {2}, COLOUR GREEN}

non-terminals = {sentence, proper\_noun, intrans\_verb, trans\_verb, noun\_phrase, adjective, common\_noun}

distinguished\_non\_terminals = sentence

productions = {
   
 sentence ::= proper\_noun intrans\_verb
   
 RESULT of sentence = RESULT (true if the SET\_OF\_PEOPLE Attribute of the intrans\_verb contains the PERSON attribute of the proper\_noun and false otherwise)
   
 | proper\_noun trans\_verb noun\_phrase
   
 RESULT of sentence = RESULT (true if the SET\_OF\_PEOPLE attribute of the trans\_verb contains the PERSON attribute of the proper\_noun, and the SET\_OF\_PEOPLE attribute as well as the COLOUR attribute of the noun\_phrase are matched, false otherwise)
 }

proper\_noun ::= john  
 meaning of proper\_noun = meaning of john  
                   | mary  
 meaning of proper\_noun = meaning of mary

intrans\_verb ::= runs  
 meaning of intrans\_verb = meaning of runs  
                   | swims  
 meaning of intrans\_verb = meaning of swims  
                   | dives  
 meaning of intrans\_verb = meaning of dives

trans\_verb ::= drinks  
 meaning of trans\_verb = meaning of drinks

noun\_phrase ::= adjective common\_noun  
 meaning of noun\_phrase = meaning of common\_noun

adjective ::= green  
 meaning of adjective = meaning of green  
                   | black  
 meaning of adjective = meaning of black

common\_noun ::= tea  
 meaning of common\_noun = meaning of tea  
                   | coffee  
 meaning of common\_noun = meaning of coffee

}