Dependency Graphs:

* Implementing a Syntax Directed Deﬁnition consists primarily in ﬁnding an order for the evaluation of attributes
* Each attribute value must be available when a computation is performed.
* Dependency Graphs are the most general technique used to evaluate syntax directed deﬁnitions with both synthesized and inherited attributes.
* A Dependency Graph shows the interdependencies among the attributes of the various nodes of a parse-tree.
* There is a node for each attribute;
* If attribute b depends on an attribute c there is a link from the node for c to the node for b (b ←c).

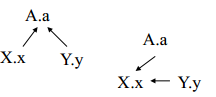
Dependency Rule: If an attribute b depends from an attribute c, then we need to ﬁre the semantic rule for c ﬁrst and then the semantic rule for b .

• If b:= f(c), i.e. b depends on c

* c must be computed before b
* In the dependency graph: c → b

• Example, A → XY

* A.a = f(X.x, Y.y) (synthesized)
* X.x = g(A.a, Y.y) (inherited)



* Dep. Gr. defines a partial order :
* A → Y → X and Y → A → X are both corrects orders
* A topological sort creates a total order m1, m2, . . . mk
* If mi → mk then evaluate mi before mk
* For the other cases the top. sort creates arbitrary order
* No topological sort exists, if the graph contains cycles
* Evaluation Order:
* The evaluation order of semantic rules depends from a
* Topological Sort derived from the dependency graph.

Any topological sort of a dependency graph gives a valid order to evaluate the semantic rules.

L-attributed Definitions :

* L-Attributed Deﬁnitions :contain both synthesized and inherited attributes but do not need to build a dependency graph to evaluate them.
* Deﬁnition. A syntax directed deﬁnition is L-Attributed if each inherited attribute of Xj in a production

A→X1. . .Xj. . . Xn, depends only on:

1. The attributes of the symbols to the left(this is what L-attributed stands for) Xj ,i.e., X1X2…Xj-1,and
2. The inherited attributes of A.

* Theorem : Inherited attributes in L-Attributed Defenitionscan be computed by a PreOrder traversal of the parse-tree.

L-attributed – example :

* Inherited attributes can also help if syntax and parse tree do not match
* Example, non-left-recursive grammar for expressions like 3 \* 5 … 