We can compute the **FF heuristic** directly from a PDDL description and achieve **state-of-the-art performance** among **lifted planners**.

Heuristics	IPC	HTG	Total
Lifted FF + Lazy P.O.	**782**	**691**	**1473**
Lifted Additive + Lazy P.O.	762	663	1425
Lifted Goalcount + Unary Relax.	575	641	1216
Ground FF + Lazy P.O.	862	595	1457

Relaxed Plans Using **Annotated Datalog Programs**

```
(:action A
        :parameters (?X ?Y)
        :precondition
        (and (P ?X ?Y)
             (S ?X))
        :effect
        (and (Q ?X)
             (R ?Y)))
(:goal (Q 0))
```

→

```
A-app(X,Y) :- P(X, Y), S(X) [Add A(X, Y) to the plan]
      Q(X) :- A-app(X,Y) [ ]
      R(Y) :- A-app(X,Y) [ ]
   goal() :- Q(0). [ ]
```

Annotations

- Sequence of **instructions**
- **Ground** with the rule
- Executed after **deriving** `goal()`
- **Backchain** through **achievers**

Transformations

Direct encoding **does not scale**.

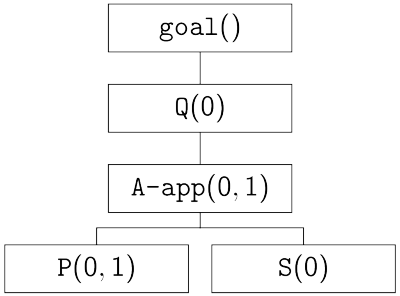
We need to apply **transformations**:

- Rule Splitting
- Rule Merging
- Predicate Collapsing
- Variable Renaming

Semantics preserved with transformations

Example

Justification Tree



Order annotations **bottom-up** and **execute** instructions to compute FF

The FF Heuristic for Lifted Classical Planning
A.B. Corrêa, F. Pommerening, M. Helmert, and G. Francès.