



Compilers

Self Type Operations

- What can be the dynamic type of the object returned by `inc`?
 - Answer: whatever could be the type of “`self`”

```
class A inherits Count { };
```

```
class B inherits Count { };
```

```
class C inherits Count { };
```

(`inc` could be invoked through any of these classes)

- In general, if **SELF_TYPE** appears textually in the class **C** as the declared type of **E** then

$$\text{dynamic_type}(E) \leq C$$

- Note: The meaning of **SELF_TYPE** depends on where it appears
 - **SELF_TYPE_C** refers to an occurrence of **SELF_TYPE** in the body of **C**
- This suggests a typing rule:

$$\text{SELF_TYPE}_C \leq C \quad (*)$$

- Rule (*) has an important consequence:
 - In type checking it is always safe to replace SELF_TYPE_C by C
- This suggests one way to handle SELF_TYPE :
 - Replace all occurrences of SELF_TYPE_C by C

- Recall the operations on types
 - $T_1 \leq T_2$ T_1 is a subtype of T_2
 - $\text{lub}(T_1, T_2)$ the least-upper bound of T_1 and T_2
- Extend these operations to handle **SELF_TYPE**

Let T and T' be any types but SELF_TYPE

1. $\text{SELF_TYPE}_C \leq \text{SELF_TYPE}_C$
 - In Cool we never compare SELF_TYPE s coming from different classes
2. $\text{SELF_TYPE}_C \leq T$ if $C \leq T$
 - SELF_TYPE_C can be any subtype of C
 - This includes C itself
 - Thus this is the most flexible rule we can allow

3. $T \leq \text{SELF_TYPE}_C$ always false

Note: SELF_TYPE_C can denote any subtype of C .

4. $T \leq T'$ (according to the rules from before)

Choose the subtype relations that are true for the class definitions given at right

☐ $\text{Square} \leq \text{SELF_TYPE}_{\text{Shape}}$

☐ $\text{SELF_TYPE}_{\text{Circle}} \leq \text{Quad}$

☐ $\text{SELF_TYPE}_{\text{Shape}} \leq \text{Shape}$

☐ $\text{SELF_TYPE}_{\text{Rect}} \leq \text{Shape}$

Self Type Operations

Class Object

Class Bool inherits Object

Class Point inherits Object

Class Line inherits Object

Class Shape inherits Object

Class Quad inherits Shape

Class Circle inherits Shape

Class Rect inherits Quad

Class Square inherits Rect

Let T and T' be any types but SELF_TYPE

1. $\text{lub}(\text{SELF_TYPE}_C, \text{SELF_TYPE}_C) = \text{SELF_TYPE}_C$

2. $\text{lub}(\text{SELF_TYPE}_C, T) = \text{lub}(C, T)$

This is the best we can do because $\text{SELF_TYPE}_C \leq C$

3. $\text{lub}(T, \text{SELF_TYPE}_C) = \text{lub}(C, T)$

4. $\text{lub}(T, T')$ defined as before