Type Checking

Introduction

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Meeting 14, CSCI 3155, Fall 2009

Announcements

• Project 1, Due Thu
• How’s it going?

Key Terms

• Type System
• Type Checking
• Type Error
• Type Equality
• Structural Equality
• Name-Based Equality

What is a type system?

What is type checking?

Language defines when ops are compatible
What is type checking?

```plaintext
x : T := y : U;
```

What about in functional language?

```plaintext
fun f (x:int) = ...
  f f x
  f (3,4) x
  f "123" x
```

When are types T and U equal?

- Structural Equality?
  - expand definitions and see if they look the same

- Name-Based Equality?
  - same name

New Names and New Types

```plaintext
type id = int  (SML)
typedef int id' (C)
```

New Names and New Types

```plaintext
int = int, int -> int  (SML)
type constructors
```

```plaintext
struct S (int x; int y; int z)  (C)
union U int E3
```

```plaintext
ARRAY, PROCEDURE, SUBRANGE, GO TO, RJ
```
Structural vs. Name Examples

- **Type Example:**
  ```
  typedef int id;
  int x;
  id y;
  x := y;
  ```

- **Equality Check:**
  - Name:  
    ```
    x := y
    ```
  - Structural:
    ```
    x : T2
    a : T1
    ```

- **Class Example:**
  ```
  class T & class T1 &
  ```
  ```
  int val;
  S & next;
  ```

- **Structural vs. Name:**
  ```
  T != T1
  ```
  ```
  Yes, Struct. Equal
  Infinite expansion of T + T1 look the same.
  ```

Advantages and Disadvantages

- Name
  - Maybe easier to keep track of
  - Apple != Orange
  - Probably a bit cheaper to check
- Structural
  - Accepts more possibilities
  - May never be unpacked

What happens in C/C++/Java?

- **Give examples**
  ```
  struct C {...
      [name-based]
  }
  ```
  ```
  class C2 { int x; }
  ```
  ```
  int E (Array of int)
  ```
  ```
  int E2, E3
  ```
  ```
  y := E; // x := E2; YES
  ```
  ```
  Structural equality for arrays =
  ```
What happens in SML?

- Give examples

```
val x = 0
val y = 1
val z = 2
```

For Next Time

- Reading
- Online discussion forum
  - ≥1 substantive question, comment, or answer each week
- Work on project