Data Types

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Meeting 15, CSCI 3155, Fall 2009

Announcements

• Project 1, Due Sun at 11:55pm

Some Data Types

• Subranges
• Enumerations
• Arrays/Vectors
• Associative Arrays/Dictionaries/Maps
• Records
• Unions

Subranges and Enumerations

• What should be the types of 'score' and 'grade'?
  \[ \text{recordScore(score, grade)} \]
  \[ \text{Mystery} \ \{0 \ \text{to} \ 100\} \]
  \[ \text{A} \ 	ext{B} \ 	ext{C} \ 	ext{D} \ 	ext{F} \]

Subrange

• What is "ordinal"?
  values that have some order to them (total orders) \( v_1 < v_2 < v_3 \)

Subrange

• Uses?
  • Better error checking - Custom values shouldn't come up
  • Security - Unintentional Overflows, Overwriting
    \[ \text{buf} \{24\} = \text{"get my root kit code"} \]
    \[ \text{buf} \{0 \ \text{to} \ 9\} \]
  • \[ \text{int a[10], b[10]; a[5] = b[5]} \]
Enumerations

• What are they? A set of possible values.
  ```
  enum Color {Red, Green, Blue};
  ```

Arrays

• Mapping from indexes/subscripts to values.
  ```
  int a[10] (C)
  int[10] a (Java)
  ```
Associative Arrays/Dictionaries/Maps

- What is different compared to ordinary arrays?
  - C library
  - Perl
  - Python
  - Implementation: - size keys

Associative Arrays/Dictionaries/Maps

- How do we implement them?
  - Type assignment = string = bool = list
  - a[“x”] = true
  - hash table: O(1) amortized lookup
  - balanced tree: O(lgn) lookup

Records

- SML (x:int, y:int)*
- C (struct int x; int y;)
- aggregate
- SML tuples (int* int)

Unions

- What are they for?
  - Union 1
  - Different possibilities: float, char
  - Union 2

- Kinds of unions?
  - Discriminated vs. non-discriminated
  - do not know which
  - do not care

Untagged/Non-Discriminated Unions
Tagged/Discriminated Unions

Exercise
- Define types and code for evaluating an expression language in C (and in SML):
  \[ e ::= n \mid -e \mid e + e \mid e \ast e \]
  
  int eval (struct Expr * e) {
    ...
    3
    struct Expr * (union)
  }

For Next Time
- Reading
- Online discussion forum
  - \( \geq 1 \) substantive question, comment, or answer each week
- Work on project