The Dictionary ADT

EECS 214, Fall 2017
The Dictionary ADT: values and operations

Looks like: \{ a: 6, b: 7, c: 8 \}

Operations:

- \textit{get}(Dict, Key): Value
- \textit{put}(Dict, Key, Value): Void
- \textit{del}(Dict, Key): Void
- \textit{isEmpty}(Dict): Bool
The Dictionary ADT: laws

\[
\text{isEmpty} (\{\}) \Rightarrow \top
\]
\[
\text{isEmpty} (\{k_1: v_1, \ldots\}) \Rightarrow \bot
\]
\[
\text{get} (\{k_1: v_1, \ldots, k_i: v_i, \ldots\}, k_i) \Rightarrow v_i
\]
\[
\{k \neq k_i\} \text{ get}(\{k_1: v_1, \ldots\}, k) \Rightarrow \text{error!}
\]
\[
\{d = \{k_1: v_1, \ldots, k_i: v_i, \ldots\}\} \text{ put}(d, k_i, v) \{d = \{k_1: v_1, \ldots, k_i: v_i, \ldots\}\}
\]
\[
\{d = \{k_1: v_1, \ldots\} \land k \neq k_i\} \text{ put}(d, k, v) \{d = \{k_1: v_1, \ldots, k: v\}\}
\]
\[
\{d = \{k_1: v_1, \ldots\}\} \text{ del}(d, k_i) \{d = \{k_1: v_1, \ldots, k_{i-1}: v_{i-1}, k_{i+1}: v_{i+1}, \ldots\}\}
\]
\[
\{d = \{k_1: v_1, \ldots\} \land k \neq k_i\} \text{ del}(d, k) \{d = \{k_1: v_1, \ldots,\}\}
\]
Law breakdown: *get*

If we try to lookup a key present in the dictionary, we get its associated value:

\[
\text{get}(\{k_1:v_1, \ldots, k_i:v_i, \ldots\}, k_i) \Rightarrow v_i
\]

If we try to lookup a key that isn’t among the dictionary’s keys—that’s the precondition \( k \neq k_i \)—then it returns a result that indicates that the key wasn’t found:

\[
\{k \neq k_i\} \quad \text{get}(\{k_1:v_1, \ldots\}, k) \Rightarrow \text{error}!
\]
Law breakdown: *put*

If we put a key that’s already present, its associated value gets replaced:

\[
\{d = \{k_1:v_1, \ldots, k_i:v_i, \ldots\}\} \text{ put}(d, k_i, v) \{d = \{k_1:v_1, \ldots, k_i:v, \ldots\}\}
\]

If we put a key that’s absent, the new key and value association is added:

\[
\{d = \{k_1:v_1, \ldots\} \land k \neq k_i\} \text{ put}(d, k, v) \{d = \{k_1:v_1, \ldots, k:v\}\}
\]
Law breakdown: del

If we delete a key that’s present, it gets removed:

\[ \{ d = \{ k_1:v_1, \ldots \} \} \ \text{del}(d, k_i) \ \{ d = \{ k_1:v_1, \ldots, k_{i-1}:v_{i-1}, k_{i+1}:v_{i+1}, \ldots \} \} \]

If we delete a key that’s absent, nothing happens:

\[ \{ d = \{ k_1:v_1, \ldots \} \land k \neq k_i \} \ \text{del}(d, k) \ \{ d = \{ k_1:v_1, \ldots, \} \} \]
Next: a data structure for dictionaries