Hashing
Hashing

Goals:
We want to define a **keyspace**, a (mathematical) description of the keys for a set of data.

...use a function to map the **keyspace** into a small set of integers.
Hashing

Hash function

...
A Hash Table based Dictionary

Client Code:

```
1 dictionary<keytype, valuetype> d;
2 d[k] = v;
```

A Hash Table consists of three things:
1. A hash function, f(k)
2. An array
3. Something to handle chaos when it occurs!
A Perfect Hash Function

(Angrave, CS 241)
(Beckman, CS 421)
(Cunningham, CS 210)
(Davis, CS 101)
(Evans, CS 126)
(Fagen-Ulmschneider, CS 225)
(Gunter, CS 463)
(Herman, CS 233)
A Perfect Hash Function

Keyspace:
Rolling 5 dice!

<table>
<thead>
<tr>
<th>Key</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
</tr>
</tbody>
</table>
Hash Function

Our hash function consists of two parts:
• A hash:
  • A compression:

Choosing a good hash function is tricky…
• Don’t create your own (yet*)
• Very smart people have created very bad hash functions
Hash Function

Characteristics of a good hash function:

1. Computation Time:

2. Deterministic:

3. Satisfy the SUHA:
General Purpose Hash Function

Easy to create if: $|\text{KeySpace}| \sim N$
General Purpose Hash Function

Keyspaces

Easy to create if: \(|\text{KeySpace}| \sim N\)

Difficult to create:
General Purpose Hash Function

Easy to create if: $|\text{KeySpace}| \sim N$

Difficult to Create:
MP5
illinois1867 Serious #ILLINOISHomecoming question... how do you say “I-L-L” in dog language?

thojordanbarry Omg @emily_tyndorf your puppy is so famous

tessafurlong @emily_tyndorf WHAT IS HAPPENING

tyndorfanne Rosy will be hosting a “meet and greet” for all that are interested😍

#unofficialillimascot❤️

idesigner3 @meg733 정말 우리 다람이 답았다

frantastic2021 @elise_marie28 !!!

meg733 @idesigner3 나이가 있어보이네

merdive_m12 😂 🏈 🐶

allison Nichols4 @emily_tyndorf why am i not surprised that Rosy made the Illinois name❤️