Lecture 2

Part 2:

Unordered Data

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Set ADT

S.Add(x)

S.Remove(x)

x in S?

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Key/Value Store

Hashmap

Associative Array

S.Add(K,V) S.Replace(K,V)

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x in S

value stored with key K

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Key/Value Store	Python Dictionary S={}
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S.Remove(k)	del S[k]
x in S	k in S
value stored with key k	S[k]

se

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Allow: Big keys, values

Don't Allow: Any other queries, eg proximity, range

Today's Plan

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- Hash Tables

  General-purpose way to store unordered data

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- Bit Vectors

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- Bloom Filters

  Compact way of storing General-purpose data at the cost of allowing errors

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- Use Hash Functions
- The best structure to use in many situations

Hash Tables: Basic idea

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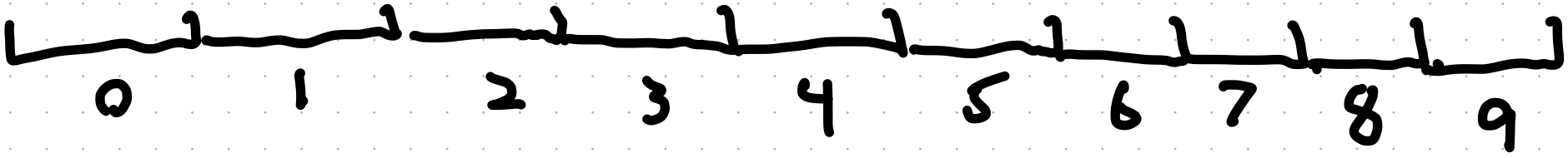

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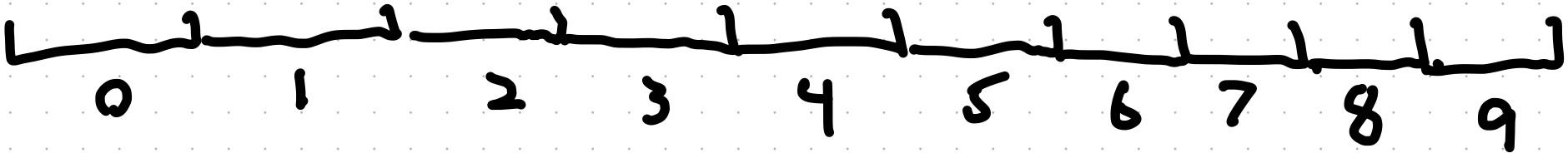

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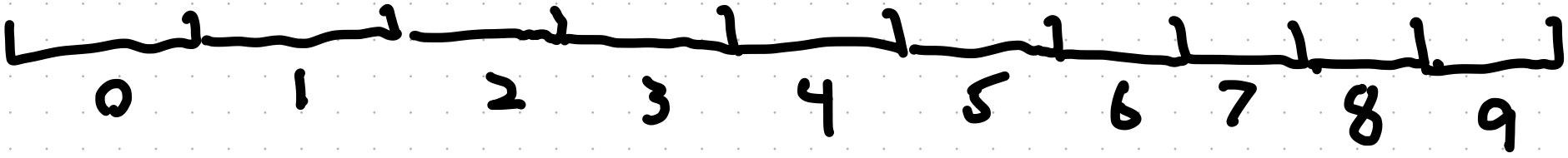

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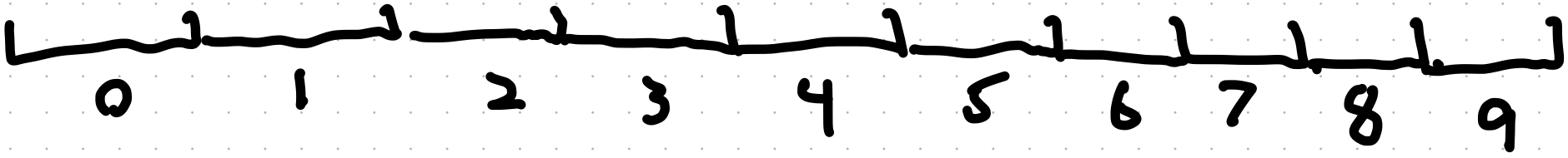

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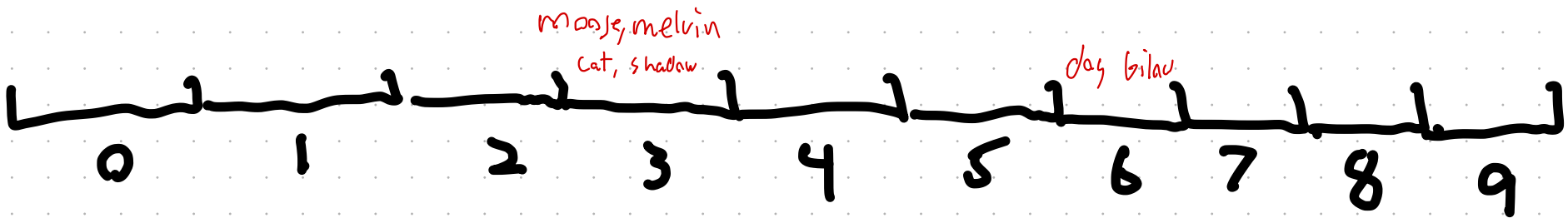

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hash("cat") = 123 hash("moose") = 313
hash("dog") = 456

H["cat"] = "shadow"
H["dog"] = "bilou"
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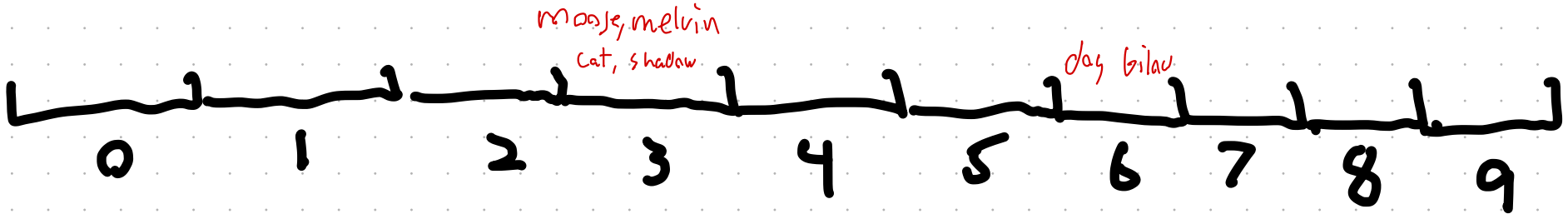
Data structure:
Table: list
Bucket: list
K,V pair: list



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__delete__	del H[K]
__contains__	K in H
__str__	str(H) shows the contents
__repr__	repr(H) shows the structure
_bucket	A helper method to determine which bucket a key belongs to

Code : __Contains__

k in H H.__contains__(k)

```
def __contains__(self, key)
    for k,v in self._A[self._bucket(key)]
        if k == key
            return True
    return False
```

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- Python does not require initialization with the table size
- Python will rebuild the table to keep $\frac{n}{b} = O(1)$ and thus keep the runtime $O(1)$
- Python supports more operations
  e.g. `for x in H:` (iterator)

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- Helps you understand how python works
- Shows you the power of hashing
- Motivates what will come next