CCT395, Week 11

Review, Permissions
Physical Storage and Performance

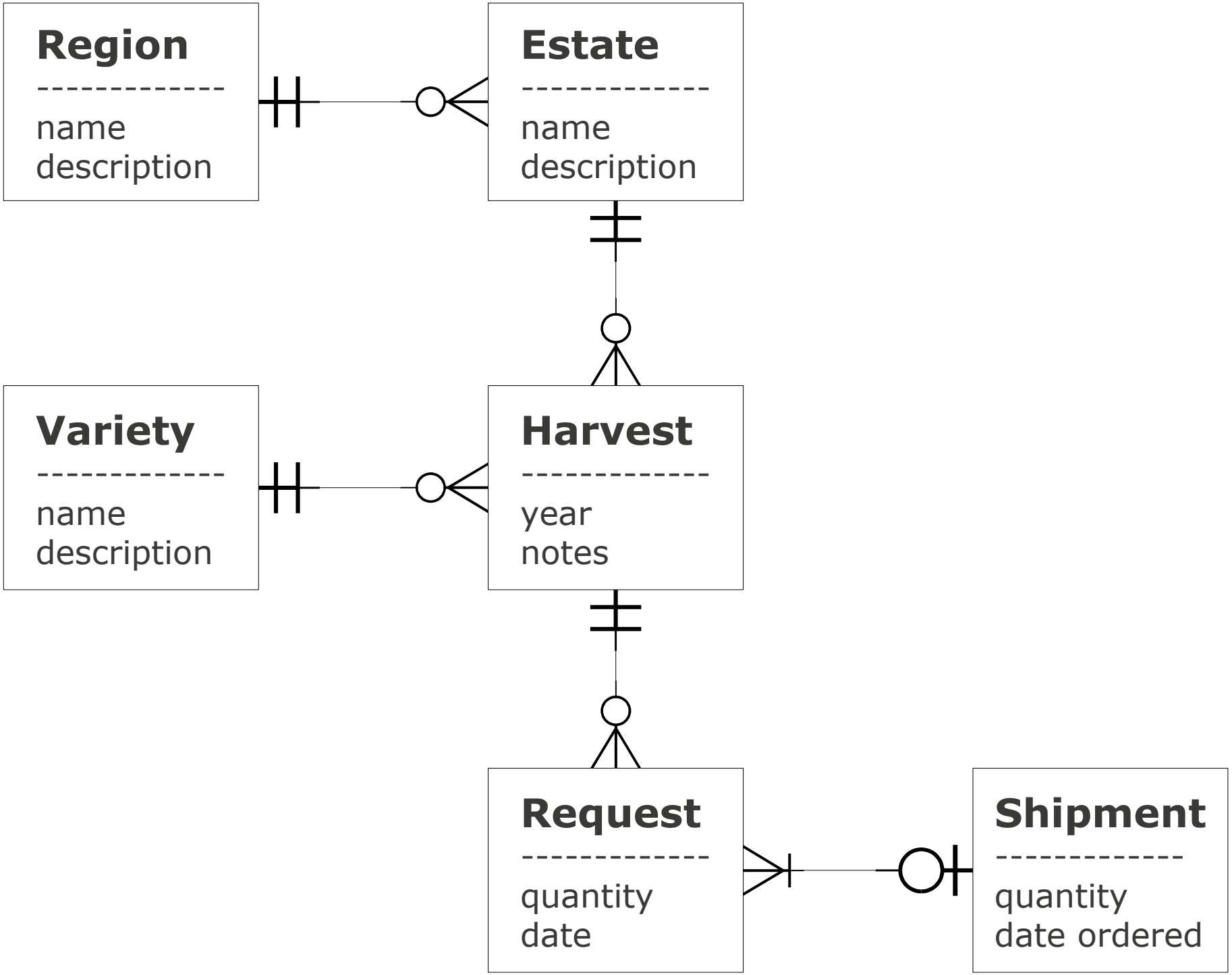
Yuri Takhteyev
University of Toronto
November 17, 2010

The Exam

25%: ER + Normalization

50%: Fill-in-the-blanks SQL

25%: Conceptual questions


Region
name
description
Estate
name
description
Variety
name
description
Harvest
year
notes
Request
quantity
date
Shipment
quantity
date ordered

```
select superhero.name from superhero

join ____________________________________

  on ____________________________________

where _____________________________!="Lex Luthor"

_____________________ by ____________________
```

Conceptual questions

- Main ideas
- Things from the last 5 weeks (check the updated outline)

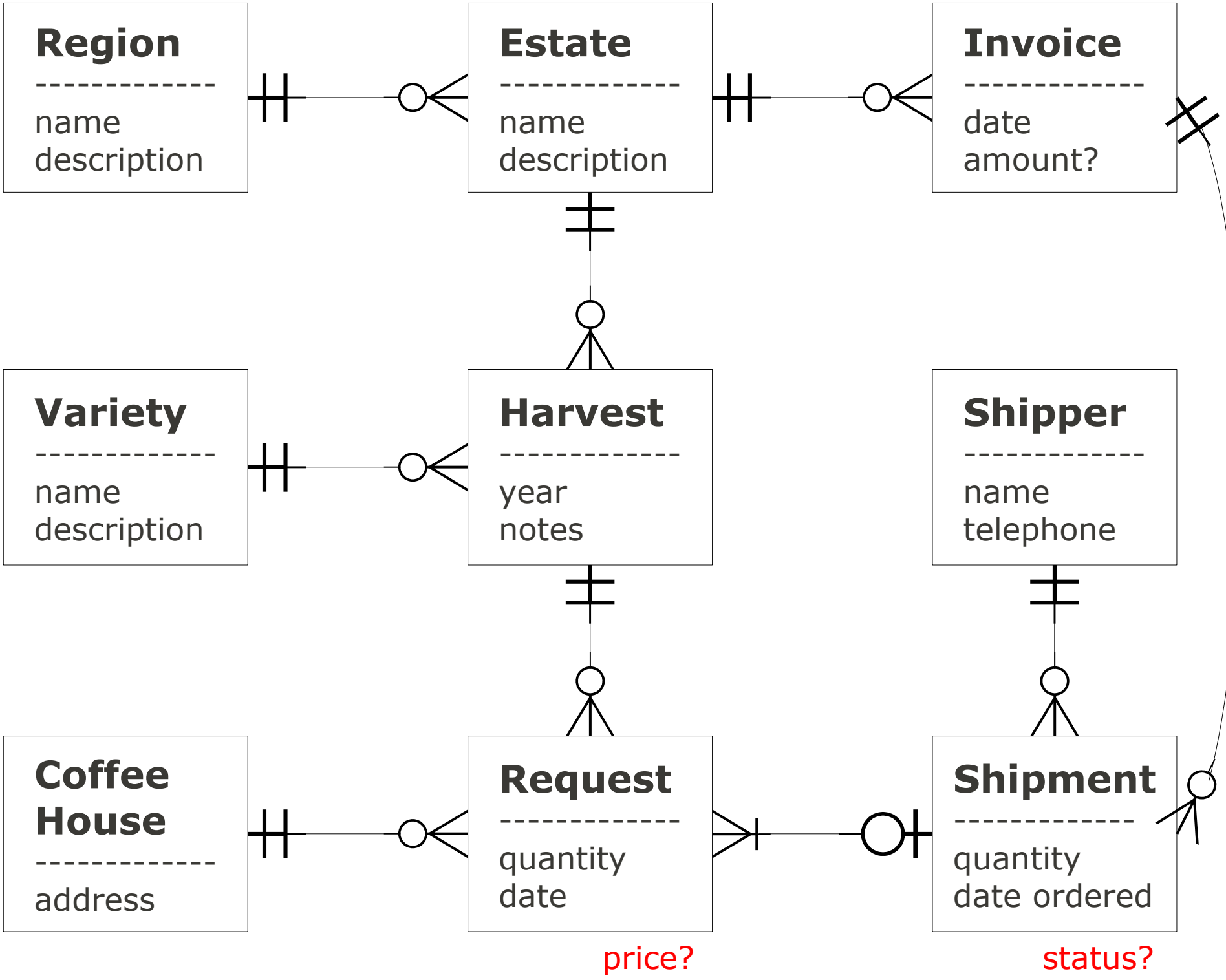
Questions?

João's Coffee

Divide and Conquer

Getting the customers the right coffee

- Ordering the right coffee
- Delivering the coffee to the right customers


Region
name
description
Estate
name
description
Invoice
date
amount?
Variety
name
description
Harvest
year
notes
Shipper
name
telephone
Coffee House
address
Request
quantity
date
price?
Shipment
quantity
date ordered
status?

SQL

```
create table harvest (
   harvest_id int,
   variety_id int,
   foreign key (variety_id)
        references variety(variety_id),
   estate_id int,
   foreign key (estate_id)
        references estate(estate_id),
   year year,
   notes varchar(200),
   primary key (harvest_id),
);
```

Storage

Persistent storage

usually a harddrive(s)

Challenges

finding a representation
not losing information
storage space
performance

CSV

simple!
relatively small
but what to do with NULLs?
and how would it perform?

CSV

657807938,559562982,223.47
755280276,889208095,590.32
934625720,459538801,344.66
852067113,660539228,684.77
+ another billion rows

How do we **add** a row?
How do we **delete** a row?
How do we **find** a row?

What if we sort it?

755280270,9898092 37,910.21
755280276,889208095,590.32
755280276,889909232,293.12
755280281,198234234,120.56
755280291,782737671,123.23

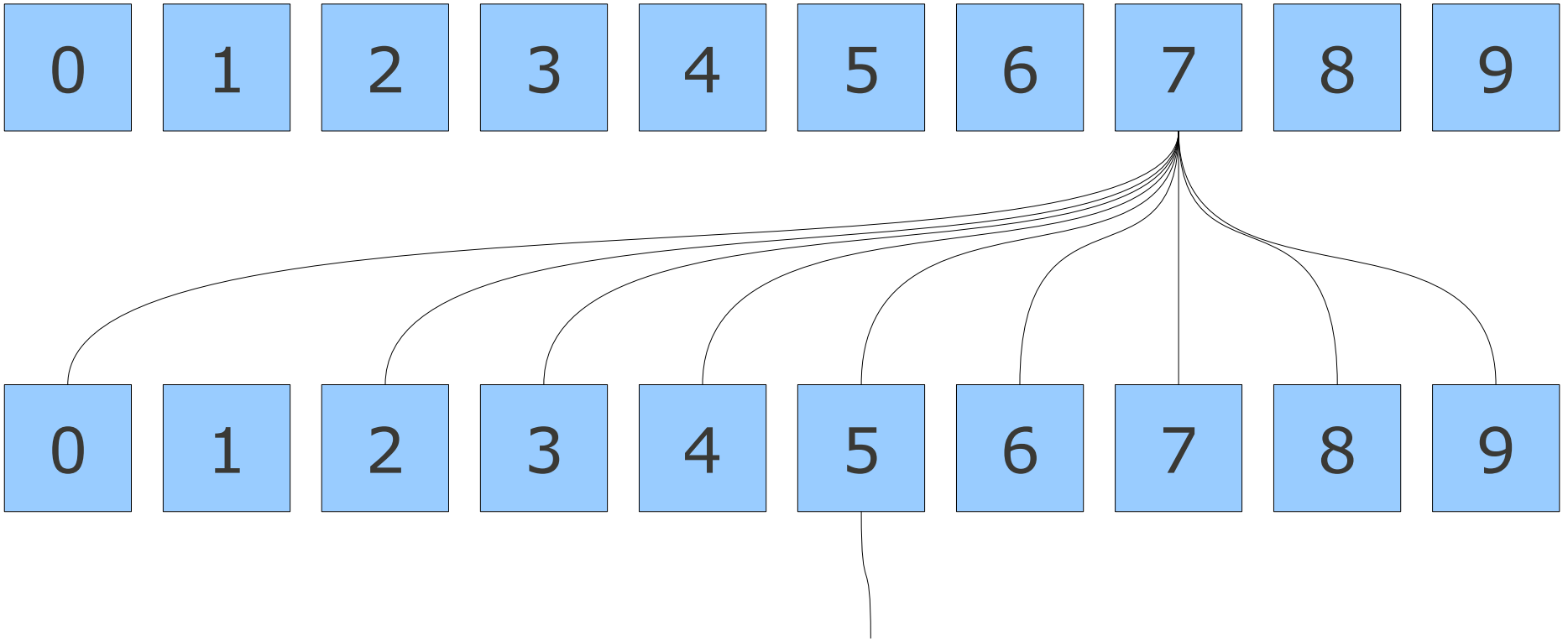
Finding is **easier**!
But adding is **harder**...

And the second field?

479837218,889208091,345.29
755280276,889208095,590.32
879873454,889208098,938.29
767983465,889208101,389.02
574983342,889208121,291.73

Essentially an **index**.
Easier to find, more stuff to store, more work to insert.

Trees



755280276,889208095,590.32

and other items that start with 75

(does not need to be ordered)

Fixed vs Dynamic

ISAM:

The structure is fixed

B+ trees:

The structure changes

A: 4%
O: <0.5%
M: 9.5%

CCT395, Week 9

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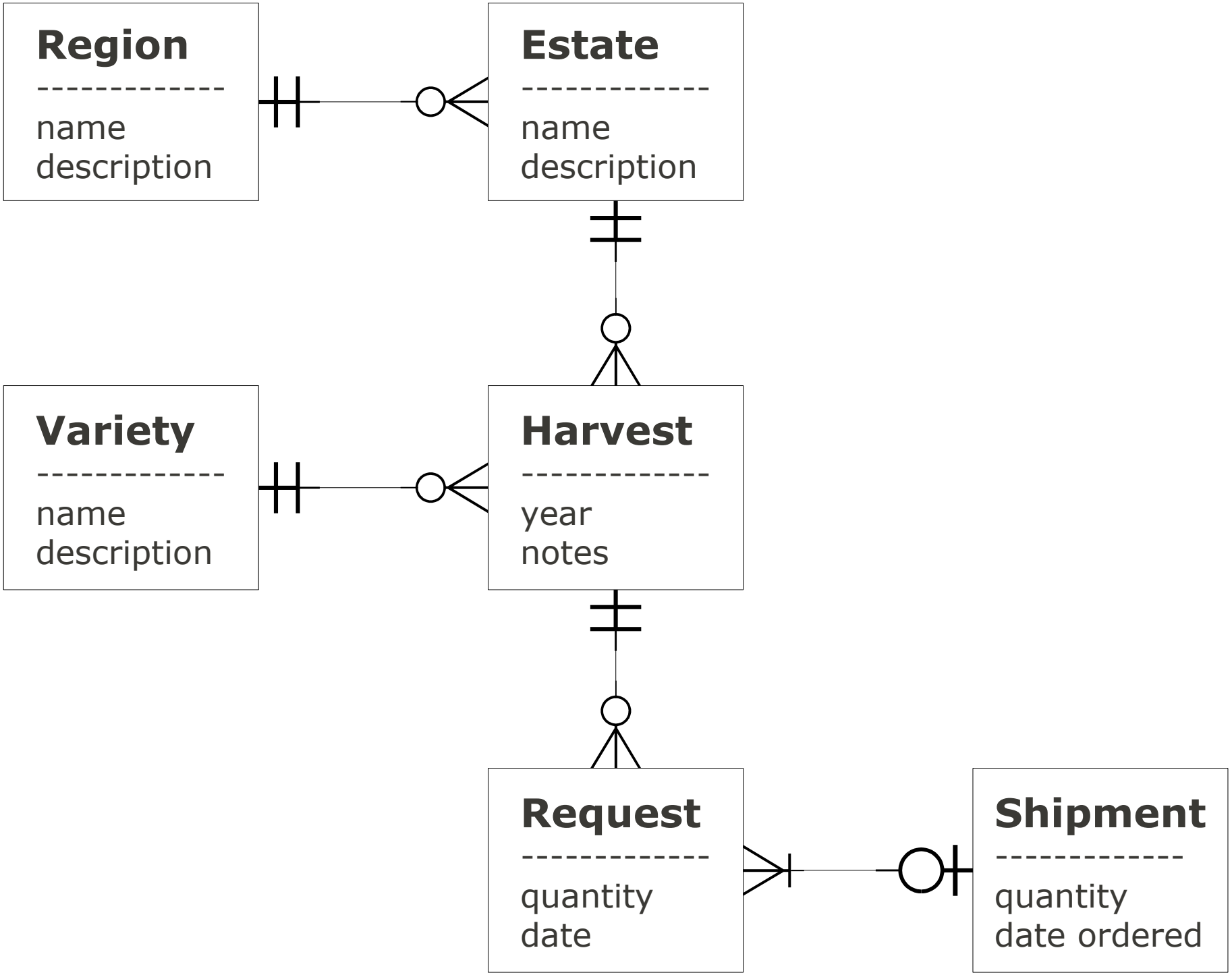
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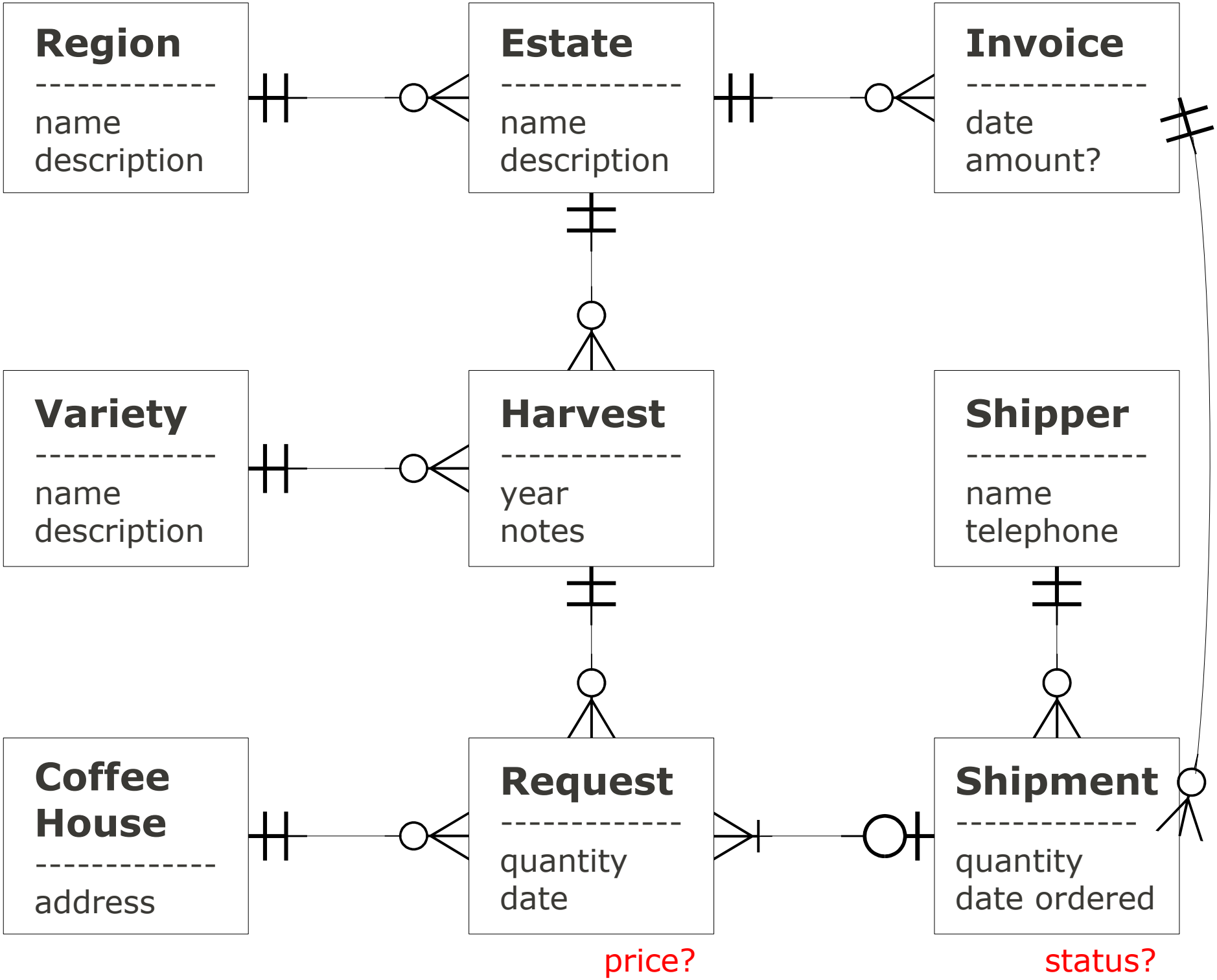
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SQL

```
create table harvest (
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   foreign key (variety_id)
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   foreign key (estate_id)
        references estate(estate_id),
   year year,
   notes varchar(200),
   primary key (harvest_id),
);
```

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657807938,559562982,23.47
755280276,889208095,590.32
934625720,459538801,44.66
852067113,660539228,1684.77
+ another billion rows

CSV

657807938,559562982,23.47↵
755280276,889208095,590.32↵
934625720,459538801,44.66↵
852067113,660539228,1684.77↵
+ another billion rows

CSV

657807938,559562982,23.47⏎755280276,889208095,590.32⏎934625720,459538801,44.66⏎852067113,660539228,1684.77⏎.....

Fixed-Length

65780793855956298 2002347
75528027688920809 5059032
93462572045953880 1004466
85206711366053922 8168477
+ another billion rows

start of Nth row = N * length of row

CSV

657807938,559562982,23.47
755280276,889208095,590.32
934625720,459538801,44.66
852067113,660539228,1684.77
+ another billion rows

How do we **add** a row?
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What if we sort it?

755280270,989809237,10.21
755280276,889208095,590.32
755280276,889909232,293.12
755280281,198234234,3120.56
755280291,782737671,13.23

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879873454,889208098,38.29
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Essentially an **index**.
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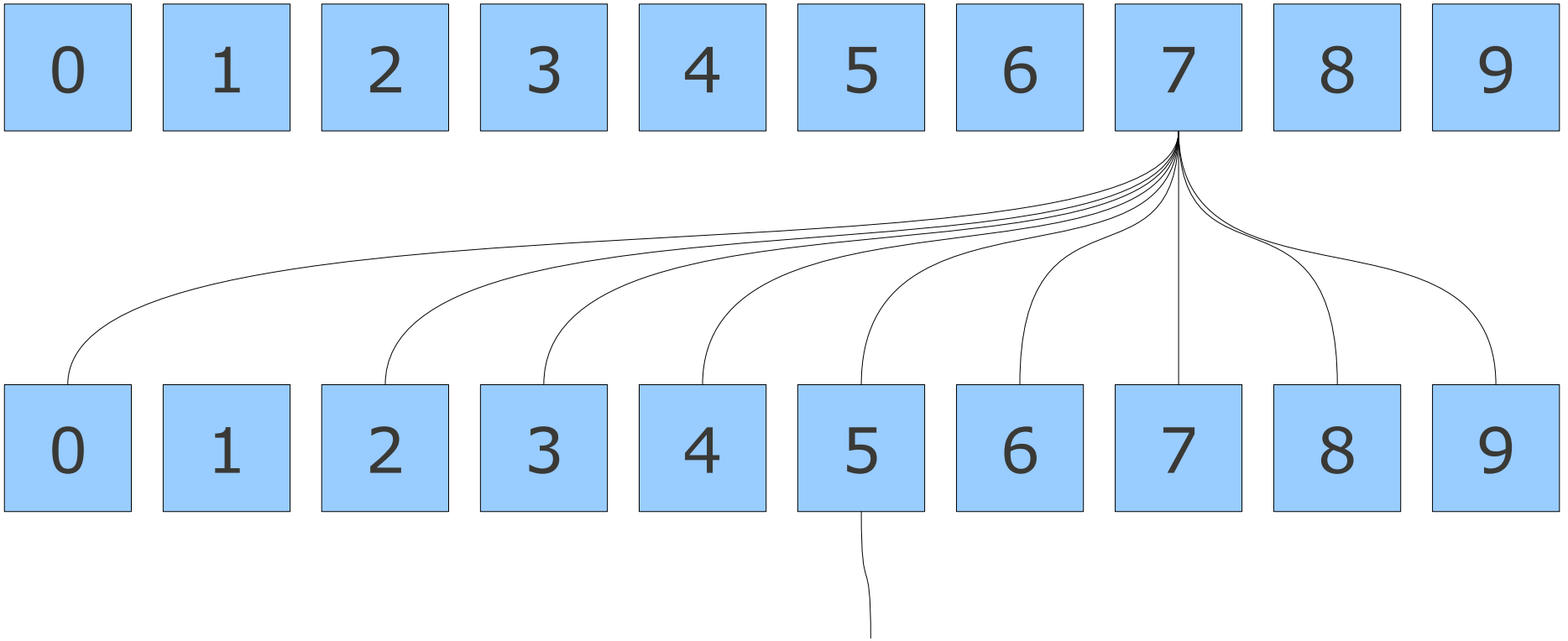

755280276,889208095,590.32

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(does not need to be ordered)

Fixed vs Balanced

Fixed:

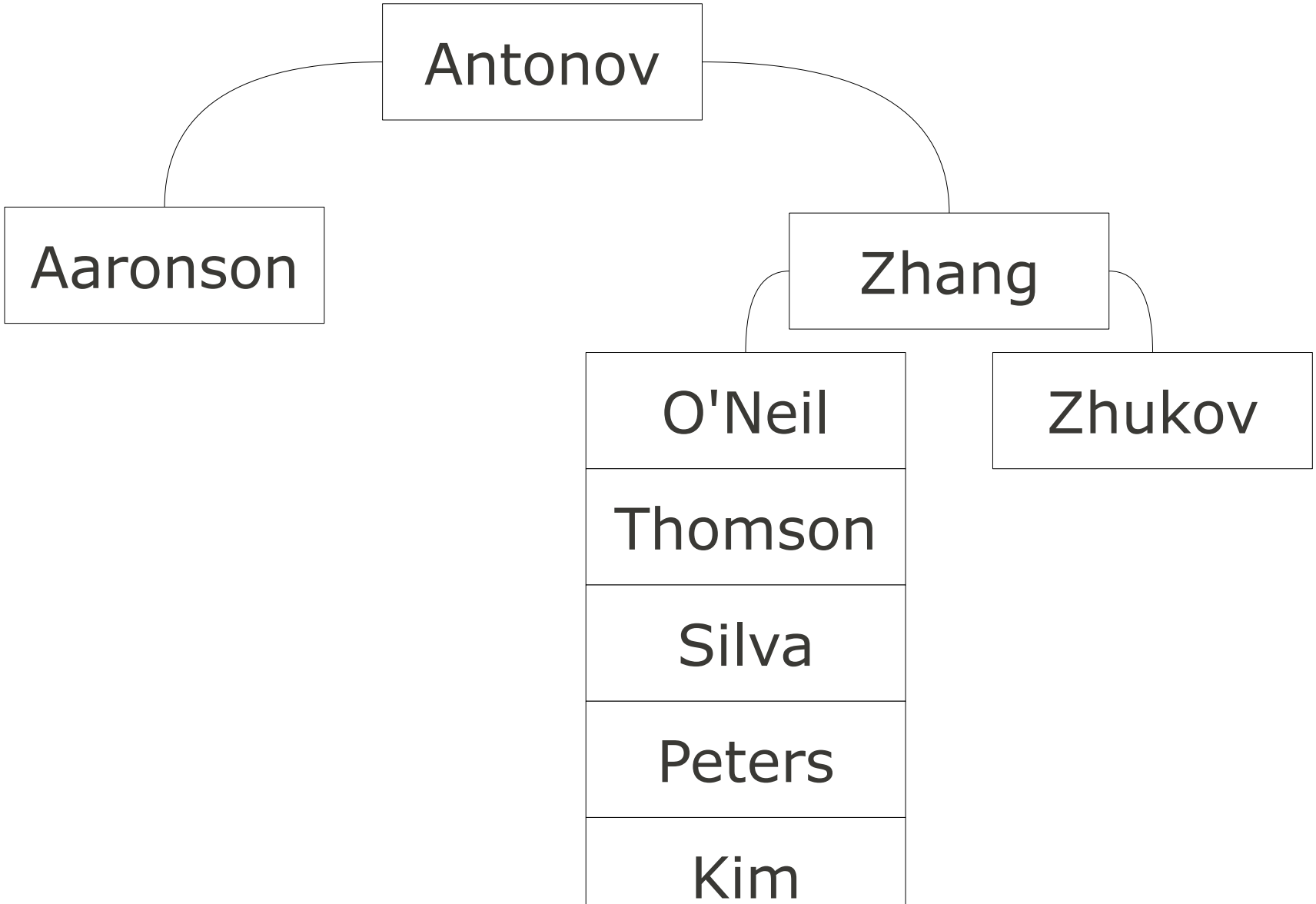
E.g., ISAM

Balanced:

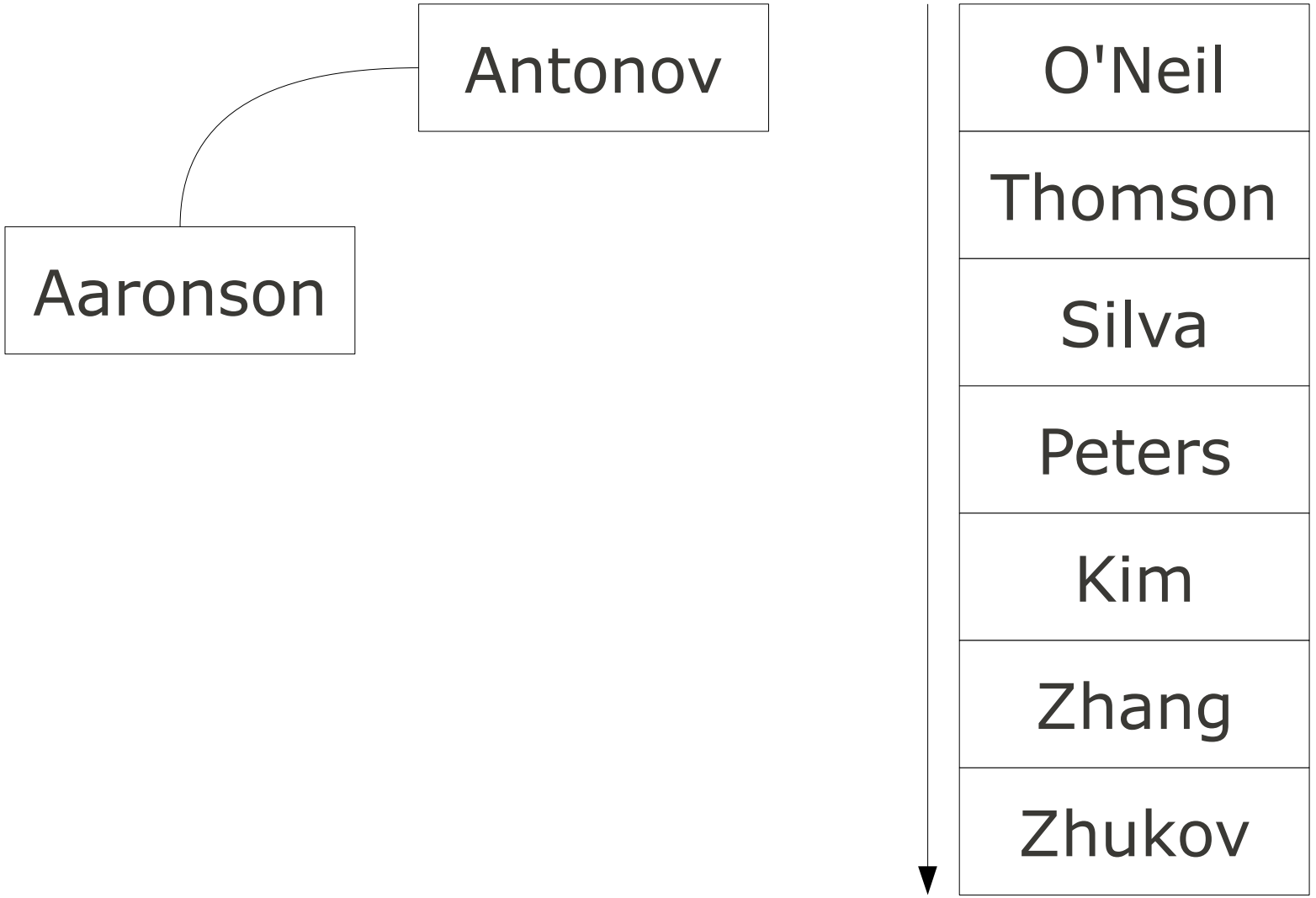
E.g., B+ Trees

A: 4%
M: 9.5%
Q: 0

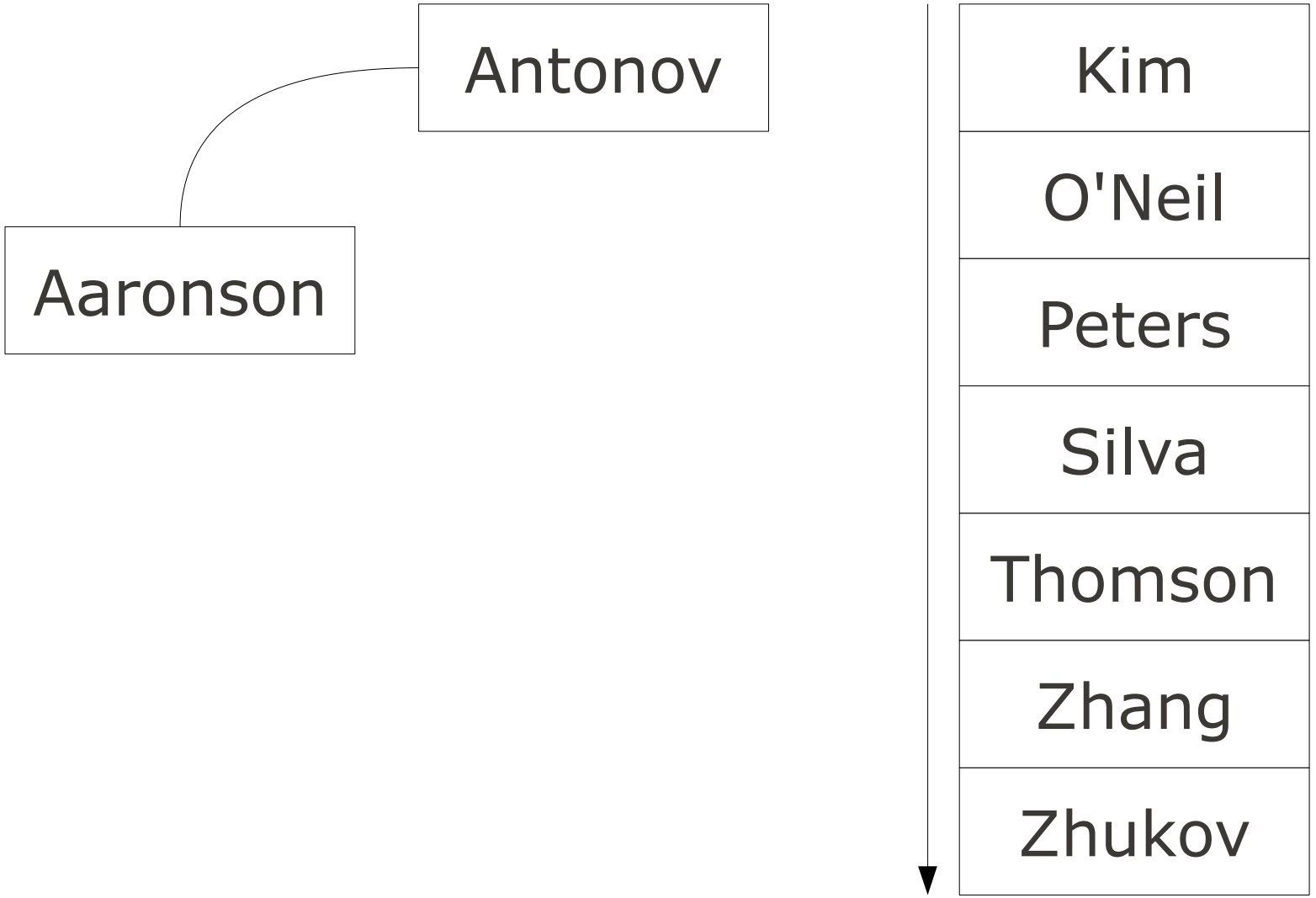
Balanced Tree



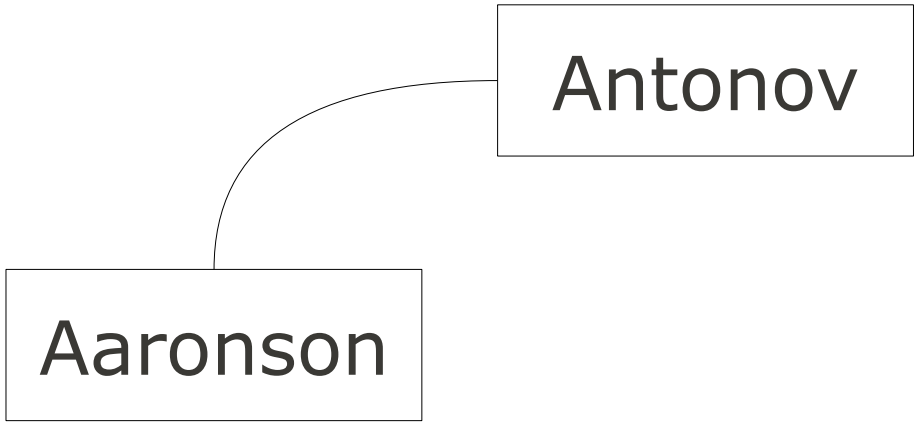
Balanced Tree



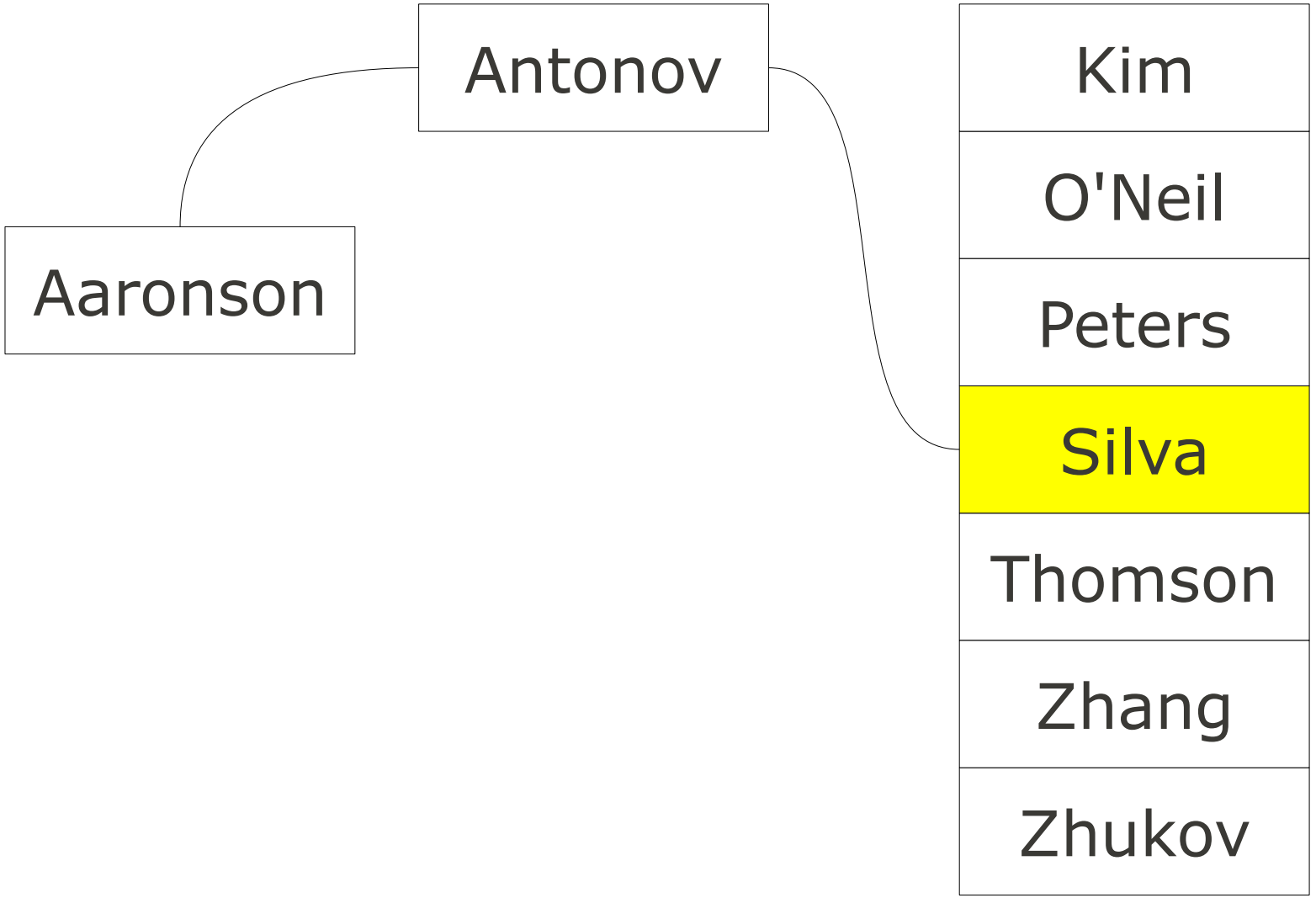
Balanced Tree



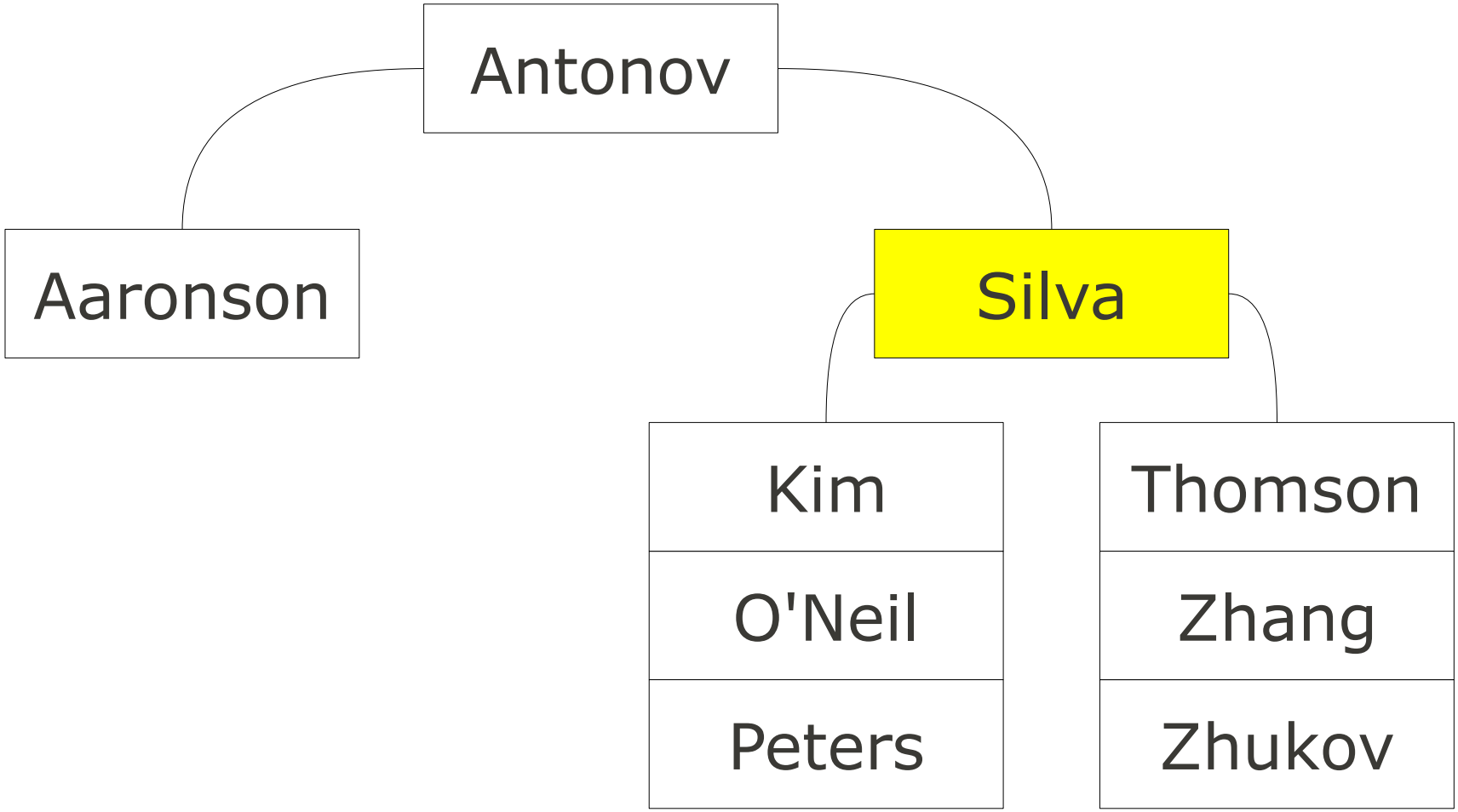
Balanced Tree



Balanced Tree



Balanced Tree



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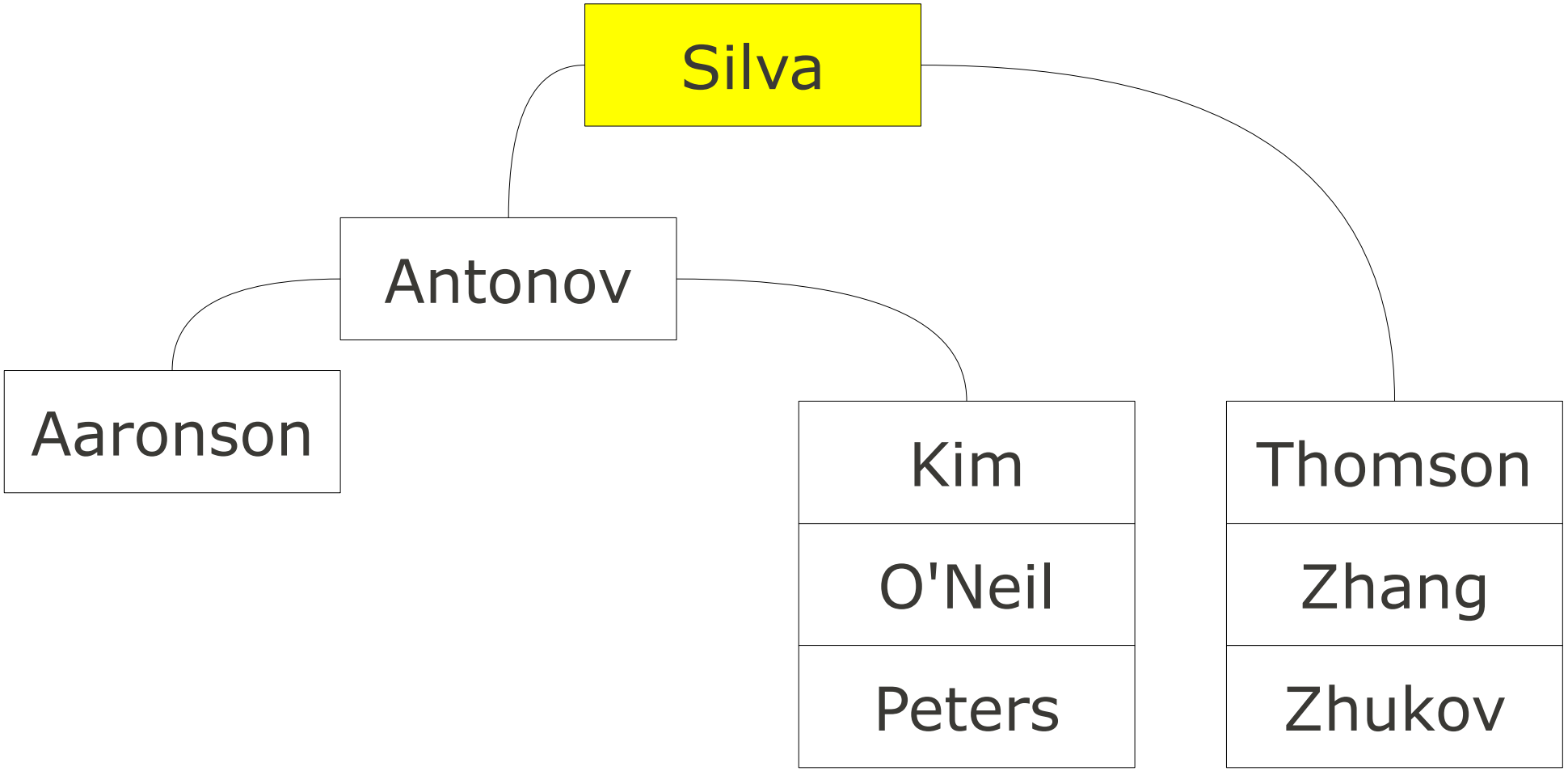

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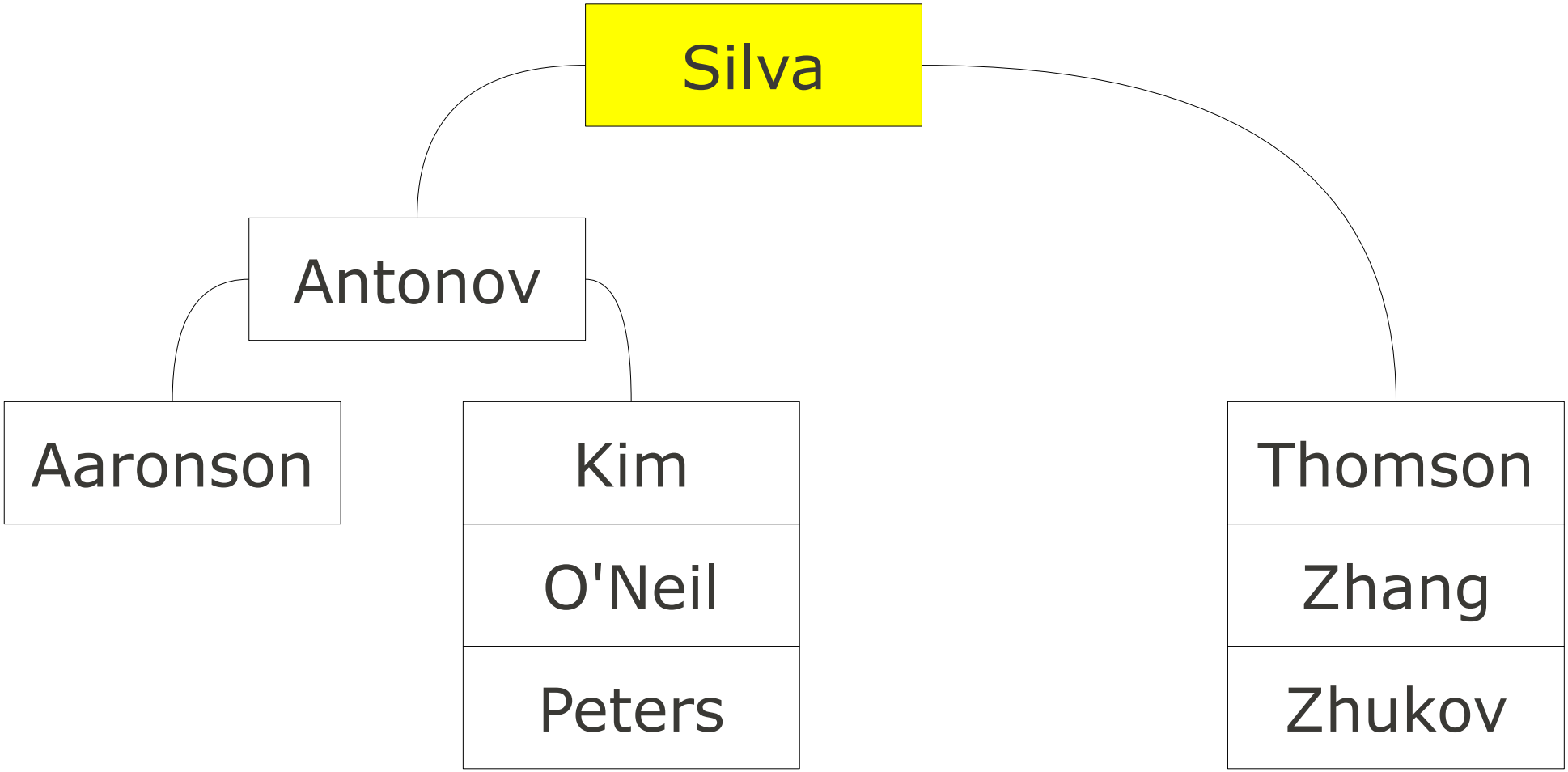
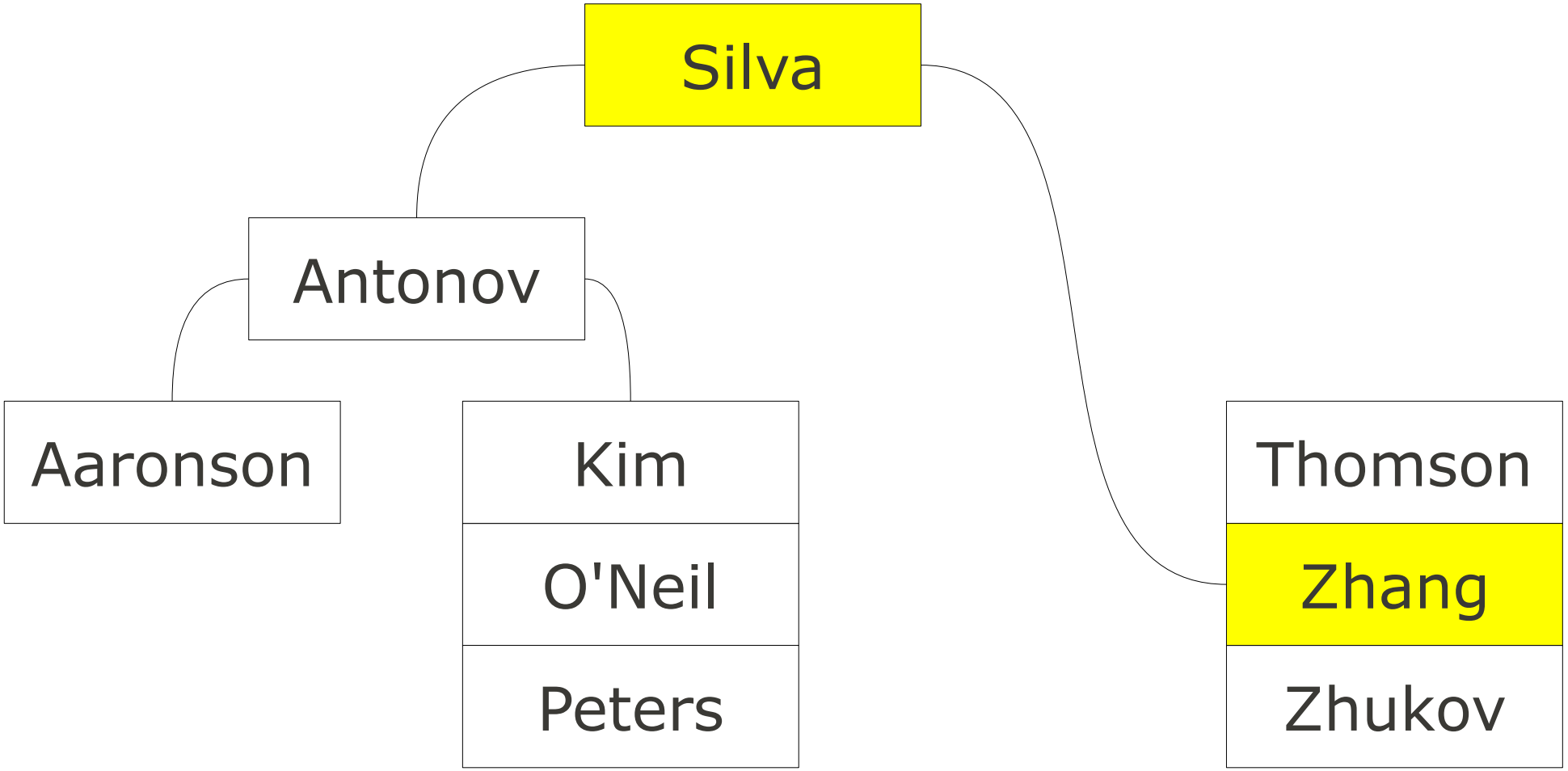


Balanced Tree



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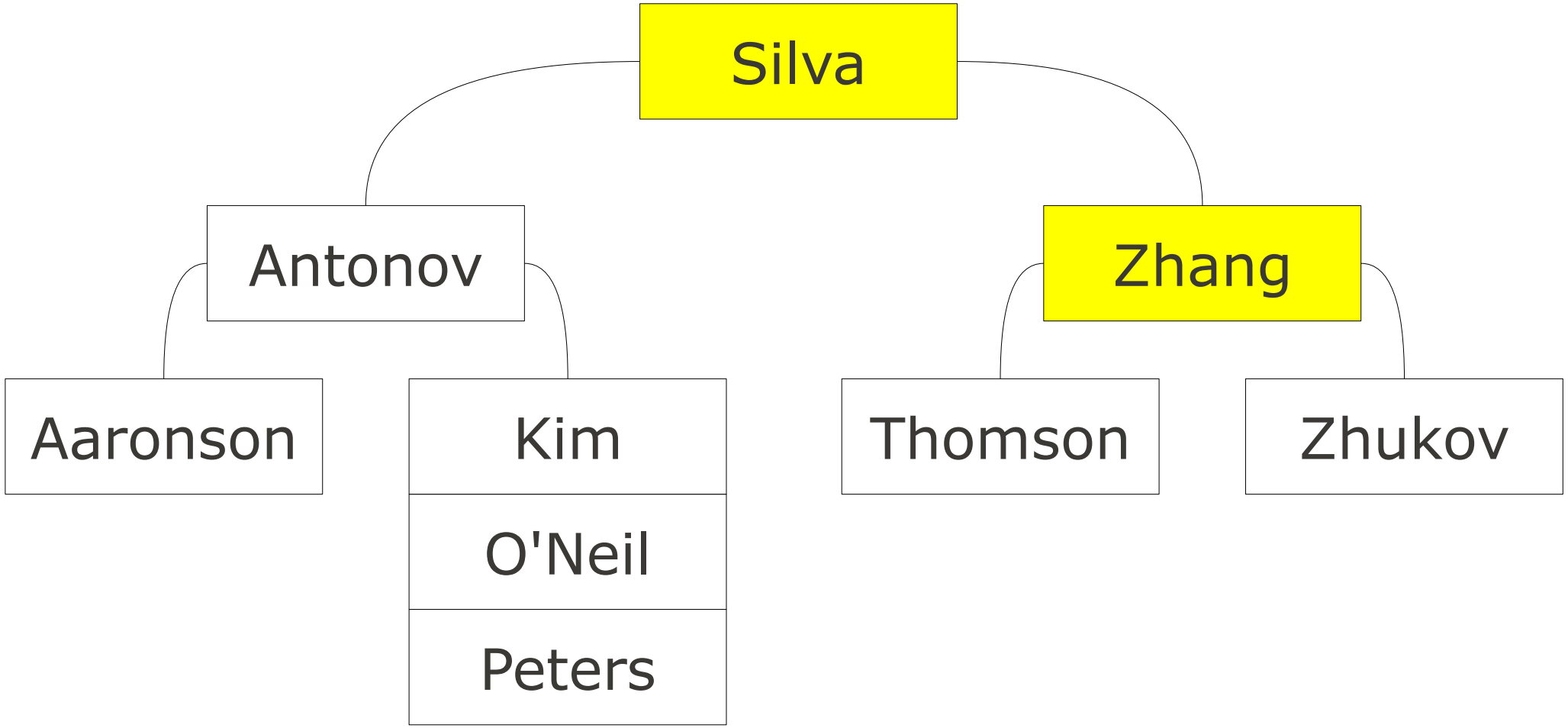

Storage Engines

CVS

yes, it's an option

MyISAM

the default

relatively simple

See: /var/lib/mysql/menagerie/

InnoDB

more features

Storage Engines

CVS

yes, it's an option

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CVS

yes, it's an option

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more features

The Extra Features

Foreign Key Constraints

no, not in MyISAM!

Transactions

```
start transaction;
update table1 ...;
update table2 ...;
commit;
```

Downside: complexity

More Engines

Memory

no harddrive → faster

Blackhole

doesn't actually store anything

Federated

allows remote tables

Etc.

Picking an Engine

```
create table superhero (
  id integer,
  primary key (id),
  name char(100)
) engine=InnoDB;
```

Index

Easy retrieval by field

- usually automatic for PK
- optional for other fields

```
create index name_index
on superhero(name);
```

to be continued