Semi-structured data

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Semi-structured data

- Data is not just text, but is not as well-structured as data in databases
- Occurs often in web databanks
- Occurs often in integration of databanks

Example

Semi-structured data - properties

- irregular structure
- implicit structure
- partial structure
- a posteriori ’data guide’ versus a priori schema
- large data guides

Semi-structured data - properties

- It should be possible to ignore the data guide upon querying
- Data guide changes fast
- object can change type/class
- difference between data guide and data is blurred

Semi-structured data - model

- network of nodes
- object model (oid)
- query: path search in the network

OEM (Object Exchange Model)

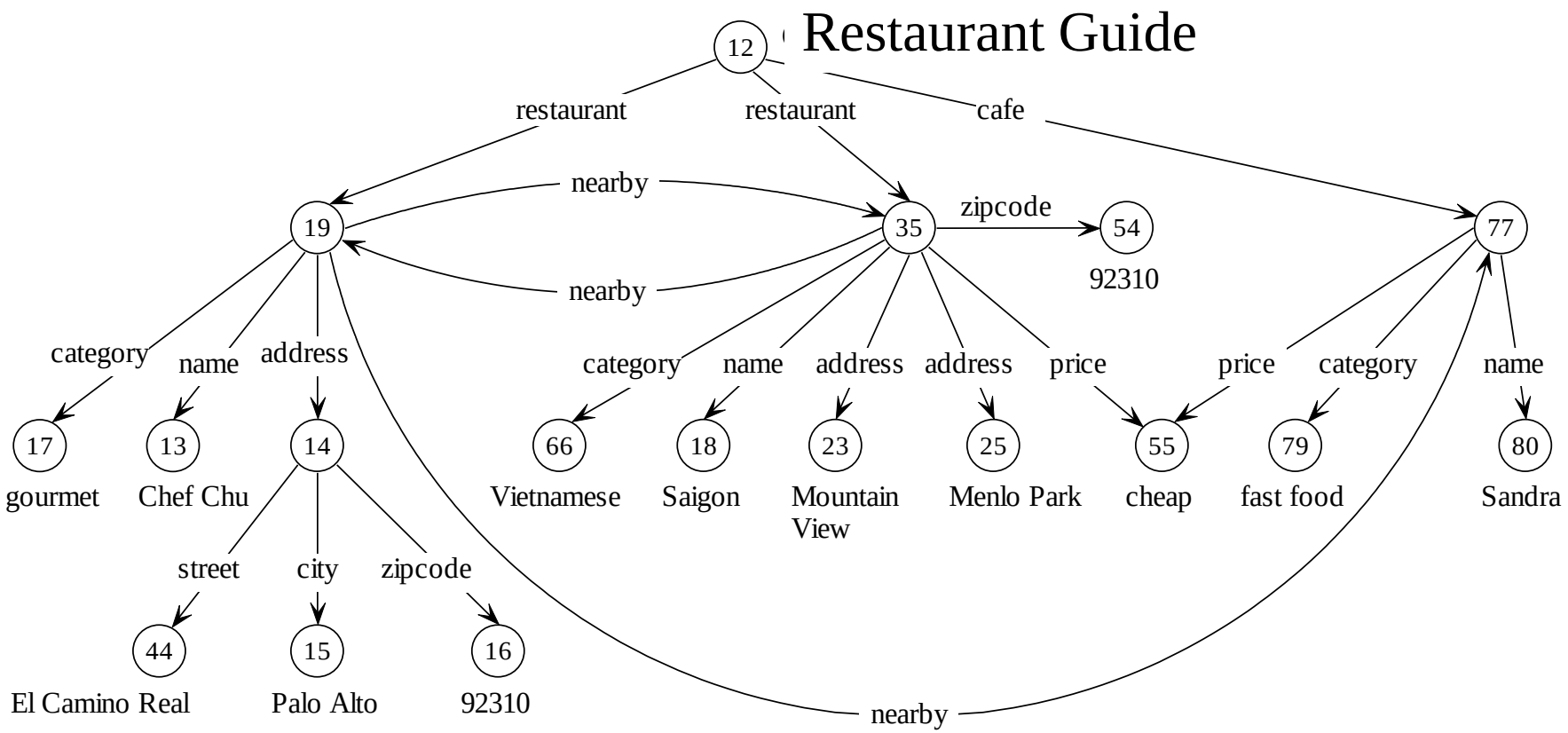
- Graph
- Nodes: objects

  oid

  atomic or complex

  - atoms: integer, string, gif, html, …
  - value of a complex object is a set of object references (label, oid)
- Edges have labels
- OEM is used by a number of systems (ex. Lorel)

OEM example


Restaurant Guide
12
restaurant
restaurant
cafe
nearby
19
35
zipcode
54
92310
77
nearby
category
name
address
category
name
address
address
price
price
category
name
17
13
14
66
18
23
25
55
79
80
gourmet
Chef Chu
Vietnamese
Saigon
Mountain View
Menlo Park
cheap
fast food
Sandra
street
city
zipcode
44
15
16
El Camino Real
Palo Alto
92310
nearby

Lorel query language

1. Find all places to eat Vietnamese food

```
select P
from RestaurantGuide.% P
where P.category grep “ietnamese”
```

2. Find the names and streets of all restaurants in Palo Alto

```
select R.name, A.street
from RestaurantGuide.restaurant{R}.address A
where A.city = “Palo Alto”
```

Lorel query language

3. Find all restaurants to eat with zipcode 92310

```
select RestaurantGuide.restaurant
where
 RestaurantGuide.restaurant(.address)?.zipcode = 92310
```

Wildcards and variables

? - 0 or 1 path

+ - 1 or more paths

* - 0 or more paths

- any path

% - 0 or more chars

- object variables

```
select P from Guide.% P
select A from #.address{A}
```

- path variables

```
select Guide.#@P.name
```

Data Guides

- A structural summary over a data source that is used as a dynamic schema
- Is used in query formulation and optimization
- Is often created a posteriori
- Properties:
  - concise
  - accurate
  - convenient

Data Guides - definitions

- Label path: sequence of labels
  L1.L2. … .Ln
- Data path: alternating sequence of labels and oid:s
  L1.o1.L2.o2. … .Ln.on
- Data path *d* is an instance of label path *l* if the sequences of labels are identical in *l* and *d*.

Data Guides - definitions

- A data guide for object *s* is an object *d* such that every label path of *s* has exact one data path instance in *d*, and each label path in *d* is a label path of *s*.

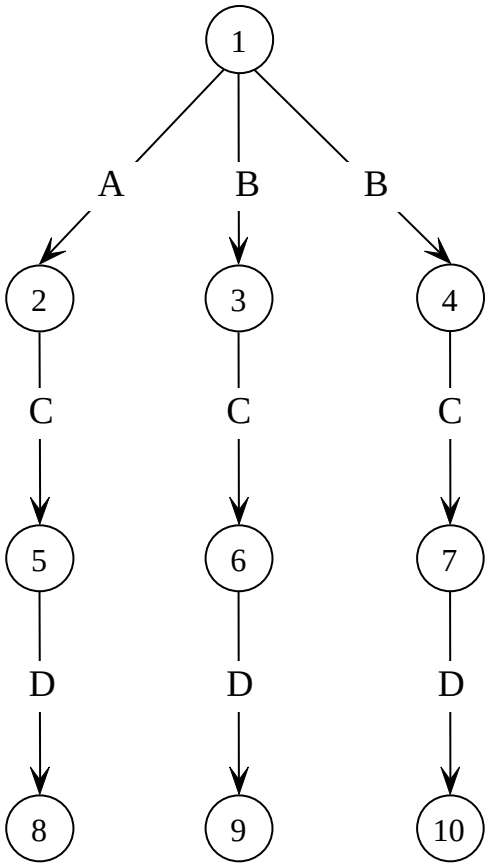
Data Guides

- A data source can have several data guides
- Minimal data guides

  the smallest data guides

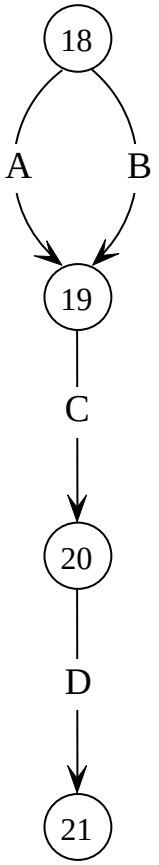
Data Guides - example

Data model



(a)

minimal Data Guide



(c)

Minimal Data Guides

- Concise
- May be hard to maintain

  Example: child node for 10 with label E

Strong Data Guides

Intuitively:

”label paths that reach the same set of objects in the data model = label paths that reach the same objects in the data guide”

Strong Data Guides - definitions

An object *o* can be reached from *s* via *l* if there is a data path of *s* that is an instance of *l* and that has *o* as last oid

(L1.o1.L2.o2. … Ln.o)

The target set for label path *l* in object *s* is the set of objects that can be reached from *s* via *l.* *Notation: T(s,l)*

L(s,l): set of label paths of *s* that have the same target set in *s* as *l*.

Strong Data Guides - definitions

Definition:

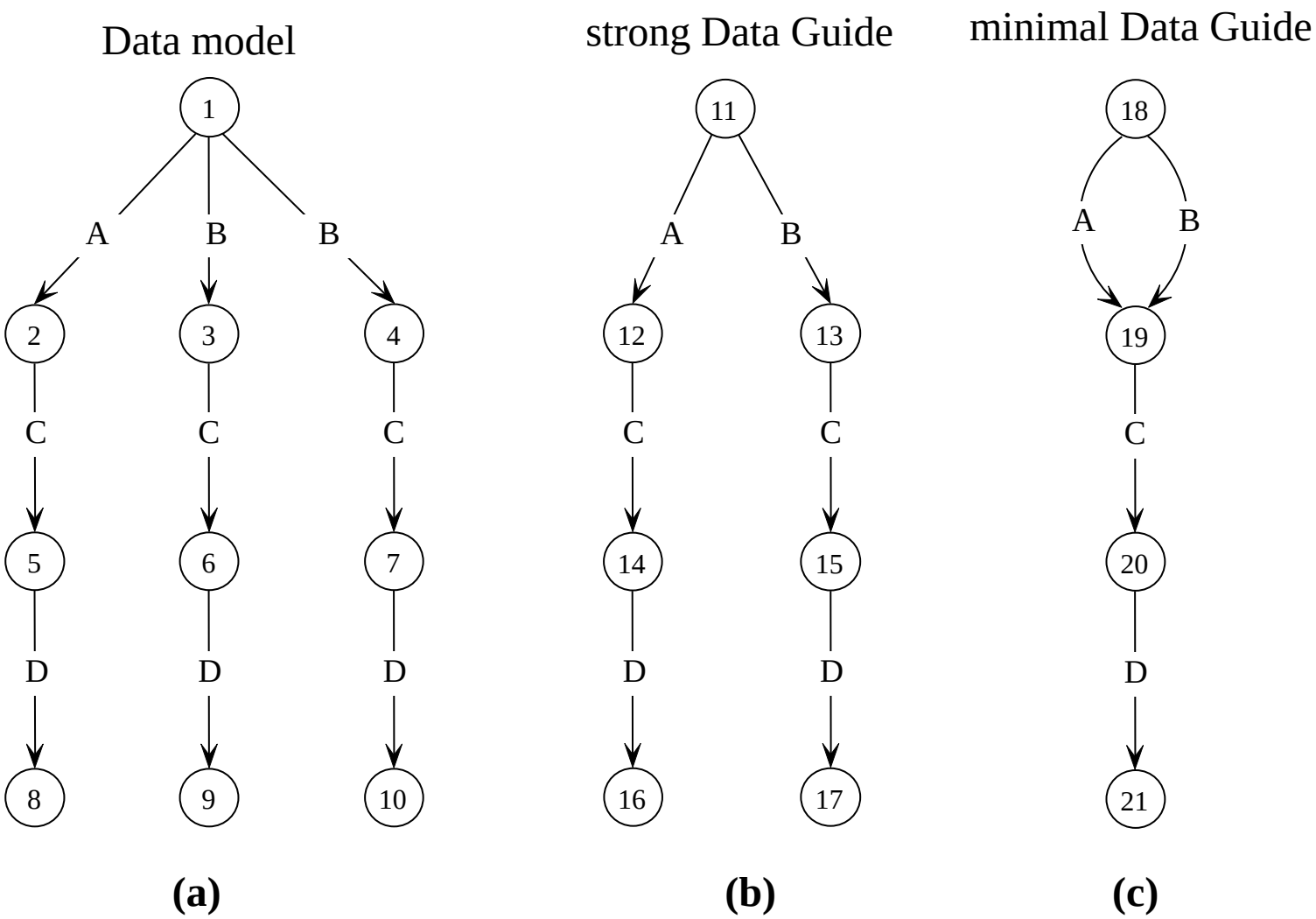
d is a strong data guide for *s* if

for all label paths *l* of *s*

it holds that *L(s,l) = L(d,l)*

There is a 1-1-mapping between target sets in the data model and nodes in a strong data guide.

Data Guides - example



Strong Data Guides - algorithm

Implementation:

- Traverse data model depth-first.
- Each time you find a new target set for label path */*, create a new object in the data guide.

If the target set is already represented in the data guide, do not create a new object, but link to the existing object.

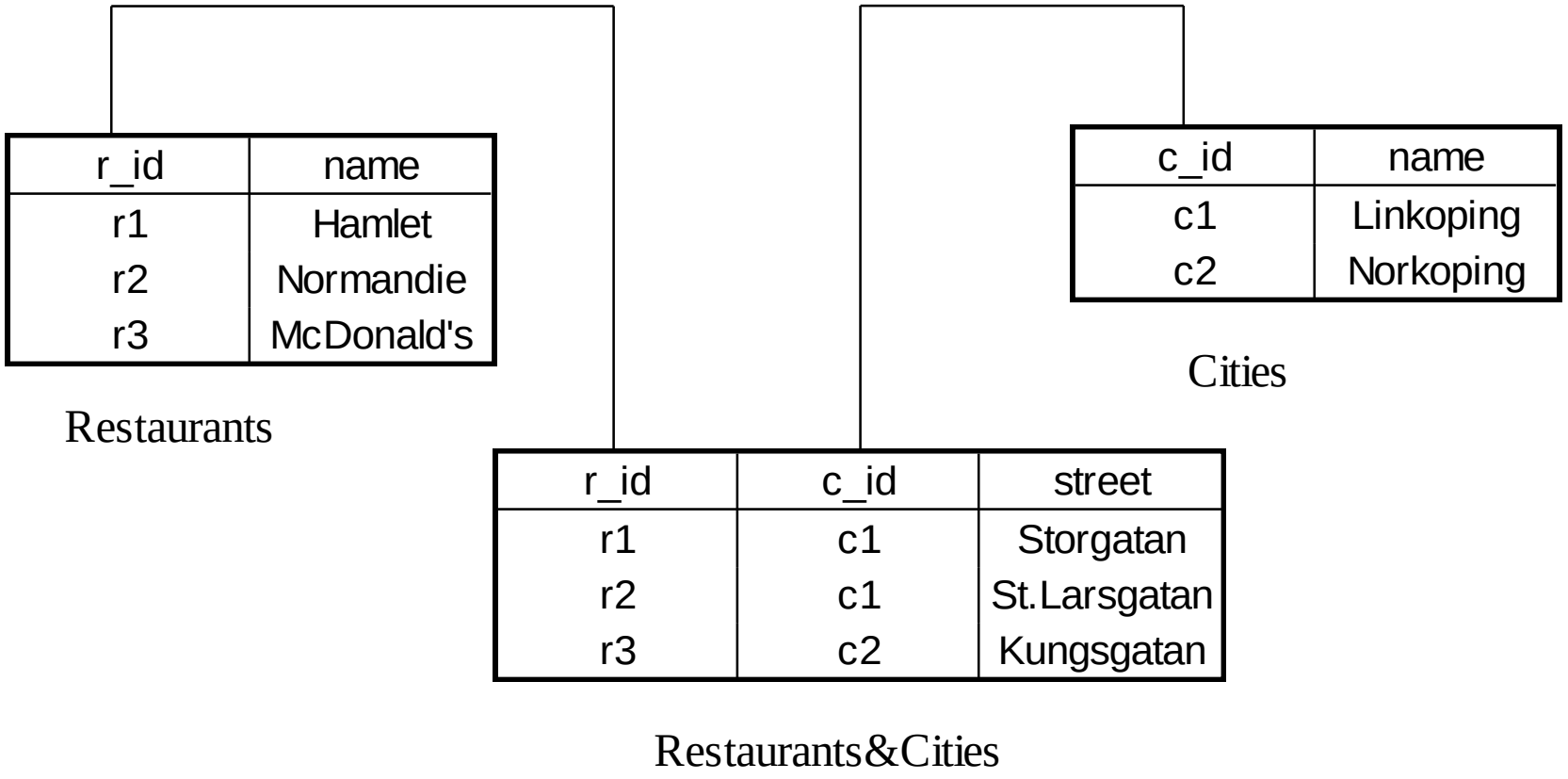
Strong Data Guides - use

- Easier to maintain
- Used as path index for query optimization

Semi-structured data - exercises

Exercise 1

- Represent the relations below using the OEM data model.



r_id	name
r1	Hamlet
r2	Normandie
r3	McDonald's

Restaurants

c_id	name
c1	Linkoping
c2	Norkoping

Cities

r_id	c_id	street
r1	c1	Storgatan
r2	c1	St.Larsgatan
r3	c2	Kungsgatan

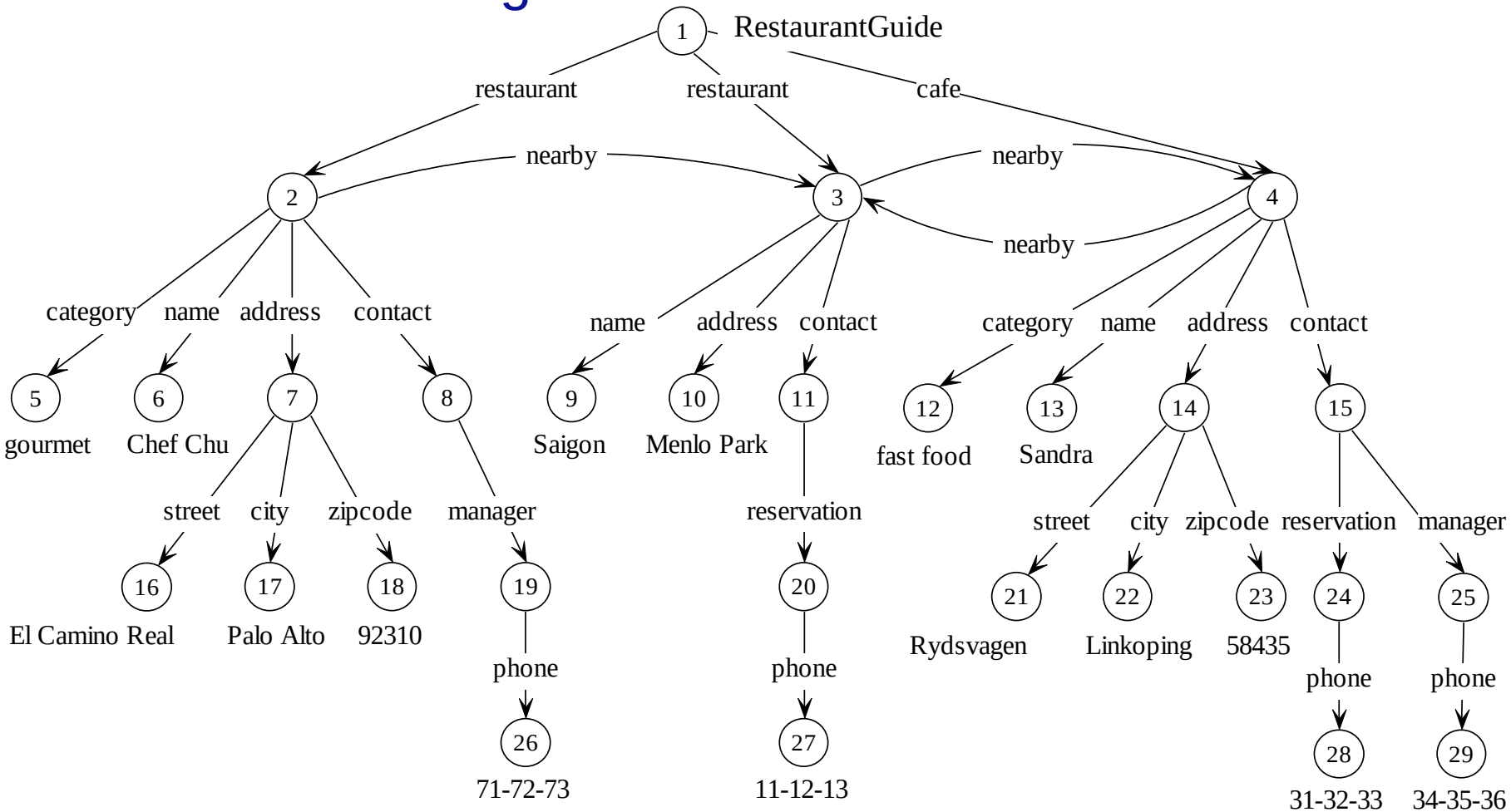
Restaurants&Cities

Exercise 2

- Using the data model from the previous question, formulate the following queries using Lorel:
  - find all the restaurants that are located in Linkoping
  - find the address (city and street) of the “Hamlet” restaurant
  - list the restaurants by city (equivalent of GROUP BY)

Exercise 3

- Draw the strong Data Guide for the restaurant guide data model below.



Draw a strong data guide for the data model below.