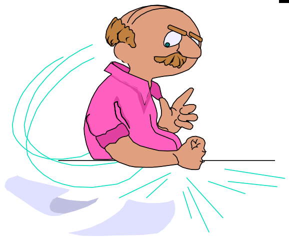
1

Introduction to Data Management

Lecture #24

~~SQL~~ ***NoSQL (cont.)***



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1

Announcements

- Last homework reminder:
  - Due this Thursday (at 5 PM), NoSQL with ***NoLateDay***
  - And remember: *LOAD* can be path-finicky (see Piazza)
- Endterm exam info:
  - Non-cumulative and ***in class on Friday!***
- Two-part lecture season finale:
  - *Today*: NoSQL & Big Data (*a la* AsterixDB), continued
    - See the *Using SQL*++ Primer and the Don Chamberlin SQL++ book
  - *Wednesday*: Transactions (a whirlwind tour)
    - See the corresponding textbook sections on the wiki page

2

Data Model: JSON (from last time...)

Customers

```
{
  "custid":"C37",
  "name":"T. Hanks",
  "address":{
    "street":"120 Harbor Blvd.",
    "city":"Boston, MA",
    "zipcode":"02115"
  },
  "rating":750
}

{
  "custid":"C47",
  "name":"S. Lauren",
  "address":{
    "street":"17 Rue d'Antibes",
    "city":"Cannes, France"
  },
  "rating":625
}
```

Orders

```
{
  "orderno":1004,
  "custid":"C35",
  "order_date":"2017-07-10",
  "ship_date":"2017-07-15",
  "items":[
    {
      "itemno":680,
      "qty":6,
      "price":9.99
    },
    {
      "itemno":195,
      "qty":4,
      "price":35.00
    }
  ]
}
```

...

```
{
  "orderno":1008,
  "custid":"C13",
  "order_date":"2017-10-13",
  "items":[
    {
      "itemno":460,
      "qty":20,
      "price":99.99
    }
  ]
}
```

Data from *D. Chamberlin. SQL++ for SQL Users: A Tutorial*

3

NESTED DATA: Nesting

```
SELECT VALUE {
  "CustomerName":c.name,
  "Orders":(SELECT VALUE o.orderno FROM orders AS o
            WHERE o.custid = c.custid)
}
FROM customers AS c
WHERE c.custid = "C41";
```

```
[
  {
    "Orders": [
      1006,
      1001
    ],
    "CustomerName": "R. Duvall"
  }
]
```

4

Unnesting

```
SELECT o.orderno,
       o.order_date,
       i.itemno AS item_number,
       i.qty AS quantity
FROM orders AS o UNNEST o.items AS i
WHERE i.qty > 100
ORDER BY o.orderno, item_number;
```

```
[
  {
    "orderno": 1002,
    "order_date": "2017-05-01",
    "item_number": 680,
    "quantity": 150
  },
  {
    "orderno": 1005,
    "order_date": "2017-08-30",
    "item_number": 347,
    "quantity": 120
  },
  {
    "orderno": 1006,
    "order_date": "2017-09-02",
    "item_number": 460,
    "quantity": 120
  }
]
```

Unnesting *(cont.)*

```
SELECT o.orderno,
       o.order_date,
       i.itemno AS item_number,
       i.qty AS quantity
FROM orders AS o UNNEST o.items AS i
WHERE i.qty > 100
ORDER BY o.orderno, item_number;
```

```
SELECT o.orderno,
       o.order_date,
       i.itemno AS item_number,
       i.qty AS quantity
FROM orders AS o, o.items AS i
WHERE i.qty > 100
ORDER BY o.orderno, item_number;
```

Quantification

```
SELECT DISTINCT VALUE o.custid
FROM orders AS o
WHERE SOME i IN o.items SATISFIES i.price >= 25.00;
```

```
[
  "C37",
  "C41",
  "C31",
  "C35",
  "C13"
]
```

7

Quantification

```
SELECT DISTINCT VALUE o.custid
FROM orders AS o
WHERE SOME i IN o.items SATISFIES i.price >= 25.00;

SELECT DISTINCT VALUE o.custid
FROM orders AS o
WHERE EVERY i IN o.items SATISFIES i.price >= 25.00;
```

```
[
  "C41",
  "C31",
  "C13"
]
```

8

Quantification

```
SELECT DISTINCT VALUE o.custid
FROM orders AS o
WHERE SOME i IN o.items SATISFIES i.price >= 25.00;

SELECT DISTINCT VALUE o.custid
FROM orders AS o
WHERE EVERY i IN o.items SATISFIES i.price >= 25.00;

SELECT DISTINCT VALUE o.custid
FROM orders AS o
WHERE EVERY i IN o.items SATISFIES i.price >= 25.00
  AND array_count(o.items) > 0;
```

```
[
  "C41",
  "C31",
  "C13"
]
```

9

Quantification

```
SELECT DISTINCT VALUE o.custid
FROM orders AS o
WHERE SOME i IN o.items SATISFIES i.price >= 25.00;

SELECT DISTINCT VALUE o.custid
FROM orders AS o
WHERE EVERY i IN o.items SATISFIES i.price >= 25.00;

SELECT DISTINCT VALUE o.custid
FROM orders AS o
WHERE array_count(o.items) > 0
  AND EVERY i IN o.items SATISFIES i.price >= 25.00;

SELECT VALUE c
FROM customers AS c
WHERE c.custid IN (
    SELECT DISTINCT VALUE o.custid
    FROM orders AS o
    WHERE SOME i IN o.items SATISFIES i.price >= 25.00
)
```

```
[
  {
    "address": {
      "city": "Boston, MA",
      "street": "120 Harbor Blvd.",
      "zipcode": "02115"
    },
    "custid": "C37",
    "name": "T. Hanks",
    "rating": 750
  },
  {
    "address": {
      "city": "St. Louis, MO",
      "street": "150 Market St.",
      "zipcode": "63101"
    },
    "custid": "C41",
    "name": "R. Duvall",
    ...
```

10

GROUPING: SQL Grouping and Aggregation

```
SELECT c.address.city, count(*) AS cnt
FROM customers AS c, orders AS o
WHERE c.custid = o.custid
GROUP BY c.address.city
```

```
[
  {
    "cnt": 2,
    "city": "Boston, MA"
  },
  {
    "cnt": 6,
    "city": "St. Louis, MO"
  }
]
```

SQL Grouping and Aggregation

```
SELECT c.address.city, count(*) AS cnt
FROM customers AS c, orders AS o
WHERE c.custid = o.custid
GROUP BY c.address.city
```

c.address.city	c	o	
Boston, MA	C_{C37}	O_{1005}	2
	C_{C35}	O_{1004}	
St. Louis, MO	C_{C41}	O_{1006}	6
	C_{C41}	O_{1001}	
	C_{C31}	O_{1003}	
	C_{C13}	O_{1007}	
	C_{C13}	O_{1002}	
	C_{C13}	O_{1008}	

SQL++ Aggregation (only)

```
SELECT c.name, array_count(o.items) AS order_size
FROM customers AS c, orders AS o
WHERE c.custid = o.custid
ORDER BY order_size DESC
LIMIT 3
```

```
[
  {
    "order_size": 4,
    "name": "T. Hanks"
  },
  {
    "order_size": 3,
    "name": "R. Duvall"
  },
  {
    "order_size": 2,
    "name": "R. Duvall"
  }
]
```

13

SQL++ Aggregation (only)

```
SELECT c.name, array_count(o.items) AS order_size
FROM customers AS c, orders AS o
WHERE c.custid = o.custid
ORDER BY order_size DESC
LIMIT 3


SELECT VALUE max(rating) FROM customers
```

```
[
  750
]
```

14

SQL++ Aggregation (only)

```
SELECT c.name, array_count(o.items) AS order_size
FROM customers AS c, orders AS o
WHERE c.custid = o.custid
ORDER BY order_size DESC
LIMIT 3
```

```
[
  750
]
```

```
SELECT VALUE max(rating) FROM customers
```

↓

```
array_max((SELECT VALUE rating FROM customers))
```

15

SQL++ Grouping (only)

```
SELECT c.address.city, g
FROM customers AS c, orders AS o
WHERE c.custid = o.custid
GROUP BY c.address.city GROUP AS g;
```

```
[
  {
    "city": "Boston, MA",
    "g": [ {
        "c": {
          "address": { "city": "Boston, MA", … },
          "custid": "C35", "name": "J. Roberts",
          "rating": 565
        },
        "o": {
          "custid": "C35",
          "items": [
            { "itemno": 680, "price": 9.99, "qty": 6 },
            { "itemno": 195, "price": 35, "qty": 4 } ],
          "order_date": "2017-07-10", "orderno": 1004,
          "ship_date": "2017-07-15"
        }
      },
      {
        "c": {
          "address": { "city": "Boston, MA", … },
          "custid": "C37", "name": "T. Hanks",
          "rating": 750
        },
        "o": {
          "custid": "C37",
          "items": [
            { "itemno": 460, "price": 99.98, "qty": 2 },
            { "itemno": 347, "price": 22, "qty": 120 },
            { "itemno": 780, "price": 1500, "qty": 1 },
            { "itemno": 375, "price": 149.98, "qty": 2 }
          ],
          "order_date": "2017-08-30", "orderno": 1005
        }
      }
    ]
  },
  . . .
]
```

16

SQL Grouping and Aggregation Explained

```
SELECT c.address.city, count(*) AS cnt
FROM customers AS c, orders AS o
WHERE c.custid = o.custid
GROUP BY c.address.city
```

```
[
  {
    "cnt": 2,
    "city": "Boston, MA"
  },
  {
    "cnt": 6,
    "city": "St. Louis, MO"
  }
]
```

17

SQL Grouping and Aggregation Explained (!)

```
SELECT c.address.city, count(*) AS cnt
FROM customers AS c, orders AS o
WHERE c.custid = o.custid
GROUP BY c.address.city


SELECT c.address.city, array_count(g) AS cnt
FROM customers AS c, orders AS o
WHERE c.custid = o.custid
GROUP BY c.address.city GROUP AS g;
```

```
[
  {
    "cnt": 2,
    "city": "Boston, MA"
  },
  {
    "cnt": 6,
    "city": "St. Louis, MO"
  }
]
```

18

MISSING INFORMATION: Remember the data from earlier...

Customers

```
{
  "custid":"C37",
  "name":"T. Hanks",
  "address":{
    "street":"120 Harbor Blvd.",
    "city":"Boston, MA",
    "zipcode":"02115"
  },
  "rating":750
}

{
  "custid":"C47",
  "name":"S. Lauren",
  "address":{
    "street":"17 Rue d'Antibes",
    "city":"Cannes, France"
  },
  "rating":625
}
```

Orders

```
{
  "orderno":1004,
  "custid":"C35",
  "order_date":"2017-07-10",
  "ship_date":"2017-07-15",
  "items":[
    {
      "itemno":680,
      "qty":6,
      "price":9.99
    },
    {
      "itemno":195,
      "qty":4,
      "price":35.00
    }
  ]
}
```

...

```
{
  "orderno":1008,
  "custid":"C13",
  "order_date":"2017-10-13",
  "items":[
    {
      "itemno":460,
      "qty":20,
      "price":99.99
    }
  ]
}
```

Data from *D. Chamberlin. SQL++ for SQL Users: A Tutorial*

Have I "missed" anything?

```
SELECT o.orderno, o.order_date, o.ship_date, o.custid
FROM orders o
WHERE o.ship_date IS MISSING
```

```
[
  {
    "orderno": 1005,
    "order_date": "2017-08-30",
    "custid": "C37"
  },
  {
    "orderno": 1008,
    "order_date": "2017-10-13",
    "custid": "C13"
  }
]
```

Have I "missed" anything?

```
SELECT o.orderno, o.order_date, o.ship_date, o.custid
FROM orders o
WHERE o.ship_date IS MISSING

SELECT VALUE {
  "orderno": o.orderno,
  "order_date": o.order_date,
  "ship_date": o.ship_date,
  "custid": o.custid
}
FROM orders o
WHERE o.ship_date IS MISSING
```

```
[
  {
    "orderno": 1005,
    "order_date": "2017-08-30",
    "custid": "C37"
  },
  {
    "orderno": 1008,
    "order_date": "2017-10-13",
    "custid": "C13"
  }
]
```

21

Have I "missed" anything?

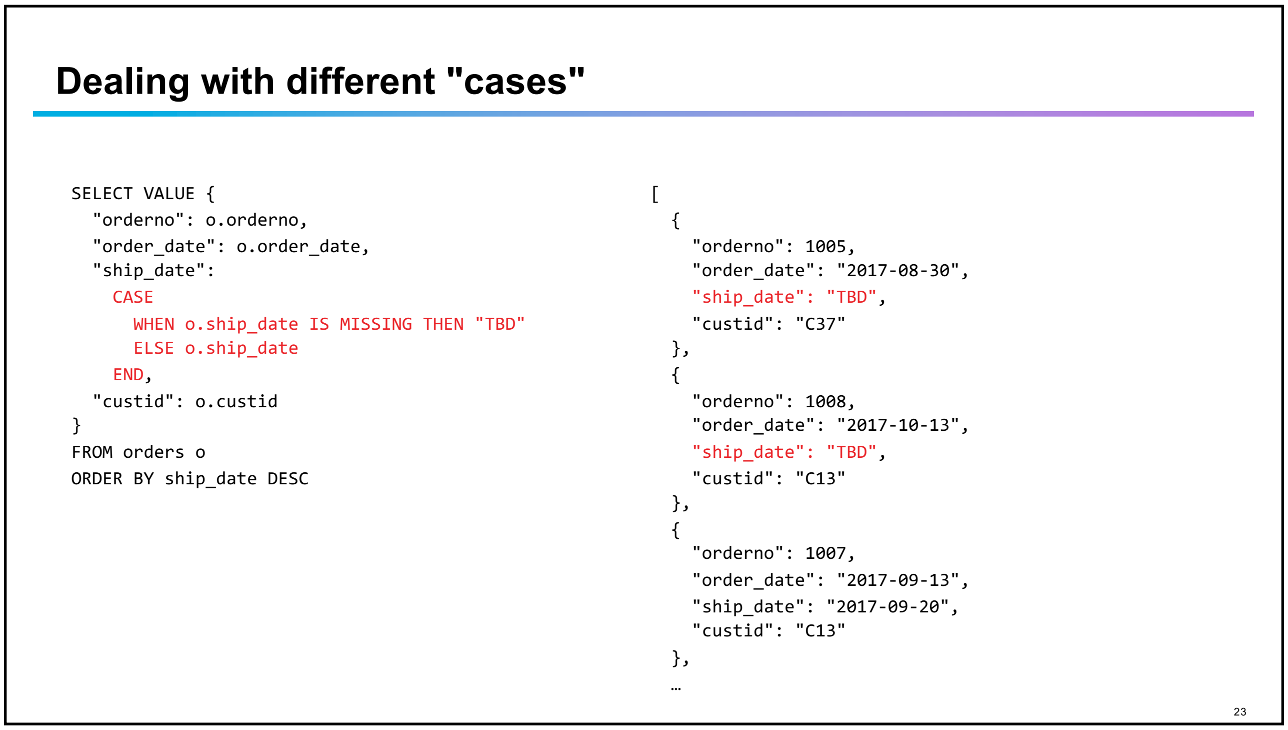
```
SELECT o.orderno, o.order_date, o.ship_date, o.custid
FROM orders o
WHERE o.ship_date IS MISSING

SELECT VALUE {
  "orderno": o.orderno,
  "order_date": o.order_date,
  "ship_date": o.ship_date,
  "custid": o.custid
}
FROM orders o
WHERE o.ship_date IS MISSING

… WHERE o.ship_date IS NOT MISSING
… WHERE o.ship_date IS UNKNOWN
… WHERE o.ship_date IS NULL
…
```

```
[
  {
    "orderno": 1005,
    "order_date": "2017-08-30",
    "custid": "C37"
  },
  {
    "orderno": 1008,
    "order_date": "2017-10-13",
    "custid": "C13"
  }
]
```

22

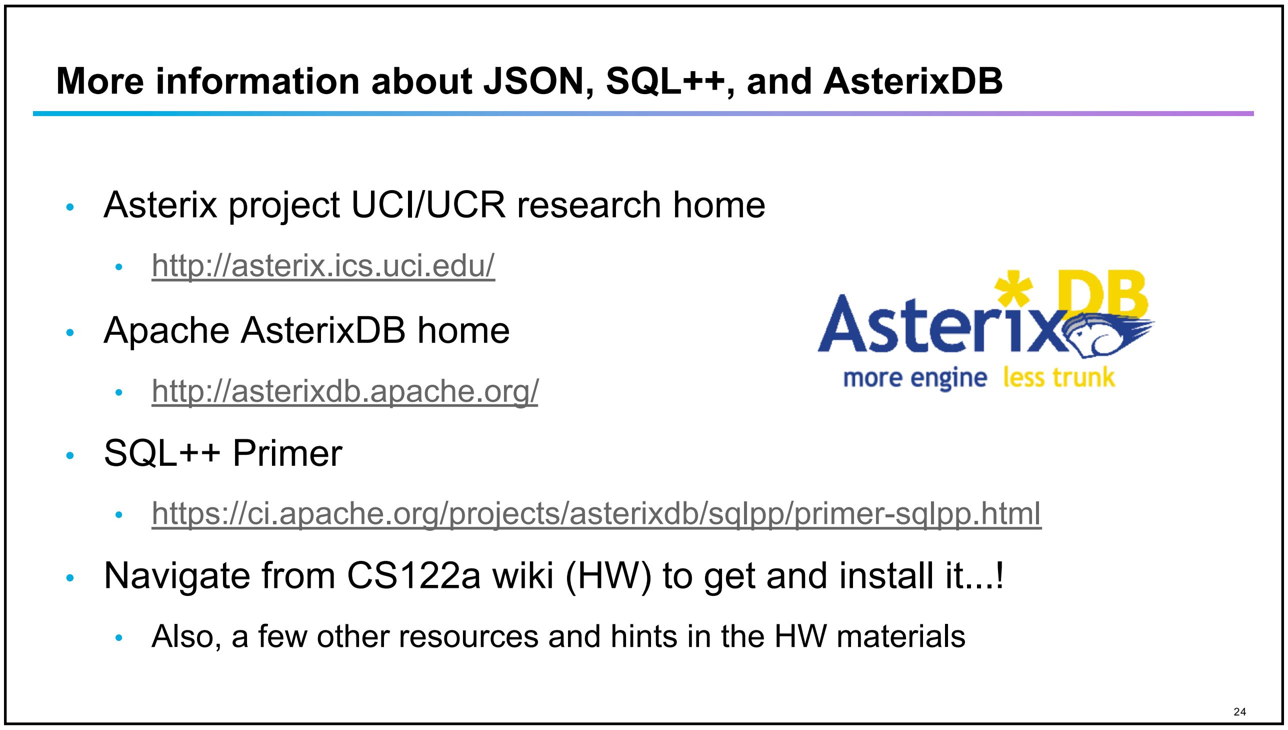


Dealing with different "cases"

```
SELECT VALUE {
  "orderno": o.orderno,
  "order_date": o.order_date,
  "ship_date":
    CASE
      WHEN o.ship_date IS MISSING THEN "TBD"
      ELSE o.ship_date
    END,
  "custid": o.custid
}
FROM orders o
ORDER BY ship_date DESC
```

```
[
  {
    "orderno": 1005,
    "order_date": "2017-08-30",
    "ship_date": "TBD",
    "custid": "C37"
  },
  {
    "orderno": 1008,
    "order_date": "2017-10-13",
    "ship_date": "TBD",
    "custid": "C13"
  },
  {
    "orderno": 1007,
    "order_date": "2017-09-13",
    "ship_date": "2017-09-20",
    "custid": "C13"
  },
  …
```

23



More information about JSON, SQL++, and AsterixDB

- Asterix project UCI/UCR research home
  - http://asterix.ics.uci.edu/
- Apache AsterixDB home
  - http://asterixdb.apache.org/
- SQL++ Primer
  - https://ci.apache.org/projects/asterixdb/sqlpp/primer-sqlpp.html
- Navigate from CS122a wiki (HW) to get and install it...!
  - Also, a few other resources and hints in the HW materials

AsterixDB more engine less trunk

24