CSCI235 Database Systems

MongoDB Query Language

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MongoDB Query language

Outline

MongoDB query language

MongoDB query language is based on a concept of pattern matching

A query is expressed as a BSON pattern and all documents that match the pattern are included in an answer

A method `find()` can be used to match a pattern with the documents in a collection `orders`

```
db.orders.find({"_id":"ALFKI"})
```
find()

Matching of an empty pattern `{}` with a collection `orders` returns an entire collection

```
db.orders.find({})
```
find()

Finding the first 3 documents in a collection `orders`

```
db.orders.find({}).limit(3)
```
find()

Finding all documents in a collection `orders` and listing the results in a nice format

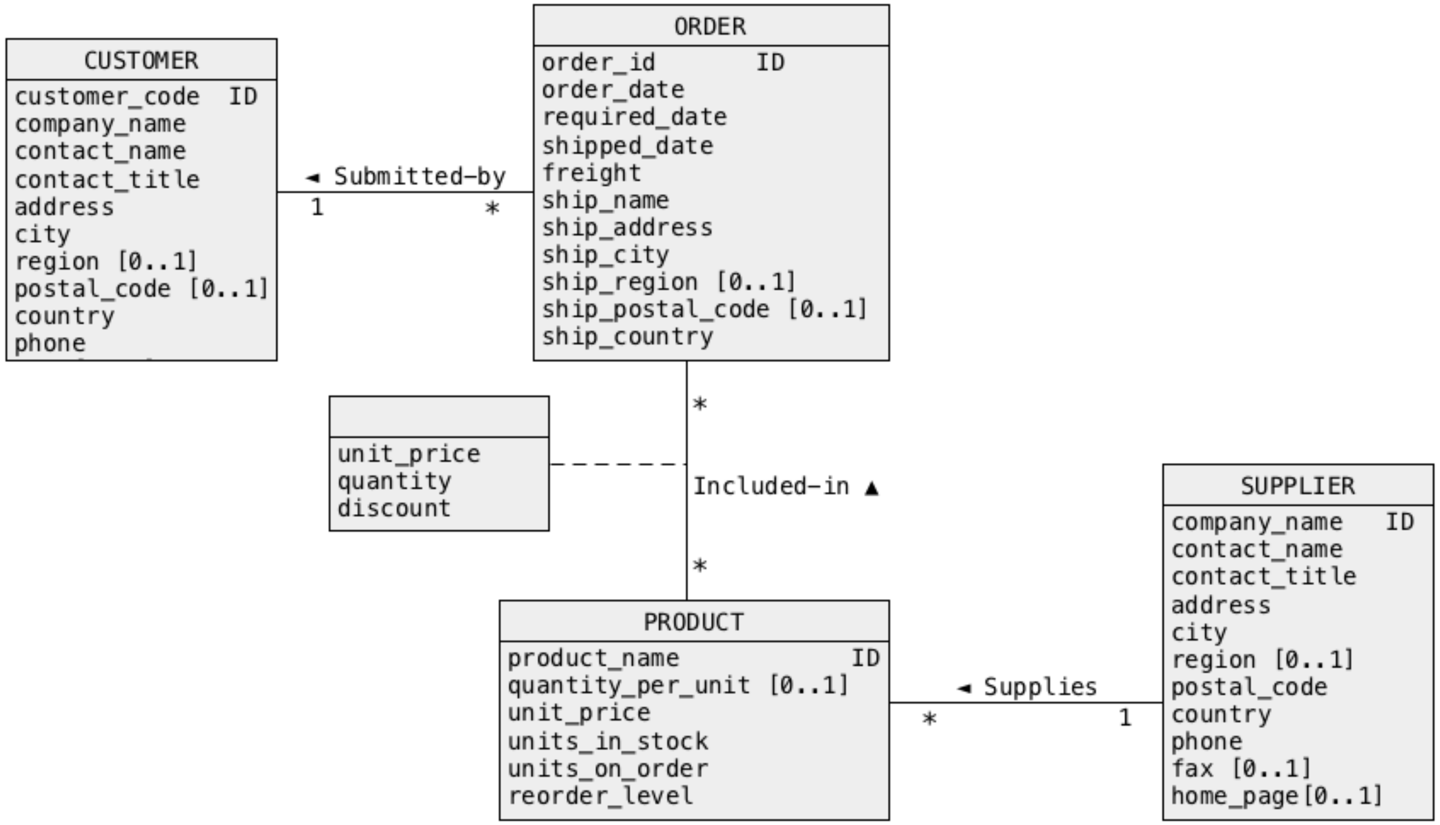
```
db.orders.find({}).pretty()
```
find()

MongoDB Query language

Outline

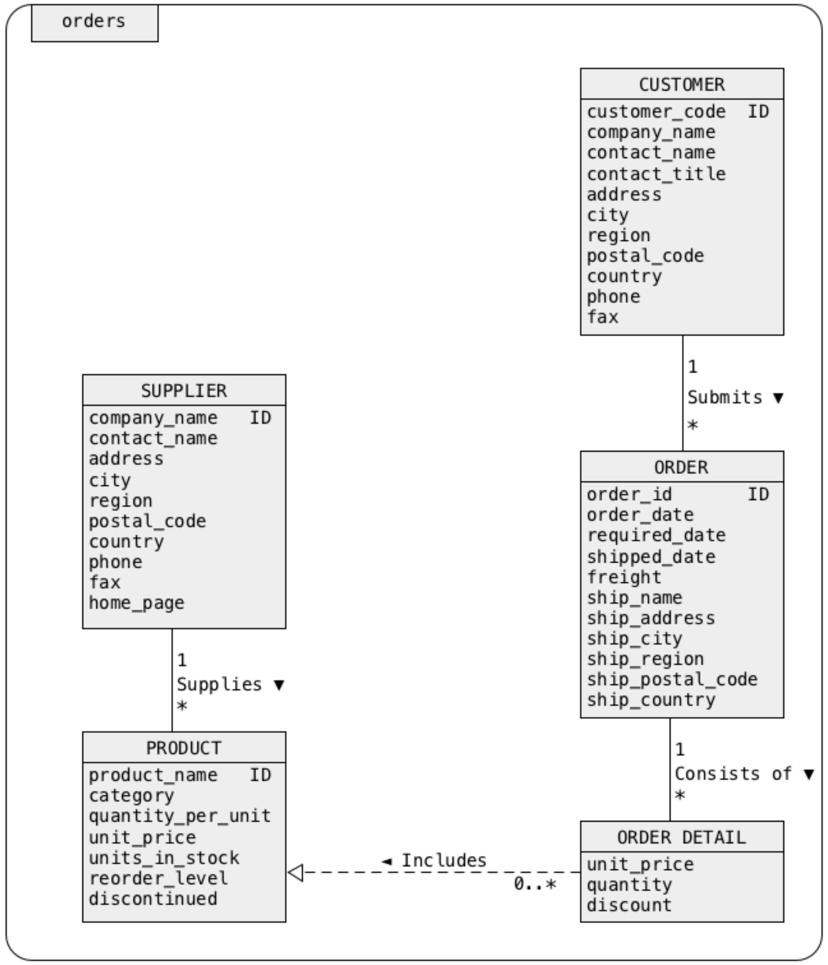
A sample database

A conceptual schema of a database with information about suppliers, products, customers, orders, and details of orders



A sample database

A sample collection `orders`



A sample database

A sample document, that belongs to a class `CUSTOMER`

```
CUSTOMER
{
        "_id" : "ALFKI",
        "CUSTOMER" : {
                 "customer code" : "ALFKI",
                 "company name" : "Alfreds Futterkiste",
                 "contact name" : "Maria Anders",
                 "contact title" : "Sales Representative",
                 "address" : "Obere Str. 57",
                 "city" : "Berlin",
                 "region" : null,
                 "postal code" : "12209",
                 "country" : "Germany",
                 "phone" : "030-0074321",
                 "fax" : "030-0076545",
                 "submits" : [ ]
        }
}
```

A sample database

A sample nested document, that belongs to a class CUSTOMER

CUSTOMER

```
{
 "_id" : "FAMIA",
 "CUSTOMER" : {
              "customer code" : "FAMIA",
               ... ... ... ... ... ...
              "submits" : [
                          {
                           "ORDER" : {
                                     "order id" : 328,
                                      ... ... ... ... ...
                                     "consists of" : [
                                                    {
                                                     "ORDER DETAIL" : {
                                                                      "product name" : "Louisiana Fiery Hot Pepper Sauce",
                                                                      ... ... ... ... ...
                                                                     }
                                                    },
                                                    {
                                                     "ORDER DETAIL" : {
                                                                      "product name" : "Raclette Courdavault",
                                                                      ... ... ... ... ...
                                                                     }
                                                    }
                                                   ]
                                    }
                          }
                         ]
             }
}
```

A sample database

A sample nested document, that belongs to a class SUPPLIER

```
SUPPLIER
{
 "_id" : "Karkki Oy",
 "SUPPLIER" : {
              "company name" : "Karkki Oy",
              "contact name" : "Anne Heikkonen",
              "contact title" : "Product Manager",
              "address" : "Valtakatu 12",
              ... ... ... ... ... ...
              "supplies" : [
                            {
                             "PRODUCT" : {
                                          "product name" : "Maxilaku",
                                          "category name" : "Confections",
                                           ... ... ... ... ...
                                         }
                            },
                            {
                             "PRODUCT" : {
                                          "product name" : "Valkoinen suklaa",
                                          "category name" : "Confections",
                                          ... ... ... ... ...
                                         }
                            }

                           ]
              }
}
```

MongoDB Query language

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Simple queries

Find total number of documents in a collection

```
db.orders.count()                                                          count()
```

Find all information about all customers

```
db.orders.find({"CUSTOMER":{$exists:true}})                      Find entire class
```

Find all information about all suppliers

```
db.orders.find({"SUPPLIER":{$exists:true}})                      Find entire class
```

Find all information about the customers living in `Germany`

```
db.orders.find({"CUSTOMER.country":"Germany"})                         Access path
```

Find all information about the suppliers living in a city of `Oviedo`

```
db.orders.find({"SUPPLIER.city":"Oviedo"})                             Access path
```

Find all information about the suppliers who live in the `Netherlands` and have a contact title `Accounting Manager`

```
db.orders.find({"SUPPLIER.country":"Netherlands",                              And
                "SUPPLIER.contact title":"Accounting Manager"})
```

MongoDB Query language

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Queries with Boolean operations

Comparison `"key"="value"`

```
{"key":"value"}                                                    =
```

```
{"key":{$eq:"value"}}                                              =
```

Comparison `"key" > "value"`

```
{"key":{$gt:"value"}}                                              >
```

Disjunction `("key1"="value1") or ("key2"="value2")`

```
{$or:[{"key1":"value1"},{"key2":"value2"}]}                        $or
```

Conjunction `("key1"="value1") and ("key2"="value2")`

```
{$and:[{"key1":"value1"},{"key2":"value2"}]}                       $and
```

Boolean expression `(("key1"="value1") or ("key2"="value2")) and ("key3"="value3")`

```
                                                    Boolean expression
{$and:[{$or:[{"key1":"value1"},{"key2":"value2"}]},{"key3":"value3"}]}
```

Queries with Boolean operations

Negation of a comparison `"key" not ="value"`

not =

```
{"key":{$not:{$eq:"value"}}}
```

Negation of an expression `not (("key1"="value1") or ("key2"="value2"))`

not or

```
{$nor:[{"key1":"value1"},{"key2":"value2"}]}
```

Negation `nor ("key1"="value1")`

not =

```
{$nor:[{"key1":"value1"}]}
```

Queries with Boolean operations

Find all information about the suppliers who live in the `Netherlands` and have a contact title `Accounting Manager`

$and
```
db.orders.find({$and:[{"SUPPLIER.country":"Netherlands"},
                      {"SUPPLIER.contact title":"Accounting Manager"}]})
```

Find all information about the suppliers who live in the `Netherlands` or have a contact title `Accounting Manager`

$or
```
db.orders.find({$or:[{"SUPPLIER.country":"Netherlands"},
                     {"SUPPLIER.contact title":"Accounting Manager"}]})
```

Find all information about the customers who live in `France` or in `Germany`

$in
```
db.orders.find({"CUSTOMER.country":{$in:["France","Germany"]}})
```

Queries with Boolean operations

Find all information about the customers who do not live in `Germany`

```
$not
db.orders.find({"CUSTOMER.country":{$not:{$eq:"Germany"}}})
```

Find all information about the customers who do not both live in `Netherlands` or have a contact title `Accounting Manager`

Find all information about the customers who do not live in `Netherlands` and do not have a contact title `Accounting Manager`

```
$nor
db.orders.find({$nor:[{"SUPPLIER.country":"Netherlands"},
                      {"SUPPLIER.contact title":"Accounting Manager"}]})
```

Find all information about the customers who do not live in `Germany`

```
$nor
db.orders.find({$nor:[{"CUSTOMER.country":"Germany"}]})
```

MongoDB Query language

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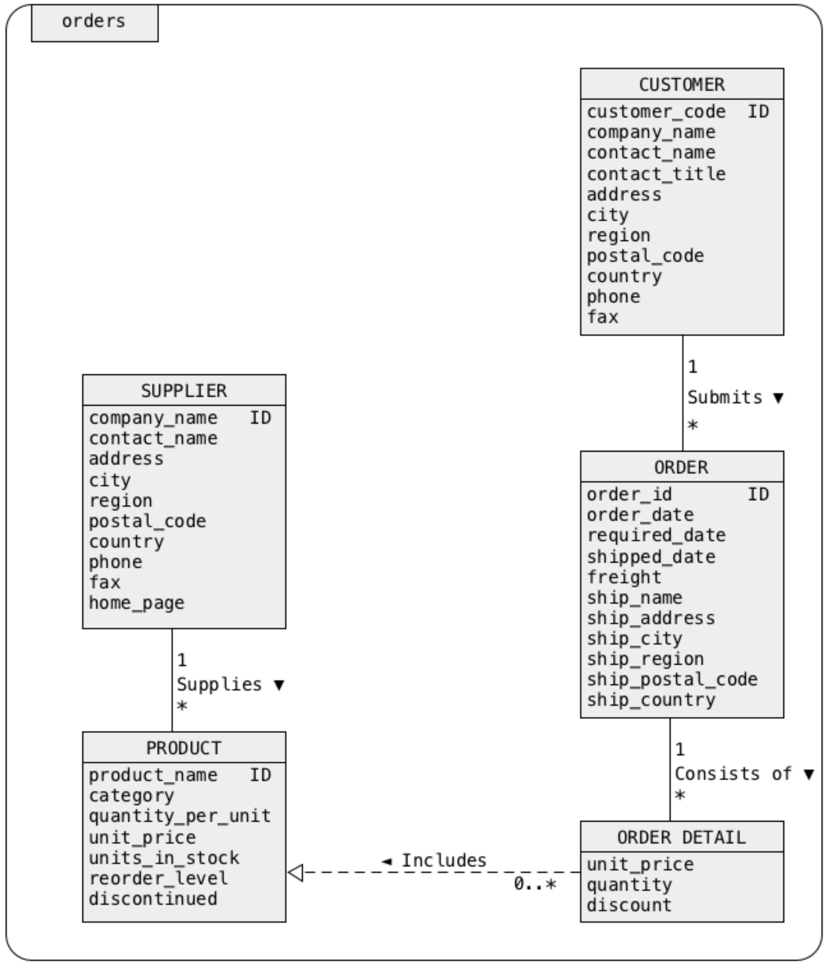
Queries on nested documents

A sample collection `orders`



Queries on nested documents

Find all information about suppliers who supply a product named `Laughing Lumberjack Lager`

```
                                                                                 path
db.orders.find({"SUPPLIER.supplies.PRODUCT.product name":"Laughing Lumberjack Lager"})
```

Find all information about suppliers living in `London` who supply a product named `Chai`

```
                                                                       path and path
db.orders.find({$and:[{"SUPPLIER.city":"London"},
                      {"SUPPLIER.supplies.PRODUCT.product name":"Chai"}]})
```

Find all information about suppliers living in `London` who supply a product named `Chai` or a product named `Chang`

```
                                                              (path or path) and path
db.orders.find({$and:[{"SUPPLIER.city":"London"},
                      {$or:[{"SUPPLIER.supplies.PRODUCT.product name":"Chai"},
                            {"SUPPLIER.supplies.PRODUCT.product name":"Chang"}]}]})
```

```
db.orders.find({$and:[{"SUPPLIER.city":"London"},                      path and path
                      {"SUPPLIER.supplies.PRODUCT.product name":{$in:["Chai","Chang"]}}]})
```

Queries on nested documents

Find all information about suppliers living in `London` who supply a product named `Chai` and a product named `Chang`

```
db.orders.find({$and:[{"SUPPLIER.city":"London"},                     path and path and path
                      {"SUPPLIER.supplies.PRODUCT.product name":"Chai"},
                      {"SUPPLIER.supplies.PRODUCT.product name":"Chang"}]})
```

Find all information about suppliers who supply at least one product

```
                                                                                 path and path
db.orders.find({$and:[{"SUPPLIER.supplies":{$exists:true}},
                      {"SUPPLIER.supplies":{$ne:[]}}]})
```

Find all information about suppliers who do not supply any products

```
                                                                                 path and path
db.orders.find({$and:[{"SUPPLIER.supplies":{$exists:true}},
                     {"SUPPLIER.supplies":{$eq:[]}}]})
```

Find all information about customers who submitted an order for at least one product `Flotemysost`

```
                                                                                     long path
db.orders.find({"CUSTOMER.submits.ORDER.consists of.ORDER DETAIL.product name":"Flotemysost"})
```

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Queries on arrays

Array equal to `[1,2,3,4,5]`

```
{"array":{$all:[1,2,3,4,5]}}                                    find()
```

Array includes an element that satisfies a condition

```
{"array":{$elemMatch:{$eq:2}}}                                  find()
```

```
{"array":{$elemMatch:{$gt:2,$lt:4}}}                            find()
```

Array includes a document satisfies a condition

```
{"array":{$elemMatch:{"key":{$eq:2}}}}                          find()
```

```
{"array":{$elemMatch:{"key":{$gt:2,$lt:4}}}}                    find()
```

Size of an array

```
{"array":{$size:5}}                                             find()
```

```
{"array":{$size:0}}                                             find()
```

```
{"array":[]}                                                    find()
```

Queries on arrays

Find all information about customers who submitted an order that contains only a product `Boston Crab Meat` at unit price `14.7` in quantity `20` with discount equal to `0`

```
db.orders.find({"CUSTOMER.submits.ORDER.consists of":                  = array
                                 {$eq:[{"ORDER DETAIL":{"product name":"Boston Crab Meat",
                                                        "unit price":14.7,
                                                        "quantity":20,
                                                        "discount":0}}]}})
```

Find all information about suppliers such that the second supplied product is named `Chang`

```
                                                                    path.n.path
db.orders.find({"SUPPLIER.supplies.1.PRODUCT.product name":"Chang"})
```

Find all information about suppliers such that the first supplied product is named `Chai` and the second supplied product is named `Chang`

```
                                                    path.n.path and path.n.path
db.orders.find({$and:[{"SUPPLIER.supplies.0.PRODUCT.product name":"Chai"},
                      {"SUPPLIER.supplies.1.PRODUCT.product name":"Chang"}]})
```

Queries on arrays

Find all information about customers who purchased at least one product with discount greater than `0.2`

```
                                                                      path > v
db.orders.find({"CUSTOMER.submits.ORDER.consists of.ORDER DETAIL.discount":{$gt:0.2}})
```

```
                                                                path &elemMatch v
db.orders.find({"CUSTOMER.submits.ORDER.consists of":{$elemMatch:{"ORDER DETAIL.discount":{$gt:0.2}}}})
```

Find all information about customers who purchased at least one product with discount equal to `0.25` and quantity equal to `16`

```
                                                          path &elemMatch v1, ...,vn
db.orders.find({"CUSTOMER.submits.ORDER.consists of":{$elemMatch:{"ORDER DETAIL.discount":{$eq:0.25},
                                                                  "ORDER DETAIL.quantity":{$eq:16}}}})
```

Find all information about customers who purchased 4 products in one order

```
                                                                           $size
db.orders.find({"CUSTOMER.submits.ORDER.consists of":{$size:4}})
```

Queries on arrays

Find all information about customers who purchased more than 4 products in one order

```
path.n $exists
db.orders.find({"CUSTOMER.submits.ORDER.consists of.4":{$exists:true}})
```

MongoDB Query language

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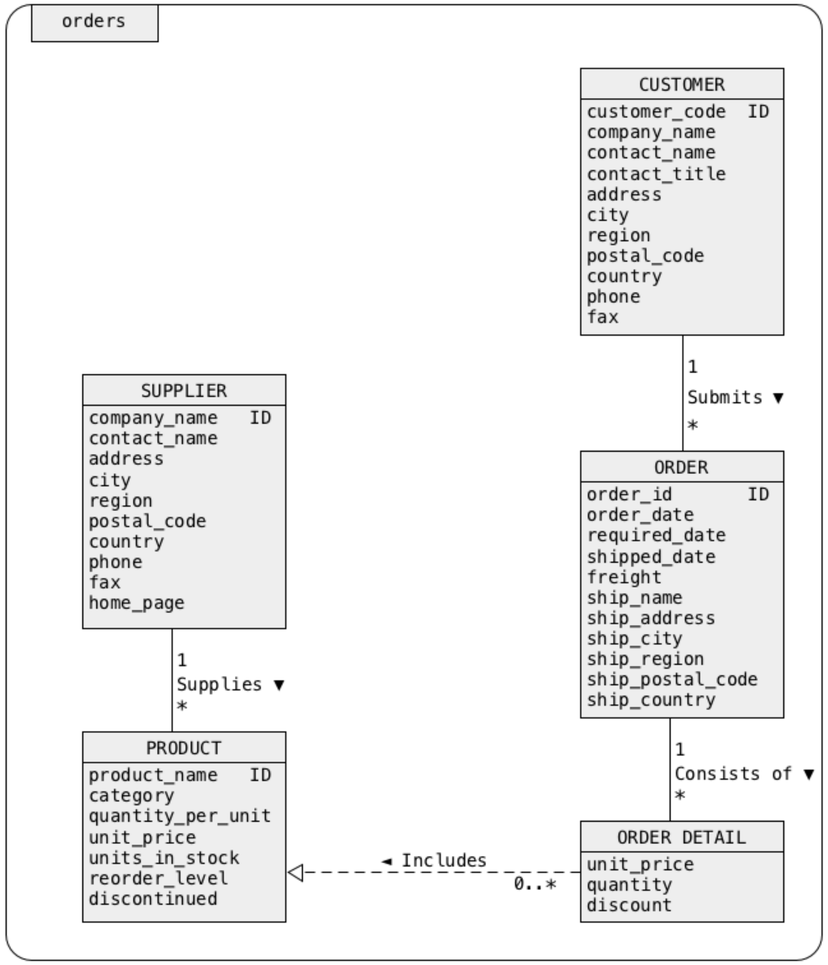
Projections

A sample collection `orders`



Projections

Find only a company name and contact name for all suppliers

```
Projection
db.orders.find({"SUPPLIER":{$exists:true}},{"_id":0,"SUPPLIER.company name":1,"SUPPLIER.contact name":1})
```

Find all information about suppliers except a company name, contact name and `_id`

```
Projection
db.orders.find({"SUPPLIER":{$exists:true}},{"_id":0,"SUPPLIER.company name":0,"SUPPLIER.contact name":0})
```

Find all information about suppliers except products supplied by suppliers and `_id`

```
Projection
db.orders.find({"SUPPLIER":{$exists:true}},{"_id":0,"SUPPLIER.supplies":0}))
```

Find only information about products supplied by suppliers

```
Projection
db.orders.find({"SUPPLIER":{$exists:true}},{"_id":0,"SUPPLIER.supplies":1}))
```

```
Projection
db.orders.find({"SUPPLIER":{$exists:true}},{"_id":0,"SUPPLIER.supplies.PRODUCT":1}))
```

Projections

Find only the names of products supplied by suppliers

```
Projection
db.orders.find({"SUPPLIER":{$exists:true}},{"_id":0,"SUPPLIER.supplies.PRODUCT.product name":1})
```

Find only the names of products and categories of products supplied by suppliers

```
Projection
db.orders.find({"SUPPLIER":{$exists:true}},{"_id":0,"SUPPLIER.supplies.PRODUCT.product name":1,
                                               "SUPPLIER.supplies.PRODUCT.category name":1})
```

Find only company names of suppliers and the names of products supplied by suppliers

```
Projection
db.orders.find({"SUPPLIER":{$exists:true}},{"_id":0,"SUPPLIER.company name":1,
                                               "SUPPLIER.supplies.PRODUCT.product name":1})
```

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Queries about nulls and missing keys

Find all information about the customers who have no `region` information

```
null
db.orders.find({"CUSTOMER.region":null})
```

Find all information about the customers who have `region` information

```
$not null
db.orders.find({"CUSTOMER.region":{$not:{$eq:null}}})
```

Find all information about the customers who have `PO Box` in their description

```
$exists
db.orders.find({"CUSTOMER.PO Box":{$exists:true}})
```

Find all information about the customers who do not have `PO Box` in their description

```
$exists
db.orders.find({"CUSTOMER.PO Box":{$exists:false}})
```

```
db.orders.find({"CUSTOMER.PO Box":{$not:{$exists:true}}})
$ not $exists
```

MongoDB Query language

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Iterations over a cursor

Create a cursor and display all information about suppliers

```
cursor
var cursor = db.orders.find({"SUPPLIER":{$exists:true}})
while(cursor.hasNext())
{ print(tojson(cursor.next())); }
```

```
cursor
var cursor = db.orders.find({"SUPPLIER":{$exists:true}})
cursor.forEach(printjson)
```

References

MongoDB Reference, Operators, Query and Projection Operators

Banker K., Bakkum P., Verch S., Garret D., Hawkins T., MongoDB in Action, 2nd ed., Manning Publishers, 2016