# BDD300 - Project 01

1. Application Description

LinkedIn Learning is one of the famous online learning platforms. This platform provides users with a vast amount of video learning materials over a wide range of academic categories such as computer technology, business, and statistics. Now that there are over 164,000 courses that can be translated into seven languages, the LinkedIn Learning services have expanded to the global as well as a variety of majors. There is no doubt that the global pandemic in 2020 caused a drastic change in learning style; online learning, rather than in-person would be a more popular style recently. Furthermore, LinkedIn, as a Social Network Service provider, encourages users to form professional communities and enables them to find new jobs on the platform. Therefore, LinkedIn would continue to provide crucial services for professionals, businesspersons, or students if we consider the following two aspects: LinkedIn is the social media platform to connect with many professionals around the world and its users can study various academic fields or practical skills on its learning platform.

Various courses in LinkedIn Learning can be related to multiple categories (academic fields or skills), and many categories can also relate to various courses. Each course must be composed of at least one material, and each material must be the composition of a certain course. Many users can enroll in multiple courses, and many courses can be enrolled in various students. Each course must have at least one instructor, and each instructor can have multiple courses.

A user and an instructor must own a LinkedIn account, and a LinkedIn account must be owned by a user or an instructor. A LinkedIn account might store one set of location information such as city, province, and country; each location information must be stored in at least one LinkedIn account (multiple users may be studying at the same place or organization). In addition, a LinkedIn account may store multiple education information such as school name and graduation date. And each educational information must be stored in a LinkedIn account.

2. ER Model
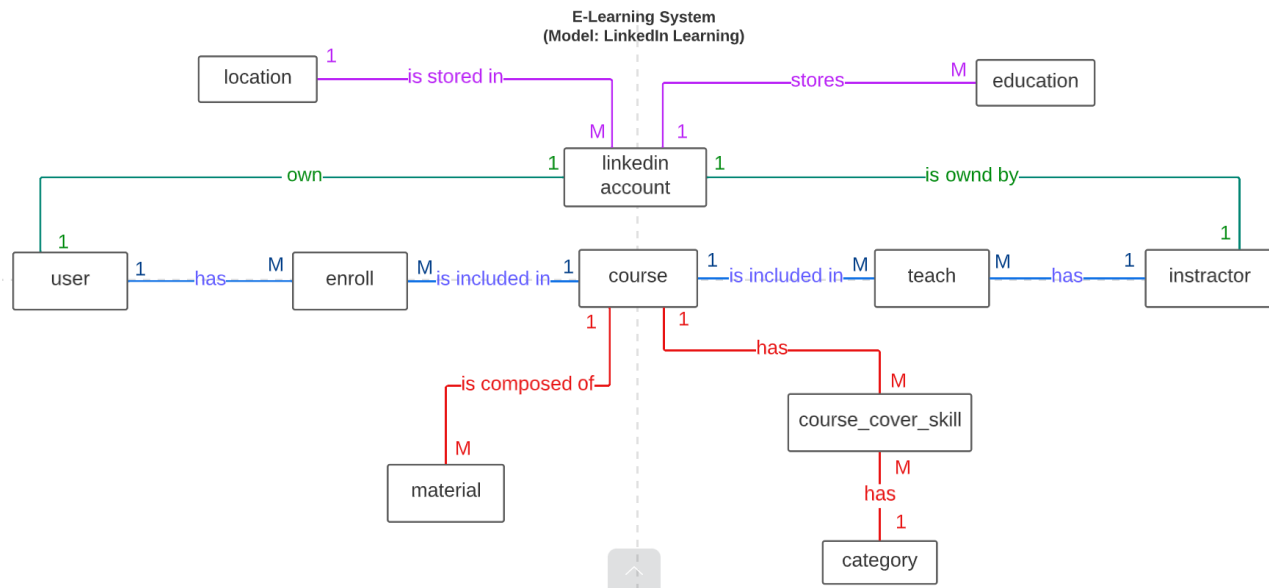
3. Schema Design (MongoDB)

Below is the ERD schema design:
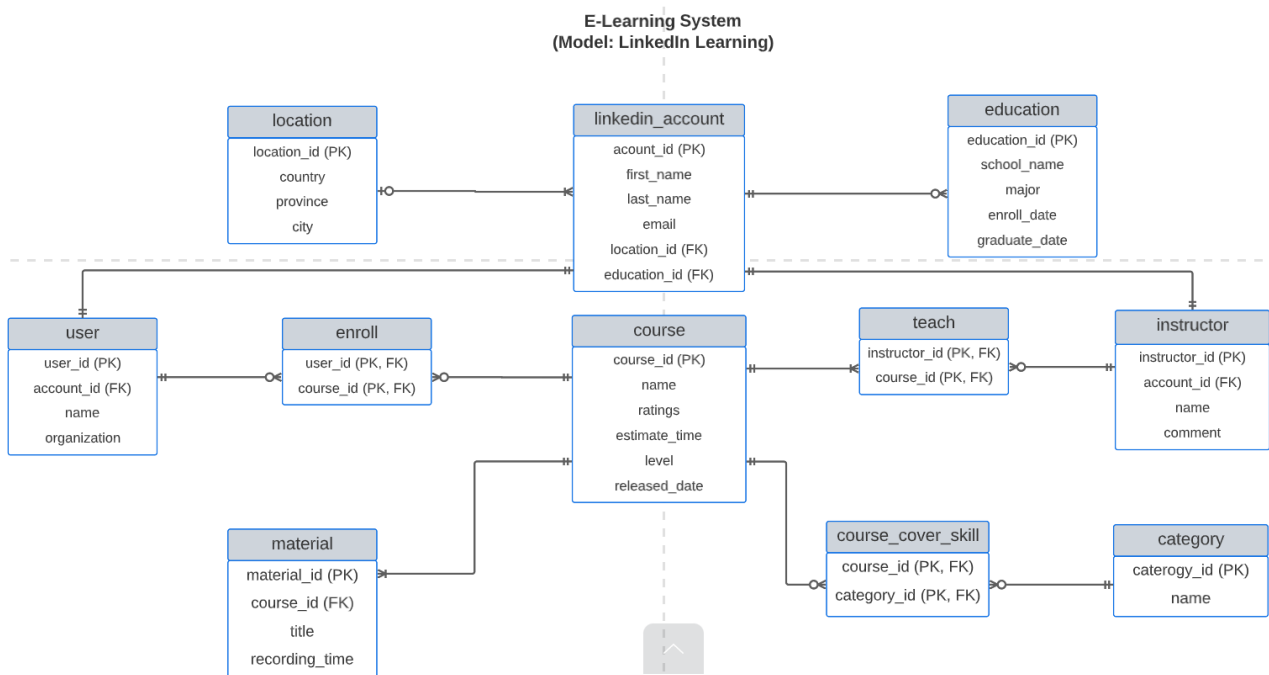
3. Database Construction

Note:

- In our implementation phase in MongoDB, all bridge entities – *enroll*, *teach*, and *course_cover_skill* – are omitted. In terms of the first two entities (*enroll* and *teach*), both are removed because the *user* and *instructor* collection (entity) have reference ids to connect with the *course* collection. In other words, each user document includes a list of course ids to show what courses each user enrolls in, and each instructor document has course ids to indicate what courses each instructor teaches. Also, the *course_cover_skill* entity is also omitted because the category collection is embedded in the course collection (entity).
- Furthermore, three entities – *location*, *education*, and *material* – are also omitted because those three entities (collections) are embedded in another collection such as *course* and *linkedin_account*.
- All in all, the below codes will establish four main collections – *course, user, instructor*, and *linkedin_account*.

> use project

> db.course.insertMany(

[
{
"course_id": 100,

"name": "Introduction of Data Science",

"ratings": 4.5,

"estimate_time": 30,

"level": "Beginner",

"released_date": "2020-10-01",

"categories": [

{"name": "Data Science"},

{"name": "Data Analysis"},

{"name": "Statistics"},

{"name": "Machine Learning"}],

"materials": [

{"title": "What is Data Science and Analysis?", "recording_time": 10},

{"title": "Fundamental Statistical Methods", "recording_time": 10},

{"title": "How to Apply Data Science Strategies to the Real World.", "recording_time": 10}]
},
{
"course_id": 101,

"name": "Structured Database Design",

"ratings": 4.75,

"estimate_time": 100,

"level": "Beginner",

"released_date": "2018-01-19",

"categories": [

{"name": "Data Analysis"},

{"name": "Database"},

{"name": "SQL"},

{"name": "Database Management System"}],

"materials": [

{"title": "What is Physical Relational Database?", "recording_time": 20},

{"title": "What is Logical Relational Database?", "recording_time": 20},

{"title": "How to Write Entity Relationship Diagram", "recording_time": 20},

{"title": "Function of Database Management System", "recording_time": 20},

{"title": "Introduction of SQL", "recording_time": 20}]
},
{
"course_id": 102,

"name": "Advanced Database Design",

"ratings": 4,

"estimate_time": 100,

"level": "Intermidiate",

"released_date": "2018-02-23",

"categories": [

{"name": "Data Analysis"},

{"name": "Database"},

{"name": "NoSQL"},

{"name": "Programming"}

],

"materials": [

{"title": "What is NoSQL?", "recording_time": 20},

{"title": "Explanation of Sharding and Replication", "recording_time": 20},

{"title": "What is Document Database?", "recording_time": 30},

{"title": "Implementation of MongoDB", "recording_time": 30}]

},
{

"course_id": 103,

"name": "Advanced Machine Learning",

"ratings": 4.8,

"estimate_time": 120,

"level": "Advanced",

"released_date": "2019-12-02",

"categories": [

{"name": "Data Analysis"},

{"name": "Data Science"},

{"name": "Machine Learning"},

{"name": "Statistics"},

{"name": "Deep Learning"}],

"materials": [

{"title": "Multiple Linear Model", "recording_time": 20},

{"title": "Probability: Bayesian theory", "recording_time": 20},

{"title": "Application of Classification", "recording_time": 20},

{"title": "Data Mining & Dimensionality Reduction", "recording_time": 20},

{"title": "Sampling Methods", "recording_time": 20},

{"title": "Introduction of Deep Learning","recording_time": 20}]
},
{
"course_id": 104,

"name": "Introduction of Python",

"ratings": 4.5,

"estimate_time": 90,

"level": "Beginner",

"released_date": "2017-05-16",

"categories": [
{"name": "Computer Science"},

{"name": "Programming"},

{"name": "Python"}

],

"materials": [
{"title": "Variables and Functions","recording_time": 10},

{"title": "Fundamental Math Operations", "recording_time": 10},

{"title": "If statement and For Loop", "recording_time": 15},

{"title": "Four Collection Data Types", "recording_time": 20},

{"title": "Numpy and Pandas", "recording_time": 20},

{"title": "Data Visualization: Matplotlib", "recording_time": 15}]
},
{
"course_id": 105,

"name": "Financial Economics",

"ratings": 4,

"estimate_time": 120,

"level": "Advanced",

"released_date": "2019-08-27",

"categories": [

{"name": "Economics"},

{"name": "Finance"},

{"name": "Stock Market"}

],

"materials": [

{"title": "Basic Concepts of Microeconomics","recording_time": 30},

{"title": "Basic Concepts of Macroeconomics","recording_time": 30},

{"title": "The development of Stock Market","recording_time": 30},

{"title": "Risk Management","recording_time": 30}]

},
{

"course_id": 106,

"name": "Excel Skills for Business",

"ratings": 3.5,

"estimate_time": 45,

"level": "Beginner",

"released_date": "2020-09-30",

"categories": [

{"name": "Excel"},

{"name": "Data Analysis"}],

"materials": [

{"title": "Excel Skills: Introduction", "recording_time": 10},

{"title": "Excel Skills: Intermidiate (1)", "recording_time": 10},

{"title": "Excel Skills: Intermidiate (2)", "recording_time": 10},

{"title": "Excel Skills: Advanced","recording_time": 15}]

},
{

"course_id": 107,

"name": "Mathematics for Data Science",

"ratings": 4,

"estimate_time": 90,

"level": "Intermidiate",

"released_date": "2019-07-11",

"categories": [

{"name": "Mathematics"},

{"name": "Data Science"},

{"name": "Python"}],

"materials": [

{"title": "Limits, Derivatives, Intergrals","recording_time": 30},

{"title": "Linear Systems","recording_time": 15},

{"title": "Vector & Matrices","recording_time": 15},

{"title": "Eigenvalues & Eigenvectors", "recording_time": 15},

{"title": "Regressions", "recording_time": 15}]

},
{

"course_id": 108,

"name": "Python for Stock Market Analysis",

"ratings": 4,

"estimate_time": 90,

"level": "Intermidiate",

"released_date": "2020-12-12",

"categories": [

{"name": "Python"},

{"name": "Finance"},

{"name": "Stock Market"}],

"materials": [

{"title": "Visualizing Stock Data in Python", "recording_time": 30,},

{"title": "Linear Regression Model for Stock Analysis", "recording_time": 30},

{"title": "Specifying Pattern of Stocks","recording_time": 30}]

```
},
{

"course_id": 109,

"name": "Advanced Deep Learning",

"ratings": 3.6,

"estimate_time": 60,

"level": "Advanced",

"released_date": "2019-06-27",

"categories": [

{"name": "Python"},

{"name": "Deep Learning"},

{"name": "Machine Learning"}],

"materials": [

{"title": "Basic Concepts of Deep Learning", "recording_time": 15},

{"title": "Deep Learning Methods in Python", "recording_time": 15},

{"title": "Implementation of Deep Learning", "recording_time": 30}]

}])
```

```
}])
< { acknowledged: true,
    insertedIds:
    { '0': ObjectId("636c129134b5a1d71dea9cbf"),
      '1': ObjectId("636c129134b5a1d71dea9cc0"),
      '2': ObjectId("636c129134b5a1d71dea9cc1"),
      '3': ObjectId("636c129134b5a1d71dea9cc2"),
      '4': ObjectId("636c129134b5a1d71dea9cc3"),
      '5': ObjectId("636c129134b5a1d71dea9cc4"),
      '6': ObjectId("636c129134b5a1d71dea9cc5"),
      '7': ObjectId("636c129134b5a1d71dea9cc6"),
      '8': ObjectId("636c129134b5a1d71dea9cc7"),
      '9': ObjectId("636c129134b5a1d71dea9cc8") } }
```
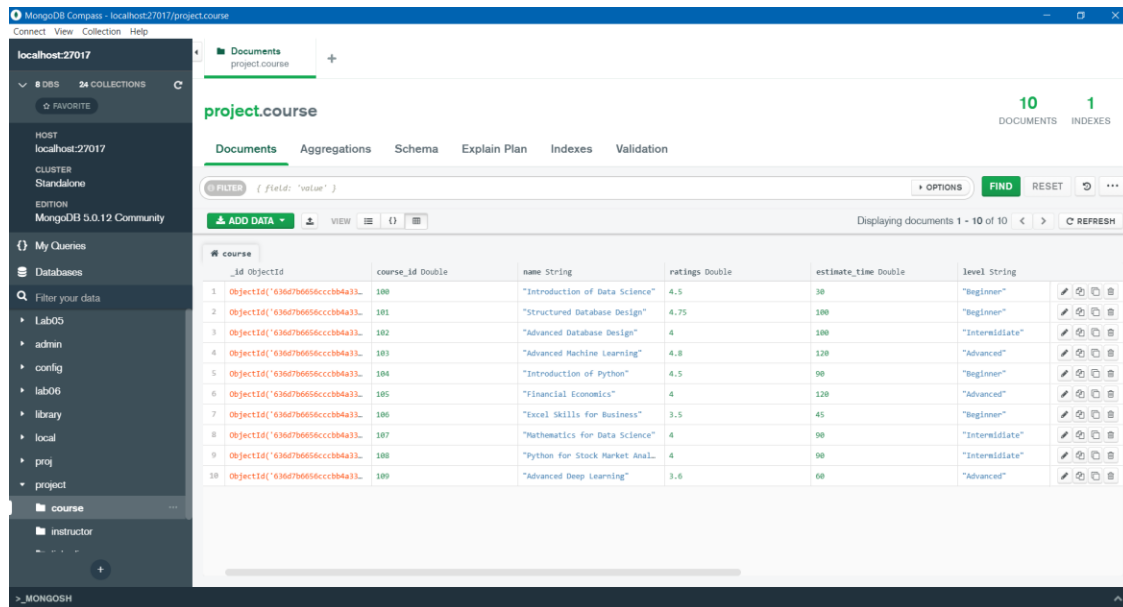
```
> db.linkedin_account.insertMany([
{
"account_id": 1,
"first_name": "Ran",
"last_name": "Arino",
"email": "rarino@myseneca.ca",
"location": {"country": "Canada", "province": "Ontario", "city": "North York"},
"education": [{"school_name": "Seneca College", "major": "Data Science and Analysis", "enroll_date":
"2022-01-13", "graduate_date": ""}]
},

{
"account_id": 2,
"first_name": "Christy",
"last_name": "Collins",
"email": "ccollins@myseneca.ca",
"location": {"country": "Canada","province": "Ontario","city": "North York"},
"education": [{"school_name": "Seneca College", "major": "Computer Science", "enroll_date": "2021-
09-06", "graduate_date": ""}]
},

{
"account_id": 3,
"first_name": "Jonathan",
"last_name": "Mcdaniel",
"email": "jmcdaniel@myseneca.ca",
"location": {"country": "Canada", "province": "Ontario", "city": "North York"},
"education": [{"school_name": "Seneca College", "major": "Data Science and Analysis", "enroll_date":
```

"2021-09-06", "graduate_date": ""}]
},

{
"account_id": 4,
"first_name": "David",
"last_name": "Abbott",
"email": "dabbott@myseneca.ca",
"location": {"country": "Canada", "province": "Ontario", "city": "North York"},
"education": [{"school_name": "Seneca College", "major": "Data Science and Analysis", "enroll_date":
"2018-09-03", "graduate_date": "2022-04-22"}]
},

{
"account_id": 5,
"first_name": "Natalie",
"last_name": "Washington",
"email": "nwashington@gmail.com",
"location": {"country": "Canada", "province": "Ontario", "city": "North York"},
"education": [{"school_name": "Toronto University", "major": "Computer Science", "enroll_date":
"2016-09-03", "graduate_date": "2020-04-22"}]
},

{
"account_id": 6,
"first_name": "Stephanie",
"last_name": "Richmond",
"email": "srichmond@gmail.com",
"location": {"country": "Canada", "province": "Ontario", "city": "North York"},
"education": [
{"school_name": "Seneca College", "major": "Liberal Arts", "enroll_date": "2020-09-05",
"graduate_date": "2021-08-15"},
{"school_name": "York University", "major": "Computer Science", "enroll_date": "2022-09-06",
"graduate_date": ""}]
},

{
"account_id": 7,
"first_name": "Terri",
"last_name": "Parker",
"email": "tparker@gmail.com",
"location": {"country": "Canada", "province": "Ontario", "city": "Ottawa"},
"education": [{"school_name": "Ottawa University", "major": "Finance", "enroll_date": "2020-09-03",
"graduate_date": ""}]
},

{
"account_id": 8,
"first_name": "John",
"last_name": "Ball",
"email": "jball@gmail.com",
"location": {"country": "Canada", "province": "Ontario", "city": "Ottawa"},
"education": [{"school_name": "Ottawa University", "major": "Finance", "enroll_date": "2022-09-06",
"graduate_date": ""}]
},

{
"account_id": 9,
"first_name": "Kristie",
"last_name": "Osborne",
"email": "kosborne@gmail.com",
"location": {"country": "Canada", "province": "Ontario", "city": "Mississauga"},
"education": [{"school_name": "Toronto University", "major": "Computer Science", "enroll_date":
"2010-09-03", "graduate_date": "2014-04-22"}]
},

{
"account_id": 10,
"first_name": "Paris",
"last_name": "Byrd",
"email": "pbyrd@gmail.com",
"location": {"country": "Canada", "province": "Ontario", "city": "North York"},
"education": [{"school_name": "York University", "major": "Computer Science", "enroll_date": "2012-
09-03", "graduate_date": "2016-04-22"}]
},

{
"account_id": 11,
"first_name": "Alec",
"last_name": "Underwood",
"email": "aunderwood@gmail.com",
"location": {"country": "Canada", "province": "Ontario", "city": "North York"},
"education": [{"school_name": "Toronto University", "major": "Finance", "enroll_date": "2007-09-
01", "graduate_date": "2011-04-24"}]
},

{
"account_id": 12,
"first_name": "Norbert",
"last_name": "Patel",
"email": "npatel@gmail.com",
"location": {"country": "America", "province": "California", "city": "Los Angeles"},
"education": [{"school_name": "University of Southern California", "major": "Data Science",

"enroll_date": "2008-09-01", "graduate_date": "2012-04-30"}]
},

{
"account_id": 13,
"first_name": "Sandy",
"last_name": "Mcbride",
"email": "smcbride@gmail.com",
"location": {"country": "America", "province": "Florida", "city": " Jacksonville"},
"education": [{"school_name": "Toronto University", "major": "Finance", "enroll_date": "2000-09-03", "graduate_date": "2004-04-22"}]
}

])

```
        '12': ObjectId("636c142234b5a1d71dea9cd5") } }
```

```
>_MONGOSH
```

> db.user.insertMany([
{
 name: "Ran Arino",
 organization: "Seneca College",
 account_id: 1,
 enroll_course_id: [100, 102, 105],
},

{
 name: "Christy",
 organization: "Seneca College",
 account_id: 2,
 enroll_course_id: [104, 109],
},

{
 name: "JM",
 organization: "Seneca College",
 account_id: 3,
 enroll_course_id: [100, 102, 107],
},

{
 name: "David.A",
 organization: "AAA Corporation",
 account_id: 4,
 enroll_course_id: [103, 105, 108, 109],
},

```
{
name: "n-washington",
organization: "BBB Corporation",
account_id: 5,
enroll_course_id: [102, 106, 107, 109],
},

{
name: "Stephanie",
organization: "York University",
account_id: 6,
enroll_course_id: [100, 101, 104, 109],
},

{
name: "T.P.",
organization: "Ottawa University",
account_id: 7,
enroll_course_id: [104, 105, 106, 108],
},

{
name: "John Ball",
organization: "Ottawa University",
account_id: 8,
enroll_course_id: [103, 105, 107, 108],
},
])
```
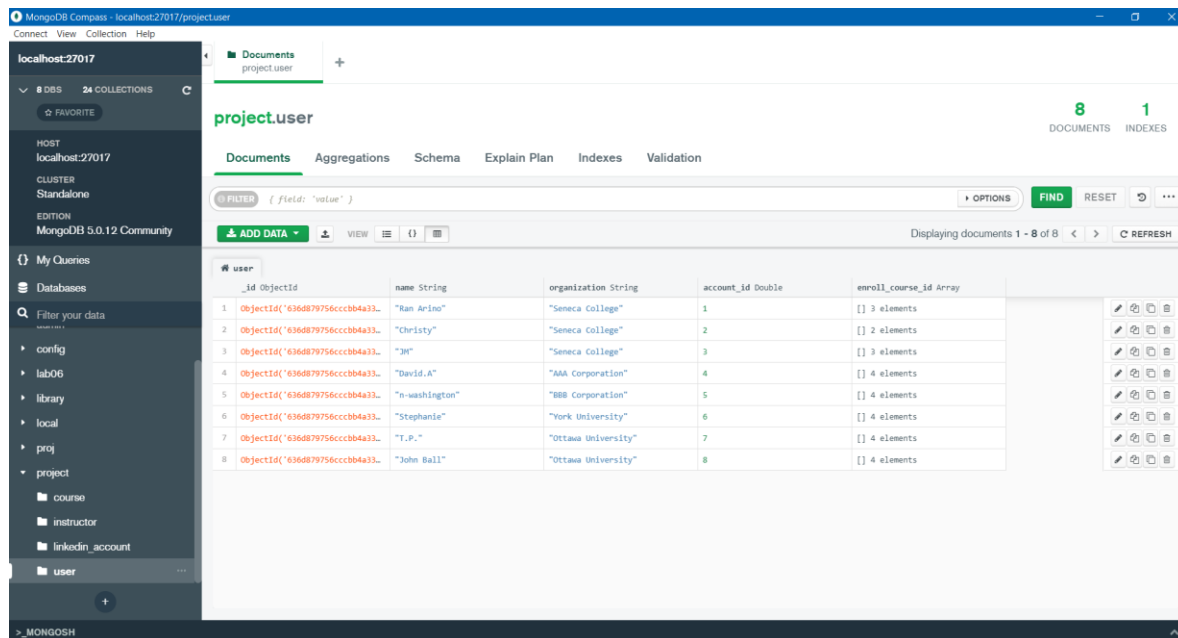
```
< { acknowledged: true,
    insertedIds:
    { '0': ObjectId("636c166f34b5a1d71dea9cd6"),
      '1': ObjectId("636c166f34b5a1d71dea9cd7"),
      '2': ObjectId("636c166f34b5a1d71dea9cd8"),
      '3': ObjectId("636c166f34b5a1d71dea9cd9"),
      '4': ObjectId("636c166f34b5a1d71dea9cda"),
      '5': ObjectId("636c166f34b5a1d71dea9cdb"),
      '6': ObjectId("636c166f34b5a1d71dea9cdc"),
      '7': ObjectId("636c166f34b5a1d71dea9cdd") } }
```

> db.instructor.insertMany([

{name: "Kristie Osborne",
 comment: "Kristie is a professor in the data science and analysis field.",
 account_id: 9,
 teach_course_id: [100, 104, 109],
},

{name: "Paris",
 comment: "Paris is a researcher in computer science and has experienced database manager in company.",
 account_id: 10,
 teach_course_id: [101, 102],
},

{name: "Alec Underwood",
 comment: "Alec is a professor in the finance and the statistics field.",
 account_id: 11,
 teach_course_id: [105, 107],
},

{name: "Norbert",
 comment: "Nobert is familiar with data science and stock market.",
 account_id: 12,
 teach_course_id: [103, 106, 108],
},

{name: "Sandy Mcbride",
 comment: "Sandy is teaching finance in Toronto University for more than 15 years.",
 account_id: 13,
 teach_course_id: [105],
}

])

```
  ])
< { acknowledged: true,
    insertedIds:
      { '0': ObjectId("636c175d34b5a1d71dea9cde"),
        '1': ObjectId("636c175d34b5a1d71dea9cdf"),
        '2': ObjectId("636c175d34b5a1d71dea9ce0"),
        '3': ObjectId("636c175d34b5a1d71dea9ce1"),
        '4': ObjectId("636c175d34b5a1d71dea9ce2") } }
```
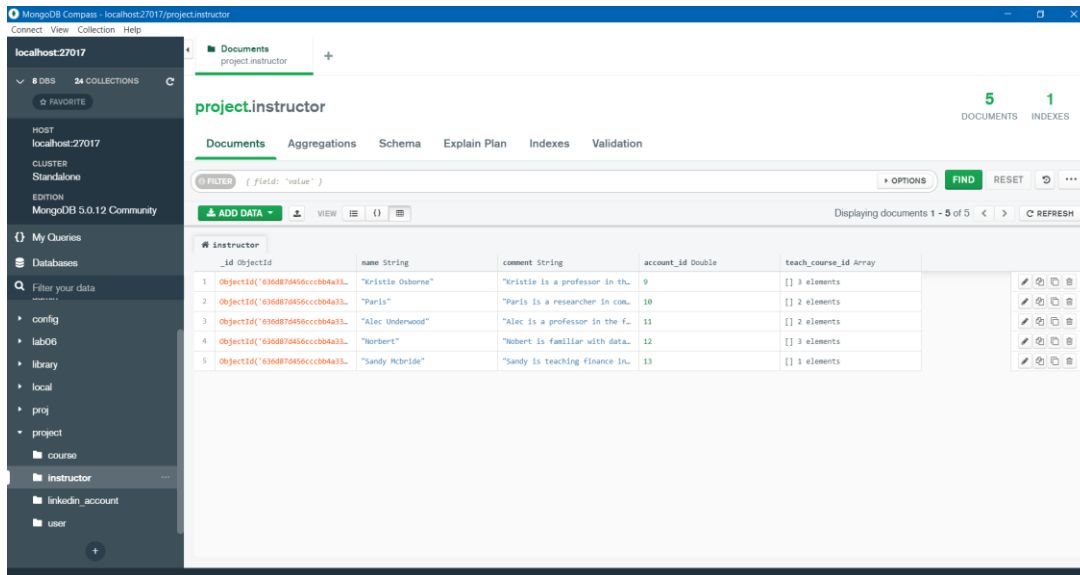
4. Simple Quarries

(1): How many users are registering on LinkedIn Learning Platforms for study?

> db.user.countDocuments()
8

> db.user.count()

8

```
> db.user.countDocuments()
< 8
```

```
>
> db.user.count()
8
```

(2): Who is enrolling in Ottawa University now?

> db.user.find({organization: 'Ottawa University'})
{ _id: ObjectId("636c166f34b5a1d71dea9cdc"),
  name: 'T.P.',
  organization: 'Ottawa University',
  account_id: 7,
  enroll_course_id: [104, 105, 106, 108] }

{ _id: ObjectId("636c166f34b5a1d71dea9cdd"),
  name: 'John Ball',
  organization: 'Ottawa University',
  account_id: 8,
  enroll_course_id: [103, 105, 107, 108] }

```
> db.user.find({organization: 'Ottawa University'})
< { _id: ObjectId("636c166f34b5a1d71dea9cdc"),
    name: 'T.P.',
    organization: 'Ottawa University',
    account_id: 7,
    enroll_course_id: [ 104, 105, 106, 108 ] }
  { _id: ObjectId("636c166f34b5a1d71dea9cdd"),
    name: 'John Ball',
    organization: 'Ottawa University',
    account_id: 8,
    enroll_course_id: [ 103, 105, 107, 108 ] }
```

(3): What courses are related to learning Python? (Showing course name, ratings by other learners, and estimated time to complete each course)

> db.course.find({"categories.name": {"$in": ['Python']}}, {_id: 0, name: 1, ratings: 1, estimate_time: 1})
{ name: 'Introduction of Python',

  ratings: 4.5,

  estimate_time: 90 }

{ name: 'Mathematics for Data Science',

ratings: 4,

  estimate_time: 90 }

{ name: 'Python for Stock Market Analysis',

  ratings: 4,

  estimate_time: 90 }

{ name: 'Advanced Deep Learning',

  ratings: 3.6,

  estimate_time: 60 }

```
> db.course.find({"categories.name": {"$in": ['Python']}}, {_id: 0, name: 1, ratings: 1, estimate_time: 1})
< { name: 'Introduction of Python',
    ratings: 4.5,
    estimate_time: 90 }
  { name: 'Mathematics for Data Science',
    ratings: 4,
    estimate_time: 90 }
  { name: 'Python for Stock Market Analysis',
    ratings: 4,
    estimate_time: 90 }
  { name: 'Advanced Deep Learning',
    ratings: 3.6,
    estimate_time: 60 }
```

<u>(4): What are courses whose rating is greater than or equal to 4.5? (Showing course name, ratings by other learners, estimated time to complete, and course level)</u>

> db.course.find({ratings: {"$gte": 4.5}}, {_id: 0, name: 1, estimate_time: 1, ratings: 1, level: 1})

{ "name" : "Introduction of Data Science", "ratings" : 4.5, "estimate_time" : 30, "level" : "Beginner" }

{ "name" : "Structured Database Design", "ratings" : 4.75, "estimate_time" : 100, "level" : "Beginner" }

{ "name" : "Advanced Machine Learning", "ratings" : 4.8, "estimate_time" : 120, "level" : "Advanced" }

{ "name" : "Introduction of Python", "ratings" : 4.5, "estimate_time" : 90, "level" : "Beginner" }

```
> db.course.find({ratings: {"$gte": 4.5}}, {_id: 0, name: 1, estimate_time: 1, ratings: 1, level: 1})
< { name: 'Introduction of Data Science',
    ratings: 4.5,
    estimate_time: 30,
    level: 'Beginner' }
  { name: 'Structured Database Design',
    ratings: 4.75,
    estimate_time: 100,
    level: 'Beginner' }
  { name: 'Advanced Machine Learning',
    ratings: 4.8,
    estimate_time: 120,
    level: 'Advanced' }
  { name: 'Introduction of Python',
    ratings: 4.5,
    estimate_time: 90,
    level: 'Beginner' }
```

(5) Retrieve all course released date is 2020-12-12.

> db.course.find({released_date: "2020-12-12"})

{ "_id" : ObjectId("636d8ba681faa9b11cc506c1"), "course_id " : 108, "name" : "Python for Stock Market Analysis", "ratings" : 4, "estimate_time" : 90, "level" : "Intermidiate", "released_date" : "2020-12-12", "categories" : [{ "name" : "Python" }, { "name" : "Finance" }, { "name" : "Stock Market" }], "materials" : [{ "title" : "Visualizing Stock Data in Python", "recording_time" : 30 }, { "title" : "Linear Regression Model for Stock Analysis", "recording_time" : 30 }, { "title" : "Specifying Pattern of Stocks", "recording_time" : 30 }] }

```
> db.course.find({released_date: "2020-12-12"})
{ "_id" : ObjectId("636d8ba681faa9b11cc506c1"), "course_id " : 108, "name" : "Python for Stock Market Analysis", "ratings" : 4, "estimate_time" : 90, "level" : "Intermidiat
e", "released_date" : "2020-12-12", "categories" : [ { "name" : "Python" }, { "name" : "Finance" }, { "name" : "Stock Market" } ], "materials" : [ { "title" : "Visualizing
Stock Data in Python", "recording_time" : 30 }, { "title" : "Linear Regression Model for Stock Analysis", "recording_time" : 30 }, { "title" : "Specifying Pattern of Stocks
", "recording_time" : 30 } ] }
>
```

(6) Retrieve all the users whose course's id are among the given arrays of ids.

> db.user.find({"enroll_course_id": {"$in": [100, 102, 105]}})

{ "_id" : ObjectId("636d8c3d81faa9b11cc506d0"), "name" : "Ran Arino", "organization" : "Seneca College", "account_id" : 1, "enroll_course_id" : [100, 102, 105] }

{ "_id" : ObjectId("636d8c3d81faa9b11cc506d2"), "name" : "JM", "organization" : "Seneca College", "account_id" : 3, "enroll_course_id" : [100, 102, 107] }

{ "_id" : ObjectId("636d8c3d81faa9b11cc506d3"), "name" : "David.A", "organization" : "AAA Corporation", "account_id" : 4, "enroll_course_id" : [103, 105, 108, 109] }

{ "_id" : ObjectId("636d8c3d81faa9b11cc506d4"), "name" : "n-washington", "organization" : "BBB Corporation", "account_id" : 5, "enroll_course_id" : [102, 106, 107, 109] }

{ "_id" : ObjectId("636d8c3d81faa9b11cc506d5"), "name" : "Stephanie", "organization" : "York University", "account_id" : 6, "enroll_course_id" : [100, 101, 104, 109] }

{ "_id" : ObjectId("636d8c3d81faa9b11cc506d6"), "name" : "T.P.", "organization" : "Ottawa University", "account_id" : 7, "enroll_course_id" : [104, 105, 106, 108] }

{ "_id" : ObjectId("636d8c3d81faa9b11cc506d7"), "name" : "John Ball", "organization" : "Ottawa University", "account_id" : 8, "enroll_course_id" : [103, 105, 107, 108] }

```
> db.user.find({"enroll_course_id": {"$in": [100, 102, 105]}})
{ "_id" : ObjectId("636d8c3d81faa9b11cc506d0"), "name" : "Ran Arino", "organization" : "Seneca College", "account_id" : 1, "enroll_course_id" : [ 100, 102, 105 ] }
{ "_id" : ObjectId("636d8c3d81faa9b11cc506d2"), "name" : "JM", "organization" : "Seneca College", "account_id" : 3, "enroll_course_id" : [ 100, 102, 107 ] }
{ "_id" : ObjectId("636d8c3d81faa9b11cc506d3"), "name" : "David.A", "organization" : "AAA Corporation", "account_id" : 4, "enroll_course_id" : [ 103, 105, 108, 109 ] }
{ "_id" : ObjectId("636d8c3d81faa9b11cc506d4"), "name" : "n-washington", "organization" : "BBB Corporation", "account_id" : 5, "enroll_course_id" : [ 102, 106, 107, 109 ] }

{ "_id" : ObjectId("636d8c3d81faa9b11cc506d5"), "name" : "Stephanie", "organization" : "York University", "account_id" : 6, "enroll_course_id" : [ 100, 101, 104, 109 ] }
{ "_id" : ObjectId("636d8c3d81faa9b11cc506d6"), "name" : "T.P.", "organization" : "Ottawa University", "account_id" : 7, "enroll_course_id" : [ 104, 105, 106, 108 ] }
{ "_id" : ObjectId("636d8c3d81faa9b11cc506d7"), "name" : "John Ball", "organization" : "Ottawa University", "account_id" : 8, "enroll_course_id" : [ 103, 105, 107, 108 ] }
>
```

(7). Retrieve course information which its course id is 100.

> db.course.find({"course_id ": 100})

{ "_id" : ObjectId("636d8ba681faa9b11cc506b9"), "course_id " : 100, "name" : "Introduction of Data Science", "ratings" : 4.5, "estimate_time" : 30, "level" : "Beginner", "released_date" : "2020-10-01", "categories" : [{ "name" : "Data Science" }, { "name" : "Data Analysis" }, { "name" : "Statistics" }, { "name" : "Machine Learning" }], "materials" : [{ "title" : "What is Data Science and Analysis?", "recording_time" : 10 }, { "title" : "Fundamental Statistical Methods", "recording_time" : 10 }, { "title" : "How to Apply Data Science Strategies to the Real World.", "recording_time" : 10 }] }

```
> db.course.find({"course_id ": 100})
{ "_id" : ObjectId("636d8ba681faa9b11cc506b9"), "course_id " : 100, "name" : "Introduction of Data Science", "ratings" : 4.5, "estimate_time" : 30, "level" : "Beginner", "r
eleased_date" : "2020-10-01", "categories" : [ { "name" : "Data Science" }, { "name" : "Data Analysis" }, { "name" : "Statistics" }, { "name" : "Machine Learning" } ], "mat
erials" : [ { "title" : "What is Data Science and Analysis?", "recording_time" : 10 }, { "title" : "Fundamental Statistical Methods", "recording_time" : 10 }, { "title" : "
How to Apply Data Science Strategies to the Real World.", "recording_time" : 10 } ] }
>
```

(8). Retrieve all instructors' information who teaches course id 105.

> db.instructor.find({teach_course_id: 105})

{ "_id" : ObjectId("636d8c5381faa9b11cc506da"), "name" : "Alec Underwood", "comment" : "Alec is a professor in the finance and the statistics field.", "account_id" : 11, "teach_course_id" : [105, 107] }

{ "_id" : ObjectId("636d8c5381faa9b11cc506dc"), "name" : "Sandy Mcbride", "comment" : "Sandy is teaching finance in Toronto University for more than 15 years.", "account_id" : 13, "teach_course_id" : [105] }

```
> db.instructor.find({teach_course_id: 105})
{ "_id" : ObjectId("636d8c5381faa9b11cc506da"), "name" : "Alec Underwood", "comment" : "Alec is a professor in the finance and the statistics field.", "account_id" : 11, "t
each_course_id" : [ 105, 107 ] }
{ "_id" : ObjectId("636d8c5381faa9b11cc506dc"), "name" : "Sandy Mcbride", "comment" : "Sandy is teaching finance in Toronto University for more than 15 years.", "account_id
" : 13, "teach_course_id" : [ 105 ] }
>
```

(9) Retrieve user's information, whose first name is Ran.

> db.linkedin_account.find({email: "rarino@myseneca.ca"})

{ "_id" : ObjectId("636d8bf081faa9b11cc506c3"), "account_id" : 1, "first_name" : "Ran", "last_name" : "Arino", "email" : "rarino@myseneca.ca", "location" : { "country" : "Canada", "province" : "Ontario", "city" : "North York" }, "education" : [{ "school_name" : "Seneca College", "major" : "Data Science and Analysis", "enroll_date" : "2022-01-13", "graduate_date" : "" }] }

```
> db.linkedin_account.find({email: "rarino@myseneca.ca"})
{ "_id" : ObjectId("636d8bf081faa9b11cc506c3"), "account_id" : 1, "first_name" : "Ran", "last_name" : "Arino", "email" : "rarino@myseneca.ca", "location" : { "country" : "C
anada", "province" : "Ontario", "city" : "North York" }, "education" : [ { "school_name" : "Seneca College", "major" : "Data Science and Analysis", "enroll_date" : "2022-01
-13", "graduate_date" : "" } ] }
```

5. Advanced Quarries

(1): Showing every course name and the name of users who are enrolling in each course.

> db.course.aggregate(
{$lookup: {from: "user", localField: "course_id", foreignField: "enroll_course_id", as: "Number of learners"}},
{$project: {_id: 0, course_name: "$name", students_name: "$Number of learners.name"}})

{ course_name: 'Introduction of Data Science', students_name: ['Ran Arino', 'JM', 'Stephanie'] }
{ course_name: 'Structured Database Design', students_name: ['Stephanie'] }
{ course_name: 'Advanced Database Design', students_name: ['Ran Arino', 'JM', 'n-washington'] }
{ course_name: 'Advanced Machine Learning', students_name: ['David.A', 'John Ball'] }
{ course_name: 'Introduction of Python', students_name: ['Christy', 'Stephanie', 'T.P.'] }
{ course_name: 'Financial Economics', students_name: ['Ran Arino', 'David.A', 'T.P.', 'John Ball'] }
{ course_name: 'Excel Skills for Business', students_name: ['n-washington', 'T.P.'] }
{ course_name: 'Mathematics for Data Science', students_name: ['JM', 'n-washington', 'John Ball'] }
{ course_name: 'Python for Stock Market Analysis', students_name: ['David.A', 'T.P.', 'John Ball'] }
{ course_name: 'Advanced Deep Learning', students_name: ['Christy', 'David.A', 'n-washington', 'Stephanie'] }

```
> db.course.aggregate(
    {$lookup: {from: "user", localField: "course_id", foreignField: "enroll_course_id", as: "Number of learners"}},
    {$project: (_id: 0, course_name: "$name", students_name: "$Number of learners.name"}})
< { course_name: 'Introduction of Data Science',
    students_name: [ 'Ran Arino', 'JM', 'Stephanie' ] }
  { course_name: 'Structured Database Design',
    students_name: [ 'Stephanie' ] }
  { course_name: 'Advanced Database Design',
    students_name: [ 'Ran Arino', 'JM', 'n-washington' ] }
  { course_name: 'Advanced Machine Learning',
    students_name: [ 'David.A', 'John Ball' ] }
  { course_name: 'Introduction of Python',
    students_name: [ 'Christy', 'Stephanie', 'T.P.' ] }
  { course_name: 'Financial Economics',
    students_name: [ 'Ran Arino', 'David.A', 'T.P.', 'John Ball' ] }
  { course_name: 'Excel Skills for Business',
    students_name: [ 'n-washington', 'T.P.' ] }
  { course_name: 'Mathematics for Data Science',
    students_name: [ 'JM', 'n-washington', 'John Ball' ] }
  { course_name: 'Python for Stock Market Analysis',
    students_name: [ 'David.A', 'T.P.', 'John Ball' ] }
  { course_name: 'Advanced Deep Learning',
    students_name: [ 'Christy', 'David.A', 'n-washington', 'Stephanie' ] }
```

(2): Showing frequency of organizations of each course (_id shows course name below)

> db.course.aggregate([
{$lookup: {from: "user", localField: "course_id", foreignField: "enroll_course_id", as: "Number of learners"}},
{$project: {_id: 0, course_name: "$name", students_organization: "$Number of learners.organization"}}, {$unwind: "$students_organization"},
{$group: {_id: {course: "$course_name", organization: "$students_organization"}, count: {$sum: 1}}},
{$group: {_id: "$_id.course", freq_organization: {$push: {name: "$_id.organization", count: "$count"}}}}
])

{ _id: 'Structured Database Design', freq_organization: [{ name: 'York University', count: 1 }] }
{ _id: 'Advanced Machine Learning', freq_organization: [{ name: 'AAA Corporation', count: 1 }, { name: 'Ottawa University', count: 1 }] }
{ _id: 'Financial Economics', freq_organization: [{ name: 'AAA Corporation', count: 1 }, { name: 'Ottawa University', count: 2 }, { name: 'Seneca College', count: 1 }] }
{ _id: 'Mathematics for Data Science', freq_organization: [{ name: 'Ottawa University', count: 1 }, { name: 'Seneca College', count: 1 }, { name: 'BBB Corporation', count: 1 }] }
{ _id: 'Excel Skills for Business', freq_organization: [{ name: 'BBB Corporation', count: 1 }, { name: 'Ottawa University', count: 1 }] }
{ _id: 'Python for Stock Market Analysis', freq_organization: [{ name: 'AAA Corporation', count: 1 }, { name: 'Ottawa University', count: 2 }] }
{ _id: 'Introduction of Data Science', freq_organization: [{ name: 'Seneca College', count: 2 }, { name: 'York University', count: 1 }] }

{ _id: 'Introduction of Python', freq_organization: [{ name: 'York University', count: 1 }, { name: 'Ottawa University', count: 1 }, { name: 'Seneca College', count: 1 }] }
{ _id: 'Advanced Deep Learning', freq_organization: [{ name: 'York University', count: 1 }, { name: 'BBB Corporation', count: 1 }, { name: 'Seneca College', count: 1 }, { name: 'AAA Corporation', count: 1 }] }
{ _id: 'Advanced Database Design', freq_organization: [{ name: 'BBB Corporation', count: 1 }, { name: 'Seneca College', count: 2 }] }

```
> db.course.aggregate([
    {$lookup: {from: "user", localField: "course_id", foreignField: "enroll_course_id", as: "Number of learners"}},
    {$project: {_id: 0, course_name: "$name", students_organization: "$Number of learners.organization"}},
    {$unwind: "$students_organization"},
    {$group: {_id: {course: "$course_name", organization: "$students_organization"}, count: {$sum: 1}}},
    {$group: {_id: "$_id.course", freq_organization: {$push: {name: "$_id.organization", count: "$count"}}}}
  ])
< { _id: 'Structured Database Design',
    freq_organization: [ { name: 'York University', count: 1 } ] }
  { _id: 'Advanced Machine Learning',
    freq_organization:
     [ { name: 'AAA Corporation', count: 1 },
       { name: 'Ottawa University', count: 1 } ] }
  { _id: 'Financial Economics',
    freq_organization:
     [ { name: 'AAA Corporation', count: 1 },
       { name: 'Ottawa University', count: 2 },
       { name: 'Seneca College', count: 1 } ] }
  { _id: 'Mathematics for Data Science',
    freq_organization:
     [ { name: 'Ottawa University', count: 1 },
       { name: 'Seneca College', count: 1 },
       { name: 'BBB Corporation', count: 1 } ] }
  { _id: 'Excel Skills for Business',
    freq_organization:
     [ { name: 'BBB Corporation', count: 1 },
       { name: 'Ottawa University', count: 1 } ] }
```

```
  { _id: 'Python for Stock Market Analysis',
    freq_organization:
     [ { name: 'AAA Corporation', count: 1 },
       { name: 'Ottawa University', count: 2 } ] }
  { _id: 'Introduction of Data Science',
    freq_organization:
     [ { name: 'Seneca College', count: 2 },
       { name: 'York University', count: 1 } ] }
  { _id: 'Introduction of Python',
    freq_organization:
     [ { name: 'York University', count: 1 },
       { name: 'Ottawa University', count: 1 },
       { name: 'Seneca College', count: 1 } ] }
  { _id: 'Advanced Deep Learning',
    freq_organization:
     [ { name: 'York University', count: 1 },
       { name: 'BBB Corporation', count: 1 },
       { name: 'Seneca College', count: 1 },
       { name: 'AAA Corporation', count: 1 } ] }
  { _id: 'Advanced Database Design',
    freq_organization:
     [ { name: 'BBB Corporation', count: 1 },
       { name: 'Seneca College', count: 2 } ] }
```

(3): Retrieve course names with their instructors' information:

> db.course.aggregate(

... {$lookup: {from: "instructor", localField: "course_id", foreignField: "teach_course_id", as: "course_name"}},

... {$project: {_id: 0, course_name: "$name", instructor_name: "$course_name"}})

{ "course_name" : "Introduction of Data Science", "instructor_name" : [{ "_id" : ObjectId("636d87d456cccbb4a3350e0e"), "name" : "Kristie Osborne", "comment" : "Kristie is a professor in the data science and analysis field.", "account_id" : 9, "teach_course_id" : [100, 104, 109] }] }

{ "course_name" : "Structured Database Design", "instructor_name" : [{ "_id" : ObjectId("636d87d456cccbb4a3350e0f"), "name" : "Paris", "comment" : "Paris is a researcher in computer science and has experienced database manager in company.", "account_id" : 10, "teach_course_id" : [101, 102] }] }

{ "course_name" : "Advanced Database Design", "instructor_name" : [{ "_id" : ObjectId("636d87d456cccbb4a3350e0f"), "name" : "Paris", "comment" : "Paris is a researcher in computer science and has experienced database manager in company.", "account_id" : 10, "teach_course_id" : [101, 102] }] }

{ "course_name" : "Advanced Machine Learning", "instructor_name" : [{ "_id" : ObjectId("636d87d456cccbb4a3350e11"), "name" : "Norbert", "comment" : "Nobert is familiar with data science and stock market.", "account_id" : 12, "teach_course_id" : [103, 106, 108] }] }

{ "course_name" : "Introduction of Python", "instructor_name" : [{ "_id" : ObjectId("636d87d456cccbb4a3350e0e"), "name" : "Kristie Osborne", "comment" : "Kristie is a professor in the data science and analysis field.", "account_id" : 9, "teach_course_id" : [100, 104, 109] }] }

{ "course_name" : "Financial Economics", "instructor_name" : [{ "_id" : ObjectId("636d87d456cccbb4a3350e10"), "name" : "Alec Underwood", "comment" : "Alec is a professor in the finance and the statistics field.", "account_id" : 11, "teach_course_id" : [105, 107] }, { "_id" : ObjectId("636d87d456cccbb4a3350e12"), "name" : "Sandy Mcbride", "comment" : "Sandy is teaching finance in Toronto University for more than 15 years.", "account_id" : 13, "teach_course_id" : [105] }] }

{ "course_name" : "Excel Skills for Business", "instructor_name" : [{ "_id" : ObjectId("636d87d456cccbb4a3350e11"), "name" : "Norbert", "comment" : "Nobert is familiar with data science and stock market.", "account_id" : 12, "teach_course_id" : [103, 106, 108] }] }

{ "course_name" : "Mathematics for Data Science", "instructor_name" : [{ "_id" : ObjectId("636d87d456cccbb4a3350e10"), "name" : "Alec Underwood", "comment" : "Alec is a professor in the finance and the statistics field.", "account_id" : 11, "teach_course_id" : [105, 107] }] }

{ "course_name" : "Python for Stock Market Analysis", "instructor_name" : [{ "_id" : ObjectId("636d87d456cccbb4a3350e11"), "name" : "Norbert", "comment" : "Nobert is familiar with data science and stock market.", "account_id" : 12, "teach_course_id" : [103, 106, 108] }] }

{ "course_name" : "Advanced Deep Learning", "instructor_name" : [{ "_id" :
ObjectId("636d87d456cccbb4a3350e0e"), "name" : "Kristie Osborne", "comment" : "Kristie is a
professor in the data science and analysis field.", "account_id" : 9, "teach_course_id" : [100, 104, 109] }
] }

```
>
> db.course.aggregate(
... {$lookup: {from: "instructor", localField: "course_id", foreignField: "teach_course_id", as: "course_name"}},
... {$project: {_id: 0, course_name: "$name", instructor_name: "$course_name"}})
{ "course_name" : "Introduction of Data Science", "instructor_name" : [ { "_id" : ObjectId("636d87d456cccbb4a3350e0e"),
 "name" : "Kristie Osborne", "comment" : "Kristie is a professor in the data science and analysis field.", "account_id"
 : 9, "teach_course_id" : [ 100, 104, 109 ] } ] }
{ "course_name" : "Structured Database Design", "instructor_name" : [ { "_id" : ObjectId("636d87d456cccbb4a3350e0f"), "
name" : "Paris", "comment" : "Paris is a researcher in computer science and has experienced database manager in company
.", "account_id" : 10, "teach_course_id" : [ 101, 102 ] } ] }
{ "course_name" : "Advanced Database Design", "instructor_name" : [ { "_id" : ObjectId("636d87d456cccbb4a3350e0f"), "na
me" : "Paris", "comment" : "Paris is a researcher in computer science and has experienced database manager in company."
, "account_id" : 10, "teach_course_id" : [ 101, 102 ] } ] }
{ "course_name" : "Advanced Machine Learning", "instructor_name" : [ { "_id" : ObjectId("636d87d456cccbb4a3350e11"), "n
ame" : "Norbert", "comment" : "Nobert is familiar with data science and stock market.", "account_id" : 12, "teach_cours
e_id" : [ 103, 106, 108 ] } ] }
{ "course_name" : "Introduction of Python", "instructor_name" : [ { "_id" : ObjectId("636d87d456cccbb4a3350e0e"), "name
" : "Kristie Osborne", "comment" : "Kristie is a professor in the data science and analysis field.", "account_id" : 9,
"teach_course_id" : [ 100, 104, 109 ] } ] }
{ "course_name" : "Financial Economics", "instructor_name" : [ { "_id" : ObjectId("636d87d456cccbb4a3350e10"), "name" :
 "Alec Underwood", "comment" : "Alec is a professor in the finance and the statistics field.", "account_id" : 11, "teac
h_course_id" : [ 105, 107 ] }, { "_id" : ObjectId("636d87d456cccbb4a3350e12"), "name" : "Sandy Mcbride", "comment" : "S
andy is teaching finance in Toronto University for more than 15 years.", "account_id" : 13, "teach_course_id" : [ 105 ]
 } ] }
{ "course_name" : "Excel Skills for Business", "instructor_name" : [ { "_id" : ObjectId("636d87d456cccbb4a3350e11"), "n
ame" : "Norbert", "comment" : "Nobert is familiar with data science and stock market.", "account_id" : 12, "teach_cours
e_id" : [ 103, 106, 108 ] } ] }
{ "course_name" : "Mathematics for Data Science", "instructor_name" : [ { "_id" : ObjectId("636d87d456cccbb4a3350e10"),
 "name" : "Alec Underwood", "comment" : "Alec is a professor in the finance and the statistics field.", "account_id" :
11, "teach_course_id" : [ 105, 107 ] } ] }
{ "course_name" : "Python for Stock Market Analysis", "instructor_name" : [ { "_id" : ObjectId("636d87d456cccbb4a3350e1
1"), "name" : "Norbert", "comment" : "Nobert is familiar with data science and stock market.", "account_id" : 12, "teac
h_course_id" : [ 103, 106, 108 ] } ] }
{ "course_name" : "Advanced Deep Learning", "instructor_name" : [ { "_id" : ObjectId("636d87d456cccbb4a3350e0e"), "name
" : "Kristie Osborne", "comment" : "Kristie is a professor in the data science and analysis field.", "account_id" : 9,
"teach_course_id" : [ 100, 104, 109 ] } ] }
```

(4): Retrieve all users who take 'Structured Database Design'. (Showing all courses of each user)

```
> db.user.aggregate(
 {$lookup: {from: "course", localField: "enroll_course_id", foreignField: "course_id", as:
"Course_info"}},
 {$project: {_id: 0, user_name: "$name", enroll_courses: "$Course_info.name"}},
 {$match: {enroll_courses: {'$in': ['Structured Database Design']}}})
```

```
{ user_name: 'Stephanie',
 enroll_courses:
  [ 'Introduction of Data Science',
    'Structured Database Design',
    'Introduction of Python',
    'Advanced Deep Learning' ] }
```

```
> db.user.aggregate(
    {$lookup: {from: "course", localField: "enroll_course_id", foreignField: "course_id", as: "Course_info"}},
    {$project: {_id: 0, user_name: "$name", enroll_courses: "$Course_info.name"}},
    {$match: {enroll_courses: {'$in': ['Structured Database Design']}}})
< { user_name: 'Stephanie',
    enroll_courses:
     [ 'Introduction of Data Science',
       'Structured Database Design',
       'Introduction of Python',
       'Advanced Deep Learning' ] }
```

(5) Showing the frequency of the categories (skills related to the course) of each user.
(Each course has multiple categories or skills. The purpose of the codes below is to show what categories each user is interested in and how many categories each user has; the bigger the frequency of a specific category in each user, the more interested each user is.)

> db.user.aggregate(
 {$lookup: {from: "course", localField: "enroll_course_id", foreignField: "course_id", as: "Courses"}},
 {$project: {_id: 0, user_name: "$name", interest_categories: '$Courses.categories'}},
 {$unwind: "$interest_categories"},
 {$unwind: "$interest_categories"},
 {$group: {_id: {user_name: "$user_name", category:"$interest_categories.name"}, count: {"$sum": 1}}},
 {$group: {_id: "$_id.user_name", freq_categories: {$push: {name: "$_id.category", count: '$count'}}}}
)

{ _id: 'David.A',
 freq_categories:
  [{ name: 'Data Analysis', count: 1 }, { name: 'Statistics', count: 1 }, { name: 'Finance', count: 2 }, { name: 'Deep Learning', count: 2 }, { name: 'Python', count: 2 }, { name: 'Data Science', count: 1 }, { name: 'Stock Market', count: 2 }, { name: 'Machine Learning', count: 2 }, { name: 'Economics', count: 1 }] }

{ _id: 'John Ball',
 freq_categories:
  [{ name: 'Data Analysis', count: 1 }, { name: 'Deep Learning', count: 1 }, { name: 'Machine Learning', count: 1 }, { name: 'Stock Market', count: 2 }, { name: 'Data Science', count: 2 }, { name: 'Finance', count: 2 }, { name: 'Python', count: 2 }, { name: 'Statistics', count: 1 }, { name: 'Economics', count: 1 }, { name: 'Mathematics', count: 1 }] }

{ _id: 'JM',
 freq_categories:
  [{ name: 'Statistics', count: 1 }, { name: 'Python', count: 1 }, { name: 'Database', count: 1 }, { name: 'Data Analysis', count: 2 }, { name: 'Data Science', count: 2 }, { name: 'Programming', count: 1 }, { name: 'NoSQL', count: 1 }, { name: 'Machine Learning', count: 1 }, { name: 'Mathematics', count: 1 }] }

{ _id: 'Ran Arino',
  freq_categories:
   [{ name: 'Programming', count: 1 }, { name: 'Machine Learning', count: 1 }, { name: 'Statistics', count: 1 }, { name: 'Stock Market', count: 1 }, { name: 'Data Analysis', count: 2 }, { name: 'Database', count: 1 }, { name: 'NoSQL', count: 1 }, { name: 'Finance', count: 1 }, { name: 'Data Science', count: 1 }, { name: 'Economics', count: 1 }]] }

{ _id: 'Christy',
  freq_categories:
   [{ name: 'Computer Science', count: 1 }, { name: 'Deep Learning', count: 1 }, { name: 'Python', count: 2 }, { name: 'Programming', count: 1 }, { name: 'Machine Learning', count: 1 }]] }

{ _id: 'n-washington',
  freq_categories:
   [{ name: 'Python', count: 2 }, { name: 'Deep Learning', count: 1 }, { name: 'Excel', count: 1 }, { name: 'Database', count: 1 }, { name: 'Data Analysis', count: 2 }, { name: 'NoSQL', count: 1 }, { name: 'Mathematics', count: 1 }, { name: 'Data Science', count: 1 }, { name: 'Programming', count: 1 }, { name: 'Machine Learning', count: 1 }]] }

{ _id: 'T.P.',
  freq_categories:
   [{ name: 'Computer Science', count: 1 }, { name: 'Economics', count: 1 }, { name: 'Finance', count: 2 }, { name: 'Excel', count: 1 }, { name: 'Programming', count: 1 }, { name: 'Stock Market', count: 2 }, { name: 'Data Analysis', count: 1 }, { name: 'Python', count: 2 }]] }

{ _id: 'Stephanie',
  freq_categories:
   [{ name: 'SQL', count: 1 }, { name: 'Machine Learning', count: 2 }, { name: 'Data Science', count: 1 }, { name: 'Statistics', count: 1 }, { name: 'Python', count: 2 }, { name: 'Database', count: 1 }, { name: 'Data Analysis', count: 2 }, { name: 'Database Management System', count: 1 }, { name: 'Programming', count: 1 }, { name: 'Computer Science', count: 1 }, { name: 'Deep Learning', count: 1 }]] }

```
> db.user.aggregate(
    {$lookup: {from: "course", localField: "enroll_course_id", foreignField: "course_id", as: "Courses"}},
    {$project: {_id: 0, user_name: "$name", interest_categories: '$Courses.categories'}},
    {$unwind: "$interest_categories"},
    {$unwind: "$interest_categories"},
    {$group: {_id: {user_name: "$user_name", category:"$interest_categories.name"}, count: {"$sum": 1}}},
    {$group: {_id: "$_id.user_name", freq_categories: {$push: {name: "$_id.category", count: '$count'}}}}
  )
< { _id: 'David.A',
    freq_categories:
     [ { name: 'Data Analysis', count: 1 },
       { name: 'Statistics', count: 1 },
       { name: 'Finance', count: 2 },
       { name: 'Deep Learning', count: 2 },
       { name: 'Python', count: 2 },
       { name: 'Data Science', count: 1 },
       { name: 'Stock Market', count: 2 },
       { name: 'Machine Learning', count: 2 },
       { name: 'Economics', count: 1 } ] }
  { _id: 'John Ball',
    freq_categories:
     [ { name: 'Data Analysis', count: 1 },
       { name: 'Deep Learning', count: 1 },
       { name: 'Machine Learning', count: 1 },
       { name: 'Stock Market', count: 2 },
```

```
       { name: 'Data Science', count: 2 },
       { name: 'Finance', count: 2 },
       { name: 'Python', count: 2 },
       { name: 'Statistics', count: 1 },
       { name: 'Economics', count: 1 },
       { name: 'Mathematics', count: 1 } ] }
  { _id: 'JM',
    freq_categories:
     [ { name: 'Statistics', count: 1 },
       { name: 'Python', count: 1 },
       { name: 'Database', count: 1 },
       { name: 'Data Analysis', count: 2 },
       { name: 'Data Science', count: 2 },
       { name: 'Programming', count: 1 },
       { name: 'NoSQL', count: 1 },
       { name: 'Machine Learning', count: 1 },
       { name: 'Mathematics', count: 1 } ] }
  { _id: 'Ran Arino',
    freq_categories:
     [ { name: 'Programming', count: 1 },
       { name: 'Machine Learning', count: 1 },
       { name: 'Statistics', count: 1 },
       { name: 'Stock Market', count: 1 },
       { name: 'Data Analysis', count: 2 },
```

```
    { name: 'Database', count: 1 },
    { name: 'NoSQL', count: 1 },
    { name: 'Finance', count: 1 },
    { name: 'Data Science', count: 1 },
    { name: 'Economics', count: 1 } ] }
  { _id: 'Christy',
    freq_categories:
     [ { name: 'Computer Science', count: 1 },
       { name: 'Deep Learning', count: 1 },
       { name: 'Python', count: 2 },
       { name: 'Programming', count: 1 },
       { name: 'Machine Learning', count: 1 } ] }
  { _id: 'n-washington',
    freq_categories:
     [ { name: 'Python', count: 2 },
       { name: 'Deep Learning', count: 1 },
       { name: 'Excel', count: 1 },
       { name: 'Database', count: 1 },
       { name: 'Data Analysis', count: 2 },
       { name: 'NoSQL', count: 1 },
       { name: 'Mathematics', count: 1 },
       { name: 'Data Science', count: 1 },
       { name: 'Programming', count: 1 },
       { name: 'Machine Learning', count: 1 } ] }
```

```
  { _id: 'T.P.',
    freq_categories:
     [ { name: 'Computer Science', count: 1 },
       { name: 'Economics', count: 1 },
       { name: 'Finance', count: 2 },
       { name: 'Excel', count: 1 },
       { name: 'Programming', count: 1 },
       { name: 'Stock Market', count: 2 },
       { name: 'Data Analysis', count: 1 },
       { name: 'Python', count: 2 } ] }
  { _id: 'Stephanie',
    freq_categories:
     [ { name: 'SQL', count: 1 },
       { name: 'Machine Learning', count: 2 },
       { name: 'Data Science', count: 1 },
       { name: 'Statistics', count: 1 },
       { name: 'Python', count: 2 },
       { name: 'Database', count: 1 },
       { name: 'Data Analysis', count: 2 },
       { name: 'Database Management System', count: 1 },
       { name: 'Programming', count: 1 },
       { name: 'Computer Science', count: 1 },
       { name: 'Deep Learning', count: 1 } ] }
```

(6): How many minutes will each user need to study to complete all enrolling courses?

```
> db.user.aggregate(
  {$lookup: {from: "course", localField: "enroll_course_id", foreignField: "course_id", as: "Courses"}},
  {$project: {_id: 0, user_name: "$name", estimated_time_of_study: {"$sum":
"$Courses.estimate_time"}}}
 )
```

{ user_name: 'Ran Arino', estimated_time_of_study: 250 }
{ user_name: 'Christy', estimated_time_of_study: 150 }
{ user_name: 'JM', estimated_time_of_study: 220 }
{ user_name: 'David.A', estimated_time_of_study: 390 }
{ user_name: 'n-washington', estimated_time_of_study: 295 }
{ user_name: 'Stephanie', estimated_time_of_study: 280 }
{ user_name: 'T.P.', estimated_time_of_study: 345 }
{ user_name: 'John Ball', estimated_time_of_study: 420 }

(7) Retrieve all the user who are taking course id 108.

> db.user.aggregate ([{$lookup: {from: 'course', pipeline: [{$match: { course_id: 108}}], as: 'Traders'}}])

{ "_id" : ObjectId("636d8c3d81faa9b11cc506d0"), "name" : "Ran Arino", "organization" : "Seneca College", "account_id" : 1, "enroll_course_id" : [100, 102, 105], "Traders" : [ ] }

{ "_id" : ObjectId("636d8c3d81faa9b11cc506d1"), "name" : "Christy", "organization" : "Seneca College", "account_id" : 2, "enroll_course_id" : [104, 109], "Traders" : [ ] }

{ "_id" : ObjectId("636d8c3d81faa9b11cc506d2"), "name" : "JM", "organization" : "Seneca College", "account_id" : 3, "enroll_course_id" : [100, 102, 107], "Traders" : [ ] }

{ "_id" : ObjectId("636d8c3d81faa9b11cc506d3"), "name" : "David.A", "organization" : "AAA Corporation", "account_id" : 4, "enroll_course_id" : [103, 105, 108, 109], "Traders" : [ ] }

{ "_id" : ObjectId("636d8c3d81faa9b11cc506d4"), "name" : "n-washington", "organization" : "BBB Corporation", "account_id" : 5, "enroll_course_id" : [102, 106, 107, 109], "Traders" : [ ] }

{ "_id" : ObjectId("636d8c3d81faa9b11cc506d5"), "name" : "Stephanie", "organization" : "York University", "account_id" : 6, "enroll_course_id" : [100, 101, 104, 109], "Traders" : [ ] }

{ "_id" : ObjectId("636d8c3d81faa9b11cc506d6"), "name" : "T.P.", "organization" : "Ottawa University", "account_id" : 7, "enroll_course_id" : [104, 105, 106, 108], "Traders" : [ ] }

{ "_id" : ObjectId("636d8c3d81faa9b11cc506d7"), "name" : "John Ball", "organization" : "Ottawa University", "account_id" : 8, "enroll_course_id" : [103, 105, 107, 108], "Traders" : [ ] }

(8) Retrieve all the courses' name that are offered at the level of beginner.

> db.course.aggregate([{ $match : { level : 'Beginner' } }, { $unwind : '$categories' }, { $project : { _id : 0, 'categories.name' : 1} }])

{ name: 'Introduction of Data Science' }
{ name: 'Structured Database Design' }
{ name: 'Introduction of Python' }
{ name: 'Excel Skills for Business' }

```
> db.course.aggregate([{ $match : { level : 'Beginner' } }, { $project : { _id : 0, 'name' : 1} }])
< { name: 'Introduction of Data Science' }
  { name: 'Structured Database Design' }
  { name: 'Introduction of Python' }
  { name: 'Excel Skills for Business' }
```

(9) Retrieve all ids of the enrolled courses for the user with the name Ran Arino.

> **db.user.aggregate([{$unwind: "$enroll_course_id"}, {$match:{ "name": "Ran Arino"}}])**

{ "_id" : ObjectId("636d8c3d81faa9b11cc506d0"), "name" : "Ran Arino", "organization" : "Seneca College", "account_id" : 1, "enroll_course_id" : 100 }

{ "_id" : ObjectId("636d8c3d81faa9b11cc506d0"), "name" : "Ran Arino", "organization" : "Seneca College", "account_id" : 1, "enroll_course_id" : 102 }

{ "_id" : ObjectId("636d8c3d81faa9b11cc506d0"), "name" : "Ran Arino", "organization" : "Seneca College", "account_id" : 1, "enroll_course_id" : 105 }

{ "_id" : ObjectId("636db7a9fd8b7e53677759f5"), "name" : "Ran Arino", "organization" : "Seneca College", "account_id" : 1, "enroll_course_id" : 100 }

{ "_id" : ObjectId("636db7a9fd8b7e53677759f5"), "name" : "Ran Arino", "organization" : "Seneca College", "account_id" : 1, "enroll_course_id" : 102 }

{ "_id" : ObjectId("636db7a9fd8b7e53677759f5"), "name" : "Ran Arino", "organization" : "Seneca College", "account_id" : 1, "enroll_course_id" : 105 }

```
> db.user.aggregate([{$unwind: "$enroll_course_id"}, {$match:{ "name": "Ran Arino"}}])
{ "_id" : ObjectId("636d8c3d81faa9b11cc506d0"), "name" : "Ran Arino", "organization" : "Seneca College", "account_id" : 1, "enroll_course_id" : 100 }
{ "_id" : ObjectId("636d8c3d81faa9b11cc506d0"), "name" : "Ran Arino", "organization" : "Seneca College", "account_id" : 1, "enroll_course_id" : 102 }
{ "_id" : ObjectId("636d8c3d81faa9b11cc506d0"), "name" : "Ran Arino", "organization" : "Seneca College", "account_id" : 1, "enroll_course_id" : 105 }
{ "_id" : ObjectId("636db7a9fd8b7e53677759f5"), "name" : "Ran Arino", "organization" : "Seneca College", "account_id" : 1, "enroll_course_id" : 100 }
{ "_id" : ObjectId("636db7a9fd8b7e53677759f5"), "name" : "Ran Arino", "organization" : "Seneca College", "account_id" : 1, "enroll_course_id" : 102 }
{ "_id" : ObjectId("636db7a9fd8b7e53677759f5"), "name" : "Ran Arino", "organization" : "Seneca College", "account_id" : 1, "enroll_course_id" : 105 }
```

(10). Concatenate the first name and last name as a one single attribute as name.

> **db.linkedin_account.aggregate({$project:{Name:{$concat:["$first_name"," ","$last_name"]}}})**

{ "_id" : ObjectId("636d8bf081faa9b11cc506c3"), "Name" : "Ran Arino" }

{ "_id" : ObjectId("636d8bf081faa9b11cc506c4"), "Name" : "Christy Collins" }

{ "_id" : ObjectId("636d8bf081faa9b11cc506c5"), "Name" : "Jonathan Mcdaniel" }

{ "_id" : ObjectId("636d8bf081faa9b11cc506c6"), "Name" : "David Abbott" }

{ "_id" : ObjectId("636d8bf081faa9b11cc506c7"), "Name" : "Natalie Washington" }

{ "_id" : ObjectId("636d8bf081faa9b11cc506c8"), "Name" : "Stephanie Richmond" }

{ "_id" : ObjectId("636d8bf081faa9b11cc506c9"), "Name" : "Terri Parker" }

{ "_id" : ObjectId("636d8bf081faa9b11cc506ca"), "Name" : "John Ball" }

{ "_id" : ObjectId("636d8bf081faa9b11cc506cb"), "Name" : "Kristie Osborne" }

{ "_id" : ObjectId("636d8bf081faa9b11cc506cc"), "Name" : "Paris Byrd" }

{ "_id" : ObjectId("636d8bf081faa9b11cc506cd"), "Name" : "Alec Underwood" }

{ "_id" : ObjectId("636d8bf081faa9b11cc506ce"), "Name" : "Norbert Patel" }

{ "_id" : ObjectId("636d8bf081faa9b11cc506cf"), "Name" : "Sandy Mcbride" }

```
> db.linkedin_account.aggregate({$project:{Name:{$concat:["$first_name"," ","$last_name"]}}})
{ "_id" : ObjectId("636d8bf081faa9b11cc506c3"), "Name" : "Ran Arino" }
{ "_id" : ObjectId("636d8bf081faa9b11cc506c4"), "Name" : "Christy Collins" }
{ "_id" : ObjectId("636d8bf081faa9b11cc506c5"), "Name" : "Jonathan Mcdaniel" }
{ "_id" : ObjectId("636d8bf081faa9b11cc506c6"), "Name" : "David Abbott" }
{ "_id" : ObjectId("636d8bf081faa9b11cc506c7"), "Name" : "Natalie Washington" }
{ "_id" : ObjectId("636d8bf081faa9b11cc506c8"), "Name" : "Stephanie Richmond" }
{ "_id" : ObjectId("636d8bf081faa9b11cc506c9"), "Name" : "Terri Parker" }
{ "_id" : ObjectId("636d8bf081faa9b11cc506ca"), "Name" : "John Ball" }
{ "_id" : ObjectId("636d8bf081faa9b11cc506cb"), "Name" : "Kristie Osborne" }
{ "_id" : ObjectId("636d8bf081faa9b11cc506cc"), "Name" : "Paris Byrd" }
{ "_id" : ObjectId("636d8bf081faa9b11cc506cd"), "Name" : "Alec Underwood" }
{ "_id" : ObjectId("636d8bf081faa9b11cc506ce"), "Name" : "Norbert Patel" }
{ "_id" : ObjectId("636d8bf081faa9b11cc506cf"), "Name" : "Sandy Mcbride" }
>
```

6. Updating and deleting database content

(1): We want to update instructor with name Sandy Mcbride with Elnaz Delpisheh in all databases.

> db.instructor.update({'name': 'Sandy Mcbride'},{$set:{'name':'Elnaz Delpisheh'}},{multi:true})

WriteResult({ "nMatched" : 2, "nUpserted" : 0, "nModified" : 2 })

```
> db.instructor.update({'name': 'Sandy Mcbride'},{$set:{'name':'Elnaz Delpisheh'}},{multi:true})
WriteResult({ "nMatched" : 2, "nUpserted" : 0, "nModified" : 2 })
>
```

(2): Change an comment of an instructor "Kristie Osborne".

> db.instructor.update({name: "Kristie Osborne"}, {$set: { comment: " Kiristie is very professional" }})

WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })

```
> db.instructor.update({name: "Kristie Osborne"}, {$set: { comment: " Kiristie is very professional" }})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
>
```

(3): We want to update the University of the user with name John Ball.

> **db.user.update({name: "John Ball"},{$set:{ organization: "Toronto University"}},{multi:true})**

WriteResult({ "nMatched" : 2, "nUpserted" : 0, "nModified" : 2 })

```
> db.user.update({name: "John Ball"},{$set:{ organization: "Toronto University"}},{multi:true})
WriteResult({ "nMatched" : 2, "nUpserted" : 0, "nModified" : 2 })
```

(4): We want to update the graduate date of the user with first name Christy.

> **db.linkedin_account.update({first_name: "Christy"},{$set:{ graduate_date: "2025-09-25"}})**

WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })

```
C:\Program Files\MongoDB\Server\5.0\bin\mongo.exe
> db.linkedin_account.update({first_name: "Christy"},{$set:{ graduate_date: "2025-09-25"}})
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
>
```

(5): we removed the account id 1 in the LinkedIn collection.

> **db.linkedin_account.remove({account_id:1})**

WriteResult({ "nRemoved" : 2 })

```
> db.linkedin_account.remove({account_id:1})
WriteResult({ "nRemoved" : 2 })
>
```

(6): we removed the user with name Stephanie from collection user.

> **db.user.remove({name: "Stephanie"})**

WriteResult({ "nRemoved" : 2 })

```
> db.user.remove({name: "Stephanie"})
WriteResult({ "nRemoved" : 2 })
>
```

(7): I removed the instructor with the name Paris from collection instructor.

> **db.instructor.remove({name: "Paris"})**

WriteResult({ "nRemoved" : 2 })

```
> db.instructor.remove({name: "Paris"})
WriteResult({ "nRemoved" : 2 })
>
```

<u>(8): I removed the course with name Structured Database Design from collection course.</u>

> db.course.remove({name: "Structured Database Design"})

WriteResult({ "nRemoved" : 2})

```
> db.course.remove({name: "Structured Database Design"})
WriteResult({ "nRemoved" : 2 })
>
```

<u>(9): Drop the database in the end.</u>

> use project

> db.dropDatabase()
{ ok: 1, dropped: 'project' }

```
> use project
< 'switched to db project'
> db.dropDatabase()
< { ok: 1, dropped: 'project' }
project >
```