Assignment 5

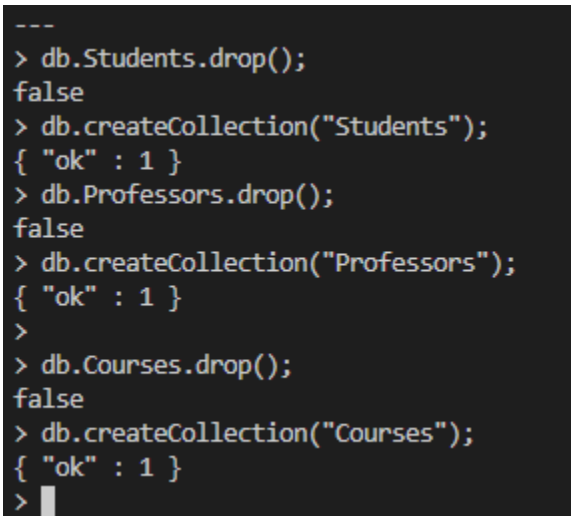
CPS610 – Database 2
Wednesday Section – Group 13
Member #1: Andy Lee (500163559)
Member #2: Sohrab Soltani (500801172)

Contents

Introduction

In this assignment, we build a simple database using MongoDB according to the assignment instructions.

Q1. Create 3 collections



Q2. Insert 10 students to Students collection.

```
> db.Students.insert({
...     StudentNo: 800587121,
...     StudentFirstName: "Andy",
...     StudentLastName: "Lee",
...     Degree: "B.Sc.",
...     Faculty: "Science",
...     GPA: 4.31,
...     Enrolled: [
...       {
...         CourseNo: "CPS 109",
...         ProfFirstName: "Ilkka",
...         ProfLastName: "Kokkarinen",
...         Term: "2015-03",
...       },
...       {
...         CourseNo: "CPS 209",
...         ProfFirstName: "Ilkka",
...         ProfLastName: "Kokkarinen",
...         Term: "2019-01",
...       },
...     ],
... });
WriteResult({ "nInserted" : 1 })
>
> db.Students.insert({
...     StudentNo: 800587122,
...     StudentFirstName: "Sohrab",
...     StudentLastName: "Soltani",
...     Degree: "B.Sc.",
...     Faculty: "Science",
...     GPA: 4.22,
...     Enrolled: [
...       {
...         CourseNo: "CPS 213",
...         ProfFirstName: "Alex",
...         ProfLastName: "Ufkes",
...         Term: "2016-03",
...       },
...       {
...         CourseNo: "CPS 310",
...         ProfFirstName: "Alex",
...         ProfLastName: "Ufkes",
...         Term: "2017-01",
...       },
...     ],
... });
WriteResult({ "nInserted" : 1 })
```

```
> db.Students.insert({
...     StudentNo: 800587123,
...     StudentFirstName: "John",
...     StudentLastName: "Smith",
...     Degree: "B.Sc.",
...     Faculty: "Science",
...     GPA: 3.15,
...     Enrolled: [
...       {
...         CourseNo: "MTH 110",
...         ProfFirstName: "Kunquan",
...         ProfLastName: "Lan",
...         Term: "2005-03",
...       },
...       {
...         CourseNo: "MTH 207",
...         ProfFirstName: "Dzung Minh",
...         ProfLastName: "Ha",
...         Term: "2006-01",
...       },
...     ],
... });
WriteResult({ "nInserted" : 1 })
>
> db.Students.insert({
...     StudentNo: 800587124,
...     StudentFirstName: "Jane",
...     StudentLastName: "Smith",
...     Degree: "B.Sc.",
...     Faculty: "Science",
...     GPA: 1.12,
...     Enrolled: [
...       {
...         CourseNo: "CPS 412",
...         ProfFirstName: "Muhammad Naeem",
...         ProfLastName: "Irfan",
...         Term: "2013-03",
...       },
...       {
...         CourseNo: "BLG 143",
...         ProfFirstName: "Vadim",
...         ProfLastName: "Bostan",
...         Term: "2014-01",
...       },
...     ],
... });
WriteResult({ "nInserted" : 1 })
>
> db.Students.insert({
...     StudentNo: 800587125,
...     StudentFirstName: "Umberto",
...     StudentLastName: "Gonzales",
...     Degree: "B.Sc.",
...     Faculty: "Science",
...     GPA: 3.15,
...     Enrolled: [
...       {
...         CourseNo: "CPS 590",
...         ProfFirstName: "Alex",
...         ProfLastName: "Ufkes",
...         Term: "2011-03",
...       },
...       {
...         CourseNo: "CPS 420",
...         ProfFirstName: "Sophie",
...         ProfLastName: "Quigley",
...         Term: "2012-01",
...       },
...     ],
... });
WriteResult({ "nInserted" : 1 })
```

```
> db.Students.insert({
...     StudentNo: 800587126,
...     StudentFirstName: "Changying",
...     StudentLastName: "Chen",
...     Degree: "B.Sc.",
...     Faculty: "Science",
...     GPA: 4.32,
...     Enrolled: [
...       {
...         CourseNo: "CPS 721",
...         ProfFirstName: "Ilkka",
...         ProfLastName: "Kokkarinen",
...         Term: "2010-03",
...       },
...       {
...         CourseNo: "CPS 420",
...         ProfFirstName: "Sophie",
...         ProfLastName: "Quigley",
...         Term: "2011-01",
...       },
...     ],
... });
WriteResult({ "nInserted" : 1 })
>
> db.Students.insert({
...     StudentNo: 800587127,
...     StudentFirstName: "Merry",
...     StudentLastName: "Poppins",
...     Degree: "B.Sc.",
...     Faculty: "Science",
...     GPA: 1.0,
...     Enrolled: [
...       {
...         CourseNo: "CPS 633",
...         ProfFirstName: "Stewart",
...         ProfLastName: "DeWitt",
...         Term: "2009-03",
...       },
...       {
...         CourseNo: "CPS 510",
...         ProfFirstName: "Abdolreza",
...         ProfLastName: "Abhari",
...         Term: "2010-01",
...       },
...     ],
... });
WriteResult({ "nInserted" : 1 })
>
> db.Students.insert({
...     StudentNo: 800587128,
...     StudentFirstName: "Jack",
...     StudentLastName: "Sparrow",
...     Degree: "B.Sc.",
...     Faculty: "Science",
...     GPA: 0.7,
...     Enrolled: [
...       {
...         CourseNo: "CPS 706",
...         ProfFirstName: "Sattar",
...         ProfLastName: "Hussain",
...         Term: "2019-03",
...       },
...       {
...         CourseNo: "CPS 406",
...         ProfFirstName: "Nawar",
...         ProfLastName: "Hakeem",
...         Term: "2020-01",
...       },
...     ],
... });
WriteResult({ "nInserted" : 1 })
```

```
> db.Students.insert({
...     StudentNo: 800587129,
...     StudentFirstName: "Harry",
...     StudentLastName: "Potter",
...     Degree: "B.Sc.",
...     Faculty: "Science",
...     GPA: 2.7,
...     Enrolled: [
...       {
...         CourseNo: "CPS 393",
...         ProfFirstName: "Lester",
...         ProfLastName: "Hiraki",
...         Term: "2009-03",
...       },
...       {
...         CourseNo: "CMN 300",
...         ProfFirstName: "Minerva",
...         ProfLastName: "McGonagall",
...         Term: "2010-01",
...       },
...     ],
... });
WriteResult({ "nInserted" : 1 })
>
> db.Students.insert({
...     StudentNo: 800587130,
...     StudentFirstName: "Hermione",
...     StudentLastName: "Granger",
...     Degree: "B.Sc.",
...     Faculty: "Science",
...     GPA: 2.7,
...     Enrolled: [
...       {
...         CourseNo: "PCS 103",
...         ProfFirstName: "Severus",
...         ProfLastName: "Snape",
...         Term: "1998-03",
...       },
...       {
...         CourseNo: "CRM 100",
...         ProfFirstName: "Gilderoy",
...         ProfLastName: "Lockhart",
...         Term: "1999-01",
...       },
...     ],
... });
WriteResult({ "nInserted" : 1 })
```

Q3. Insert 5 professors into Profession collection

```
> db.Professors.insert(
...   {
...     ProfFirstName: "Ilkka",
...     ProfLastName: "Kokkarinen",
...     ProfPhone: "416-888-8881",
...     Faculty: "Science",
...     CanTeach: [
...       {
...         CourseNo: "CPS 109",
...         Term: "Fall 2021",
...         Preference: "CPS 209"
...       },
...       {
...         CourseNo: "CPS 209",
...         Term: "Fall 2021",
...         Preference: "CPS 721"
...       },
...     ],
...     Teaches: [
...       {
...         CourseNo: "CPS 721",
...         Term: "Winter 2021",
...       },
...       {
...         CourseNo: "CPS 616",
...         Term: "Winter 2021",
...       },
...     ],
... });
WriteResult({ "nInserted" : 1 })
>
>
> db.Professors.insert(
...   {
...     ProfFirstName: "Alex",
...     ProfLastName: "Ufkes",
...     ProfPhone: "416-888-8882",
...     Faculty: "Science",
...     CanTeach: [
...       {
...         CourseNo: "CPS 213",
...         Term: "Fall 2021",
...         Preference: "CPS 310"
...       },
...       {
...         CourseNo: "CPS 310",
...         Term: "Fall 2021",
...         Preference: "CPS 616"
...       },
...     ],
...     Teaches: [
...       {
...         CourseNo: "CPS 616",
...         Term: "Winter 2021",
...       },
...       {
...         CourseNo: "CPS 506",
...         Term: "Winter 2021",
...       },
...     ],
... });
WriteResult({ "nInserted" : 1 })
```

```
> db.Professors.insert(
...   {
...     ProfFirstName: "Kunquan",
...     ProfLastName: "Lan",
...     ProfPhone: "416-888-8883",
...     Faculty: "Mathematics",
...     CanTeach: [
...       {
...         CourseNo: "MTH 110",
...         Term: "Fall 2021",
...         Preference: "MTH 217"
...       },
...     ],
...     Teaches: [
...       {
...         CourseNo: "MTH 110",
...         Term: "Winter 2021",
...       },
...       {
...         CourseNo: "MTH 217",
...         Term: "Winter 2021",
...       },
...     ],
... });
WriteResult({ "nInserted" : 1 })
>
>
>
> db.Professors.insert(
...   {
...     ProfFirstName: "Sophie",
...     ProfLastName: "Quigley",
...     ProfPhone: "416-888-8884",
...     Faculty: "Science",
...     CanTeach: [
...       {
...         CourseNo: "CPS 420",
...         Term: "Fall 2021",
...         Preference: "CPS 721"
...       },
...     ],
...     Teaches: [
...       {
...         CourseNo: "MTH 420",
...         Term: "Winter 2021",
...       }
...     ],
... });
WriteResult({ "nInserted" : 1 })
```

```
> db.Professors.insert(
...   {
...     ProfFirstName: "Abdolreza",
...     ProfLastName: "Abhari",
...     ProfPhone: "416-888-8885",
...     Faculty: "Science",
...     CanTeach: [
...       {
...         CourseNo: "CPS 510",
...         Term: "Fall 2021",
...         Preference: "CPS 610"
...       },
...       {
...         CourseNo: "CPS 610",
...         Term: "Winter 2021",
...         Preference: "CPS 610"
...       },
...     ],
...     Teaches: [
...       {
...         CourseNo: "CPS 610",
...         Term: "Winter 2021",
...       }
...     ],
... });
WriteResult({ "nInserted" : 1 })
```

Q4. Insert 5 courses to Courses collection

```
> db.Courses.insert({
...    CourseNo: 109,
...    CourseName: "Computer Science I",
...    CourseDescription:
...      "An introductory programming course designed to introduce fundamental " +
...      "Computer Science concepts such as abstraction, modelling and algorithm design. " +
...      "Emphasis is placed on producing correct software.",
...    Faculty: "Science",
... });
WriteResult({ "nInserted" : 1 })
>
> db.Courses.insert({
...    CourseNo: 310,
...    CourseName: "Computer Organizartion II",
...    CourseDescription:
...      "A continuation of CPS 213. Memory; CPU architecture and instruction set; " +
...      "the instruction processing sequence; generic assembler level programming " +
...      "illustrated for specific CPUs; I/O essentials including interrupts and DMA; " +
...      "characteristics of major peripherals interfaces; RISC and CISC architectures compared; " +
...      "parallel processing. The laboratory requires using a specific assembler/editor for the " +
...      "creation of programs illustrating some of the principles discussed in lectures.",
...    Faculty: "Science",
... });
WriteResult({ "nInserted" : 1 })
>
> db.Courses.insert({
...    CourseNo: 616,
...    CourseName: "Algorithms",
...    CourseDescription:
...      "Complexity analysis and order notations, recurrence equations, brute force, " +
...      "advanced divide-and-conquer techniques and the master theorem, transform-and-conquer and " +
...      "problem reduction, greedy method, dynamic programming, the knapsack and travelling " +
...      "salesman problems, graph algorithms, text processing and pattern matching techniques, P, NP, and NP-complete classes.",
...    Faculty: "Science",
... });
WriteResult({ "nInserted" : 1 })
>
>
> db.Courses.insert({
...      CourseNo: 510,
...      CourseName: "Database Systems I",
...      CourseDescription:
...        "Advanced file management techniques involving fundamentals of database organization, " +
...        "design and management. Emphasis is given to Relational Database Management Systems " +
...        "including relational algebra, normal Forms, physical Database Structures and their " +
...        "implementation, and Relational Database Languages. Other types of Database Managers " +
...        "are also discussed such as Hierarchical, Network and Inverted Files.",
...      Faculty: "Science",
...    });
WriteResult({ "nInserted" : 1 })
>
>   db.Courses.insert({
...      CourseNo: 610,
...      CourseName: "Database Systems II",
...      CourseDescription:
...        "This course is a continuation of CPS510. Topics include: embedded DB languages " +
...        "(e.g. JDBC class libraries) and Embedded SQL, Transaction management, Distributed " +
...        "Databases, Transaction Concurrency Control, Concurrency Control through " +
...        "Locking/protocol and time stamps, Object-Oriented and Object-Relational " +
...        "Database Systems, non-structured and NOSQL databases (e.g. Mongo DB). " +
...        "Introduction to big data management, Map-Reduce and Hadoop.",
...      Faculty: "Science",
...    });
WriteResult({ "nInserted" : 1 })
```

Q5. List all the documents for…

Students

```
> db.Students.find();
{ "_id" : ObjectId("60669a34c2d84128f0d7b559"), "StudentNo" : 800587121, "StudentFirstName" : "Andy", "StudentLastName" : "Lee", "Degree" : "B.Sc.", "Faculty" : "Science", "GPA" : 4.31,
 "Enrolled" : [ { "CourseNo" : "CPS 109", "ProfFirstName" : "Ilkka", "ProfLastName" : "Kokkarinen", "Term" : "2015-03" }, { "CourseNo" : "CPS 209", "ProfFirstName" : "Ilkka", "ProfLastN
ame" : "Kokkarinen", "Term" : "2019-01" } ] }
{ "_id" : ObjectId("60669a34c2d84128f0d7b55a"), "StudentNo" : 800587122, "StudentFirstName" : "Sohrab", "StudentLastName" : "Soltani", "Degree" : "B.Sc.", "Faculty" : "Science", "GPA" :
 4.22, "Enrolled" : [ { "CourseNo" : "CPS 213", "ProfFirstName" : "Alex", "ProfLastName" : "Ufkes", "Term" : "2016-03" }, { "CourseNo" : "CPS 310", "ProfFirstName" : "Alex", "ProfLastNa
me" : "Ufkes", "Term" : "2017-01" } ] }
{ "_id" : ObjectId("60669a34c2d84128f0d7b55b"), "StudentNo" : 800587123, "StudentFirstName" : "John", "StudentLastName" : "Smith", "Degree" : "B.Sc.", "Faculty" : "Science", "GPA" : 3.1
5, "Enrolled" : [ { "CourseNo" : "MTH 110", "ProfFirstName" : "Kunquan", "ProfLastName" : "Lan", "Term" : "2005-03" }, { "CourseNo" : "MTH 207", "ProfFirstName" : "Dzung Minh", "ProfLas
tName" : "Ha", "Term" : "2006-01" } ] }
{ "_id" : ObjectId("60669a34c2d84128f0d7b55c"), "StudentNo" : 800587124, "StudentFirstName" : "Jane", "StudentLastName" : "Smith", "Degree" : "B.Sc.", "Faculty" : "Science", "GPA" : 1.1
2, "Enrolled" : [ { "CourseNo" : "CPS 412", "ProfFirstName" : "Muhammad Naeem", "ProfLastName" : "Irfan", "Term" : "2013-03" }, { "CourseNo" : "BLG 143", "ProfFirstName" : "Vadim", "Pro
fLastName" : "Bostan", "Term" : "2014-01" } ] }
{ "_id" : ObjectId("60669a34c2d84128f0d7b55d"), "StudentNo" : 800587125, "StudentFirstName" : "Umberto", "StudentLastName" : "Gonzales", "Degree" : "B.Sc.", "Faculty" : "Science", "GPA"
 : 3.15, "Enrolled" : [ { "CourseNo" : "CPS 590", "ProfFirstName" : "Alex", "ProfLastName" : "Ufkes", "Term" : "2011-03" }, { "CourseNo" : "CPS 420", "ProfFirstName" : "Sophie", "ProfLa
stName" : "Quigley", "Term" : "2012-01" } ] }
{ "_id" : ObjectId("60669a34c2d84128f0d7b55e"), "StudentNo" : 800587126, "StudentFirstName" : "Changying", "StudentLastName" : "Chen", "Degree" : "B.Sc.", "Faculty" : "Science", "GPA" :
 4.32, "Enrolled" : [ { "CourseNo" : "CPS 721", "ProfFirstName" : "Ilkka", "ProfLastName" : "Kokkarinen", "Term" : "2010-03" }, { "CourseNo" : "CPS 420", "ProfFirstName" : "Sophie", "Pr
ofLastName" : "Quigley", "Term" : "2011-01" } ] }
{ "_id" : ObjectId("60669a34c2d84128f0d7b55f"), "StudentNo" : 800587127, "StudentFirstName" : "Merry", "StudentLastName" : "Poppins", "Degree" : "B.Sc.", "Faculty" : "Science", "GPA" :
1, "Enrolled" : [ { "CourseNo" : "CPS 633", "ProfFirstName" : "Stewart", "ProfLastName" : "DeWitt", "Term" : "2009-03" }, { "CourseNo" : "CPS 510", "ProfFirstName" : "Abdolreza", "ProfL
astName" : "Abhari", "Term" : "2010-01" } ] }
{ "_id" : ObjectId("60669a34c2d84128f0d7b560"), "StudentNo" : 800587128, "StudentFirstName" : "Jack", "StudentLastName" : "Sparrow", "Degree" : "B.Sc.", "Faculty" : "Science", "GPA" : 0
.7, "Enrolled" : [ { "CourseNo" : "CPS 706", "ProfFirstName" : "Sattar", "ProfLastName" : "Hussain", "Term" : "2019-03" }, { "CourseNo" : "CPS 406", "ProfFirstName" : "Nawar", "ProfLast
Name" : "Hakeem", "Term" : "2020-01" } ] }
{ "_id" : ObjectId("60669a34c2d84128f0d7b561"), "StudentNo" : 800587129, "StudentFirstName" : "Harry", "StudentLastName" : "Potter", "Degree" : "B.Sc.", "Faculty" : "Science", "GPA" : 2
.7, "Enrolled" : [ { "CourseNo" : "CPS 393", "ProfFirstName" : "Lester", "ProfLastName" : "Hiraki", "Term" : "2009-03" }, { "CourseNo" : "CMN 300", "ProfFirstName" : "Minerva", "ProfLas
tName" : "McGonagall", "Term" : "2010-01" } ] }
{ "_id" : ObjectId("60669a34c2d84128f0d7b562"), "StudentNo" : 800587130, "StudentFirstName" : "Hermione", "StudentLastName" : "Granger", "Degree" : "B.Sc.", "Faculty" : "Science", "GPA"
 : 2.7, "Enrolled" : [ { "CourseNo" : "PCS 103", "ProfFirstName" : "Severus", "ProfLastName" : "Snape", "Term" : "1998-03" }, { "CourseNo" : "CRM 100", "ProfFirstName" : "Gilderoy", "Pr
ofLastName" : "Lockhart", "Term" : "1999-01" } ] }
```

Professors

```
> db.Professors.find();
{ "_id" : ObjectId("60669bfec2d84128f0d7b563"), "ProfFirstName" : "Ilkka", "ProfLastName" : "Kokkarinen", "ProfPhone" : "416-888-8881", "Faculty" : "Science", "CanTeach" : [ { "CourseNo
" : "CPS 109", "Term" : "Fall 2021", "Preference" : "CPS 209" }, { "CourseNo" : "CPS 209", "Term" : "Fall 2021", "Preference" : "CPS 721" } ], "Teaches" : [ { "CourseNo" : "CPS 721", "T
erm" : "Winter 2021" }, { "CourseNo" : "CPS 616", "Term" : "Winter 2021" } ] }
{ "_id" : ObjectId("60669bfec2d84128f0d7b564"), "ProfFirstName" : "Alex", "ProfLastName" : "Ufkes", "ProfPhone" : "416-888-8882", "Faculty" : "Science", "CanTeach" : [ { "CourseNo" : "C
PS 213", "Term" : "Fall 2021", "Preference" : "CPS 310" }, { "CourseNo" : "CPS 310", "Term" : "Fall 2021", "Preference" : "CPS 616" } ], "Teaches" : [ { "CourseNo" : "CPS 616", "Term" :
 "Winter 2021" }, { "CourseNo" : "CPS 506", "Term" : "Winter 2021" } ] }
{ "_id" : ObjectId("60669bfec2d84128f0d7b565"), "ProfFirstName" : "Kunquan", "ProfLastName" : "Lan", "ProfPhone" : "416-888-8883", "Faculty" : "Mathematics", "CanTeach" : [ { "CourseNo"
 : "MTH 110", "Term" : "Fall 2021", "Preference" : "MTH 217" } ], "Teaches" : [ { "CourseNo" : "MTH 110", "Term" : "Winter 2021" }, { "CourseNo" : "MTH 217", "Term" : "Winter 2021" } ]
}
{ "_id" : ObjectId("60669bffc2d84128f0d7b566"), "ProfFirstName" : "Sophie", "ProfLastName" : "Quigley", "ProfPhone" : "416-888-8884", "Faculty" : "Science", "CanTeach" : [ { "CourseNo"
 : "CPS 420", "Term" : "Fall 2021", "Preference" : "CPS 721" } ], "Teaches" : [ { "CourseNo" : "MTH 420", "Term" : "Winter 2021" } ] }
{ "_id" : ObjectId("60669c00c2d84128f0d7b567"), "ProfFirstName" : "Abdolreza", "ProfLastName" : "Abhari", "ProfPhone" : "416-888-8885", "Faculty" : "Science", "CanTeach" : [ { "CourseNo
" : "CPS 510", "Term" : "Fall 2021", "Preference" : "CPS 610" }, { "CourseNo" : "CPS 610", "Term" : "Winter 2021", "Preference" : "CPS 610" } ], "Teaches" : [ { "CourseNo" : "CPS 610",
"Term" : "Winter 2021" } ] }
{ "_id" : ObjectId("60669c5cc2d84128f0d7b568"), "ProfFirstName" : "Abdolreza", "ProfLastName" : "Abhari", "ProfPhone" : "416-888-8885", "Faculty" : "Science", "CanTeach" : [ { "CourseNo
" : "CPS 510", "Term" : "Fall 2021", "Preference" : "CPS 610" }, { "CourseNo" : "CPS 610", "Term" : "Winter 2021", "Preference" : "CPS 610" } ], "Teaches" : [ { "CourseNo" : "CPS 610",
"Term" : "Winter 2021" } ] }
```

Courses

```
> db.Courses.find();
{ "_id" : ObjectId("60669c71c2d84128f0d7b569"), "CourseNo" : 109, "CourseName" : "Computer Science I", "CourseDescription" : "An introductory programming course designed to introduce fu
ndamental Computer Science concepts such as abstraction, modelling and algorithm design. Emphasis is placed on producing correct software.", "Faculty" : "Science" }
{ "_id" : ObjectId("60669c71c2d84128f0d7b56a"), "CourseNo" : 310, "CourseName" : "Computer Organizartion II", "CourseDescription" : "A continuation of CPS 213. Memory; CPU architecture
and instruction set; the instruction processing sequence; generic assembler level programming illustrated for specific CPUs; I/O essentials including interrupts and DMA; characteristics
 of major peripherals interfaces; RISC and CISC architectures compared; parallel processing. The laboratory requires using a specific assembler/editor for the creation of programs illus
trating some of the principles discussed in lectures.", "Faculty" : "Science" }
{ "_id" : ObjectId("60669c71c2d84128f0d7b56b"), "CourseNo" : 616, "CourseName" : "Algorithms", "CourseDescription" : "Complexity analysis and order notations, recurrence equations, brut
e force, advanced divide-and-conquer techniques and the master theorem, transform-and-conquer and problem reduction, greedy method, dynamic programming, the knapsack and travelling sale
sman problems, graph algorithms, text processing and pattern matching techniques, P, NP, and NP-complete classes.", "Faculty" : "Science" }
{ "_id" : ObjectId("60669c71c2d84128f0d7b56c"), "CourseNo" : 510, "CourseName" : "Database Systems I", "CourseDescription" : "Advanced file management techniques involving fundamentals
of database organization, design and management. Emphasis is given to Relational Database Management Systems including relational algebra, normal Forms, physical Database Structures and
 their implementation, and Relational Database Languages. Other types of Database Managers are also discussed such as Hierarchical, Network and Inverted Files.", "Faculty" : "Science" }
{ "_id" : ObjectId("60669c72c2d84128f0d7b56d"), "CourseNo" : 610, "CourseName" : "Database Systems II", "CourseDescription" : "This course is a continuation of CPS510. Topics include: e
mbedded DB languages (e.g. JDBC class libraries) and Embedded SQL, Transaction management, Distributed Databases, Transaction Concurrency Control, Concurrency Control through Locking/pr
otocol and time stamps, Object-Oriented and Object-Relational Database Systems, non-structured and NOSQL databases (e.g. Mongo DB). Introduction to big data management, Map-Reduce and H
adoop.", "Faculty" : "Science" }
```

Q6. Use findOne() to find Students and Professors.

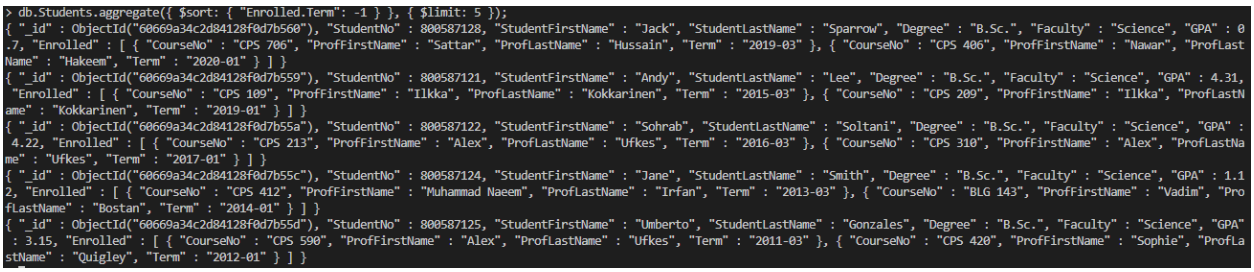
```
> db.Students.findOne({ StudentLastName: "Lee" });
{
        "_id" : ObjectId("60669a34c2d84128f0d7b559"),
        "StudentNo" : 800587121,
        "StudentFirstName" : "Andy",
        "StudentLastName" : "Lee",
        "Degree" : "B.Sc.",
        "Faculty" : "Science",
        "GPA" : 4.31,
        "Enrolled" : [
                {
                        "CourseNo" : "CPS 109",
                        "ProfFirstName" : "Ilkka",
                        "ProfLastName" : "Kokkarinen",
                        "Term" : "2015-03"
                },
                {
                        "CourseNo" : "CPS 209",
                        "ProfFirstName" : "Ilkka",
                        "ProfLastName" : "Kokkarinen",
                        "Term" : "2019-01"
                }
        ]
}
```

```
> db.Professors.findOne({ ProfLastName: "Kokkarinen" });
{
        "_id" : ObjectId("60669bfec2d84128f0d7b563"),
        "ProfFirstName" : "Ilkka",
        "ProfLastName" : "Kokkarinen",
        "ProfPhone" : "416-888-8881",
        "Faculty" : "Science",
        "CanTeach" : [
                {
                        "CourseNo" : "CPS 109",
                        "Term" : "Fall 2021",
                        "Preference" : "CPS 209"
                },
                {
                        "CourseNo" : "CPS 209",
                        "Term" : "Fall 2021",
                        "Preference" : "CPS 721"
                }
        ],
        "Teaches" : [
                {
                        "CourseNo" : "CPS 721",
                        "Term" : "Winter 2021"
                },
                {
                        "CourseNo" : "CPS 616",
                        "Term" : "Winter 2021"
                }
        ]
}
```

```
> db.Students.findOne({ StudentLastName: "Soltani" });
{
        "_id" : ObjectId("60669a34c2d84128f0d7b55a"),
        "StudentNo" : 800587122,
        "StudentFirstName" : "Sohrab",
        "StudentLastName" : "Soltani",
        "Degree" : "B.Sc.",
        "Faculty" : "Science",
        "GPA" : 4.22,
        "Enrolled" : [
                {
                        "CourseNo" : "CPS 213",
                        "ProfFirstName" : "Alex",
                        "ProfLastName" : "Ufkes",
                        "Term" : "2016-03"
                },
                {
                        "CourseNo" : "CPS 310",
                        "ProfFirstName" : "Alex",
                        "ProfLastName" : "Ufkes",
                        "Term" : "2017-01"
                }
        ]
}
```

```
> db.Professors.findOne({ ProfLastName: "Abhari" });
{
        "_id" : ObjectId("60669c00c2d84128f0d7b567"),
        "ProfFirstName" : "Abdolreza",
        "ProfLastName" : "Abhari",
        "ProfPhone" : "416-888-8885",
        "Faculty" : "Science",
        "CanTeach" : [
                {
                        "CourseNo" : "CPS 510",
                        "Term" : "Fall 2021",
                        "Preference" : "CPS 610"
                },
                {
                        "CourseNo" : "CPS 610",
                        "Term" : "Winter 2021",
                        "Preference" : "CPS 610"
                }
        ],
        "Teaches" : [
                {
                        "CourseNo" : "CPS 610",
                        "Term" : "Winter 2021"
                }
        ]
}
```

Q7. Retrieve top 5 newest student.



```
> db.Students.aggregate({ $sort: { "Enrolled.Term": -1 } }, { $limit: 5 });
{ "_id" : ObjectId("60669a34c2d84128f0d7b560"), "StudentNo" : 800587128, "StudentFirstName" : "Jack", "StudentLastName" : "Sparrow", "Degree" : "B.Sc.", "Faculty" : "Science", "GPA" : 0
.7, "Enrolled" : [ { "CourseNo" : "CPS 706", "ProfFirstName" : "Sattar", "ProfLastName" : "Hussain", "Term" : "2019-03" }, { "CourseNo" : "CPS 406", "ProfFirstName" : "Nawar", "ProfLast
Name" : "Hakeem", "Term" : "2020-01" } ] }
{ "_id" : ObjectId("60669a34c2d84128f0d7b559"), "StudentNo" : 800587121, "StudentFirstName" : "Andy", "StudentLastName" : "Lee", "Degree" : "B.Sc.", "Faculty" : "Science", "GPA" : 4.31,
 "Enrolled" : [ { "CourseNo" : "CPS 109", "ProfFirstName" : "Ilkka", "ProfLastName" : "Kokkarinen", "Term" : "2015-03" }, { "CourseNo" : "CPS 209", "ProfFirstName" : "Ilkka", "ProfLastN
ame" : "Kokkarinen", "Term" : "2019-01" } ] }
{ "_id" : ObjectId("60669a34c2d84128f0d7b55a"), "StudentNo" : 800587122, "StudentFirstName" : "Sohrab", "StudentLastName" : "Soltani", "Degree" : "B.Sc.", "Faculty" : "Science", "GPA" :
 4.22, "Enrolled" : [ { "CourseNo" : "CPS 213", "ProfFirstName" : "Alex", "ProfLastName" : "Ufkes", "Term" : "2016-03" }, { "CourseNo" : "CPS 310", "ProfFirstName" : "Alex", "ProfLastNa
me" : "Ufkes", "Term" : "2017-01" } ] }
{ "_id" : ObjectId("60669a34c2d84128f0d7b55c"), "StudentNo" : 800587124, "StudentFirstName" : "Jane", "StudentLastName" : "Smith", "Degree" : "B.Sc.", "Faculty" : "Science", "GPA" : 1.1
2, "Enrolled" : [ { "CourseNo" : "CPS 412", "ProfFirstName" : "Muhammad Naeem", "ProfLastName" : "Irfan", "Term" : "2013-03" }, { "CourseNo" : "BLG 143", "ProfFirstName" : "Vadim", "Pro
fLastName" : "Bostan", "Term" : "2014-01" } ] }
{ "_id" : ObjectId("60669a34c2d84128f0d7b55d"), "StudentNo" : 800587125, "StudentFirstName" : "Umberto", "StudentLastName" : "Gonzales", "Degree" : "B.Sc.", "Faculty" : "Science", "GPA"
 : 3.15, "Enrolled" : [ { "CourseNo" : "CPS 590", "ProfFirstName" : "Alex", "ProfLastName" : "Ufkes", "Term" : "2011-03" }, { "CourseNo" : "CPS 420", "ProfFirstName" : "Sophie", "ProfLa
stName" : "Quigley", "Term" : "2012-01" } ] }
```

Q8. Update StudentNo

```
> db.Students.update(
...   { _id: db.Students.findOne({ StudentLastName: "Lee" })._id },
...   {
...     $set: {
...       StudentNo: "500163559",
...     },
...   }
... );
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
```

```
> db.Students.update(
...   { _id: db.Students.findOne({ StudentLastName: "Soltani" })._id },
...   {
...     $set: {
...       StudentNo: "500801172",
...     },
...   }
... );
WriteResult({ "nMatched" : 1, "nUpserted" : 0, "nModified" : 1 })
```

Q9. Changing all students from Sciences to Arts.

```
> db.Students.update(
...   { Faculty: "Science" },
...   {
...     $set: {
...       Faculty: "Arts",
...     },
...   },
...   { multi: true }
... );
WriteResult({ "nMatched" : 10, "nUpserted" : 0, "nModified" : 10 })
```

Q10. Find course description containing “advanced”

```
> db.Courses.find({ CourseDescription: /advanced/i });
{ "_id" : ObjectId("60669c71c2d84128f0d7b56b"), "CourseNo" : 616, "CourseName" : "Algorithms", "CourseDescription" : "Complexity analysis and order notations, recurrence equations, brut
e force, advanced divide-and-conquer techniques and the master theorem, transform-and-conquer and problem reduction, greedy method, dynamic programming, the knapsack and travelling sale
sman problems, graph algorithms, text processing and pattern matching techniques, P, NP, and NP-complete classes.", "Faculty" : "Science" }
{ "_id" : ObjectId("60669c71c2d84128f0d7b56c"), "CourseNo" : 510, "CourseName" : "Database Systems I", "CourseDescription" : "Advanced file management techniques involving fundamentals
of database organization, design and management. Emphasis is given to Relational Database Management Systems including relational algebra, normal Forms, physical Database Structures and
 their implementation, and Relational Database Languages. Other types of Database Managers are also discussed such as Hierarchical, Network and Inverted Files.", "Faculty" : "Science" }
```