IT2234: Web Service and Server Technologies – Practical

ICAE 02

2021ICT86

1.Create the students and grades collections and insert the sample documents into both collections.
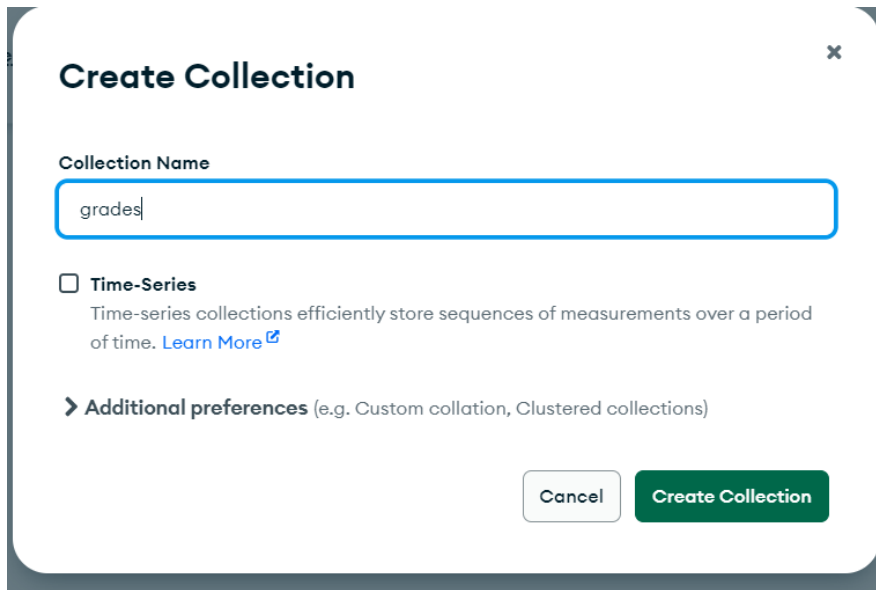
Create Collection

Collection Name

grades

☐ **Time-Series**
Time-series collections efficiently store sequences of measurements over a period of time. Learn More

❯ **Additional preferences** (e.g. Custom collation, Clustered collections)

Cancel   Create Collection

```
//Insert sample documents into students collection

db.students.insertMany([

 {

  _id: ObjectId("64b1fcd1f4a13a001e3d41a1"),

  name: "Alice Johnson",

  enrollmentYear: 2021,

  major: "Computer Science",

  email: "alice.johnson@example.com",

  gender: "Female",

  age: 20

 },

 {

  _id: ObjectId("64b1fcd1f4a13a001e3d41a2"),

  name: "Bob Smith",

  enrollmentYear: 2020,

  major: "Mathematics",

  email: "bob.smith@example.com",
```

```
    gender: "Male",

    age: 22

  },

  {

    _id: ObjectId("64b1fcd1f4a13a001e3d41a3"),

    name: "Clara Lee",

    enrollmentYear: 2022,

    major: "Physics",

    email: "clara.lee@example.com",

    gender: "Female",

    age: 19

  },

  {

    _id: ObjectId("64b1fcd1f4a13a001e3d41a4"),

    name: "Daniel Kim",

    enrollmentYear: 2021,

    major: "Engineering",

    email: "daniel.kim@example.com",

    gender: "Male",

    age: 21

  },

  {

    _id: ObjectId("64b1fcd1f4a13a001e3d41a5"),

    name: "Eva Chen",

    enrollmentYear: 2020,

    major: "Biology",
```

```
    email: "eva.chen@example.com",

    gender: "Female",

    age: 23

  },

  {

    _id: ObjectId("64b1fcd1f4a13a001e3d41a6"),

    name: "Frank Wright",

    enrollmentYear: 2019,

    major: "Chemistry",

    email: "frank.wright@example.com",

    gender: "Male",

    age: 24

  },

  {

    _id: ObjectId("64b1fcd1f4a13a001e3d41a7"),

    name: "Grace Liu",

    enrollmentYear: 2022,

    major: "Economics",

    email: "grace.liu@example.com",

    gender: "Female",

    age: 20

  },

  {

    _id: ObjectId("64b1fcd1f4a13a001e3d41a8"),

    name: "Henry Davis",

    enrollmentYear: 2021,
```

```
      major: "Philosophy",

      email: "henry.davis@example.com",

      gender: "Male",

      age: 22

    },

    {

      _id: ObjectId("64b1fcd1f4a13a001e3d41a9"),

      name: "Ivy Zhang",

      enrollmentYear: 2020,

      major: "Statistics",

      email: "ivy.zhang@example.com",

      gender: "Female",

      age: 21

    },

    {

      _id: ObjectId("64b1fcd1f4a13a001e3d41aa"),

      name: "Jack Lee",

      enrollmentYear: 2023,

      major: "Business",

      email: "jack.lee@example.com",

      gender: "Male",

      age: 18

    }

]);
```

```
]},
< {
    acknowledged: true,
    insertedIds: {
      '0': ObjectId('64b1fcd1f4a13a001e3d41a1'),
      '1': ObjectId('64b1fcd1f4a13a001e3d41a2'),
      '2': ObjectId('64b1fcd1f4a13a001e3d41a3'),
      '3': ObjectId('64b1fcd1f4a13a001e3d41a4'),
      '4': ObjectId('64b1fcd1f4a13a001e3d41a5'),
      '5': ObjectId('64b1fcd1f4a13a001e3d41a6'),
      '6': ObjectId('64b1fcd1f4a13a001e3d41a7'),
      '7': ObjectId('64b1fcd1f4a13a001e3d41a8'),
      '8': ObjectId('64b1fcd1f4a13a001e3d41a9'),
      '9': ObjectId('64b1fcd1f4a13a001e3d41aa')
    }
  }
ICA2 >
```

Documents 0   Aggregations   Schema   Indexes 1   Validation

```
🕐 ▾    Type a query: { field: 'value' } or Generate query +    Explain    Reset    Find    </>    Options ▸
```

⊕ ADD DATA ▾   ⬈ EXPORT DATA ▾   ✎ UPDATE   🗑 DELETE   25 ▾   1 – 10 of 10   ⟳   ‹   ›   ▾   ☰ {} E

```
    _id: ObjectId('64b1fcd1f4a13a001e3d41a1')
    name : "Alice Johnson"
    enrollmentYear : 2021
    major : "Computer Science"
    email : "alice.johnson@example.com"
    gender : "Female"
    age : 20

    _id: ObjectId('64b1fcd1f4a13a001e3d41a2')
    name : "Bob Smith"
    enrollmentYear : 2020
    major : "Mathematics"
    email : "bob.smith@example.com"
    gender : "Male"
    age : 22

    _id: ObjectId('64b1fcd1f4a13a001e3d41a3')
    name : "Clara Lee"
    enrollmentYear : 2022
    major : "Physics"
    email : "clara.lee@example.com"
    gender : "Female"
    age : 19
```

// Insert sample documents into grades collection

db.grades.insertMany([

  { subject: "Mathematics", score: 85, term: "Fall 2022", studentId: ObjectId("64b1fcd1f4a13a001e3d41a1") },

```
  { subject: "English", score: 90, term: "Fall 2022", studentId:
ObjectId("64b1fcd1f4a13a001e3d41a1") },


  { subject: "Mathematics", score: 75, term: "Spring 2022", studentId:
ObjectId("64b1fcd1f4a13a001e3d41a2") },

  { subject: "Statistics", score: 80, term: "Fall 2022", studentId:
ObjectId("64b1fcd1f4a13a001e3d41a2") },


  { subject: "Physics", score: 92, term: "Fall 2022", studentId:
ObjectId("64b1fcd1f4a13a001e3d41a3") },

  { subject: "Mathematics", score: 86, term: "Spring 2023", studentId:
ObjectId("64b1fcd1f4a13a001e3d41a3") },


  { subject: "Engineering", score: 89, term: "Fall 2021", studentId:
ObjectId("64b1fcd1f4a13a001e3d41a4") },

  { subject: "Mathematics", score: 84, term: "Spring 2022", studentId:
ObjectId("64b1fcd1f4a13a001e3d41a4") },


  { subject: "Biology", score: 78, term: "Spring 2021", studentId:
ObjectId("64b1fcd1f4a13a001e3d41a5") },

  { subject: "Chemistry", score: 82, term: "Fall 2021", studentId:
ObjectId("64b1fcd1f4a13a001e3d41a5") },


  { subject: "Chemistry", score: 88, term: "Fall 2021", studentId:
ObjectId("64b1fcd1f4a13a001e3d41a6") },

  { subject: "Physics", score: 79, term: "Spring 2022", studentId:
ObjectId("64b1fcd1f4a13a001e3d41a6") },


  { subject: "Economics", score: 83, term: "Spring 2023", studentId:
ObjectId("64b1fcd1f4a13a001e3d41a7") },
```

```
  { subject: "English", score: 89, term: "Fall 2022", studentId:
ObjectId("64b1fcd1f4a13a001e3d41a7") },


  { subject: "Philosophy", score: 91, term: "Fall 2022", studentId:
ObjectId("64b1fcd1f4a13a001e3d41a8") },

  { subject: "History", score: 77, term: "Spring 2023", studentId:
ObjectId("64b1fcd1f4a13a001e3d41a8") },


  { subject: "Statistics", score: 79, term: "Spring 2022", studentId:
ObjectId("64b1fcd1f4a13a001e3d41a9") },

  { subject: "Data Science", score: 88, term: "Fall 2022", studentId:
ObjectId("64b1fcd1f4a13a001e3d41a9") },


  { subject: "Business", score: 87, term: "Fall 2023", studentId:
ObjectId("64b1fcd1f4a13a001e3d41aa") },

  { subject: "Finance", score: 82, term: "Spring 2024", studentId:
ObjectId("64b1fcd1f4a13a001e3d41aa") }

]);
```

```
>_MONGOSH
  { subject: "Finance", score: 82, term: "Spring 2024", studentId: ObjectId("64b1fcd1f4a13a001e3d41aa") }
]);
< {
    acknowledged: true,
    insertedIds: {
      '0': ObjectId('682760962d45e5a3987a2d99'),
      '1': ObjectId('682760962d45e5a3987a2d9a'),
      '2': ObjectId('682760962d45e5a3987a2d9b'),
      '3': ObjectId('682760962d45e5a3987a2d9c'),
      '4': ObjectId('682760962d45e5a3987a2d9d'),
      '5': ObjectId('682760962d45e5a3987a2d9e'),
      '6': ObjectId('682760962d45e5a3987a2d9f'),
      '7': ObjectId('682760962d45e5a3987a2da0'),
      '8': ObjectId('682760962d45e5a3987a2da1'),
      '9': ObjectId('682760962d45e5a3987a2da2'),
      '10': ObjectId('682760962d45e5a3987a2da3'),
      '11': ObjectId('682760962d45e5a3987a2da4'),
      '12': ObjectId('682760962d45e5a3987a2da5'),
      '13': ObjectId('682760962d45e5a3987a2da6'),
      '14': ObjectId('682760962d45e5a3987a2da7'),
      '15': ObjectId('682760962d45e5a3987a2da8'),
      '16': ObjectId('682760962d45e5a3987a2da9'),
      '17': ObjectId('682760962d45e5a3987a2daa'),
      '18': ObjectId('682760962d45e5a3987a2dab'),
      '19': ObjectId('682760962d45e5a3987a2dac')
    }
  }
```

Type a query: { field: 'value' } or **Generate query** ✦   Explain   Reset   **Find**   ‹/›   Options

● **ADD DATA** ▾   ✏ **EXPORT DATA** ▾   ✏ UPDATE   🗑 DELETE   25 ▾ 1 – 20 of 20 ↻ ‹ › ▾ ≡ {}

```
_id: ObjectId('682760962d45e5a3987a2d99')
subject : "Mathematics"
score : 85
term : "Fall 2022"
studentId : ObjectId('64b1fcd1f4a13a001e3d41a1')
```

```
_id: ObjectId('682760962d45e5a3987a2d9a')
subject : "English"
score : 90
term : "Fall 2022"
studentId : ObjectId('64b1fcd1f4a13a001e3d41a1')
```

```
_id: ObjectId('682760962d45e5a3987a2d9b')
subject : "Mathematics"
score : 75
term : "Spring 2022"
studentId : ObjectId('64b1fcd1f4a13a001e3d41a2')
```

```
_id: ObjectId('682760962d45e5a3987a2d9c')
subject : "Statistics"
score : 80
term : "Fall 2022"
studentId : ObjectId('64b1fcd1f4a13a001e3d41a2')
```

2. Show both collections in table view

Type a query: { field: 'value' } or **Generate query** ✦   Explain   Reset   **Find**   ‹/›   Options ▸

● **ADD DATA** ▾   ✏ **EXPORT DATA** ▾   ✏ UPDATE   🗑 DELETE   25 ▾ 1 – 10 of 10 ↻ ‹ › ▾ ≡ {} ▦

🏠 students

	_id ObjectId	name String	enrollmentYear Int32	major String	email String	
1	ObjectId('64b1fcd1f4a13a0…	"Alice Johnson"	2021	"Computer Science"	"alice.johnson@examp'	✏ 🗐 🗐 🗑
2	ObjectId('64b1fcd1f4a13a0…	"Bob Smith"	2020	"Mathematics"	"bob.smith@example.cc	✏ 🗐 🗐 🗑
3	ObjectId('64b1fcd1f4a13a0…	"Clara Lee"	2022	"Physics"	"clara.lee@example.cc	✏ 🗐 🗐 🗑
4	ObjectId('64b1fcd1f4a13a0…	"Daniel Kim"	2021	"Engineering"	"daniel.kim@example.(	✏ 🗐 🗐 🗑
5	ObjectId('64b1fcd1f4a13a0…	"Eva Chen"	2020	"Biology"	"eva.chen@example.coi	✏ 🗐 🗐 🗑
6	ObjectId('64b1fcd1f4a13a0…	"Frank Wright"	2019	"Chemistry"	"frank.wright@example	✏ 🗐 🗐 🗑
7	ObjectId('64b1fcd1f4a13a0…	"Grace Liu"	2022	"Economics"	"grace.liu@example.cc	✏ 🗐 🗐 🗑
8	ObjectId('64b1fcd1f4a13a0…	"Henry Davis"	2021	"Philosophy"	"henry.davis@example	✏ 🗐 🗐 🗑
9	ObjectId('64b1fcd1f4a13a0…	"Ivy Zhang"	2020	"Statistics"	"ivy.zhang@example.cc	✏ 🗐 🗐 🗑
10	ObjectId('64b1fcd1f4a13a0…	"Jack Lee"	2023	"Business"	"jack.lee@example.coi	✏ 🗐 🗐 🗑

Type a query: { field: 'value' } or **Generate query** +   Explain   Reset   Find   </>   Options ▶

⊕ ADD DATA ▾   ☒ EXPORT DATA ▾   ✎ UPDATE   🗑 DELETE   25 ▾   1 – 20 of 20   ↻   < >   ▾   ≡ | {}   ⊞

🏠 grades

	_id ObjectId	subject String	score Int32	term String	studentId ObjectId	
1	ObjectId('682760962d45e5a…	"Mathematics"	85	"Fall 2022"	ObjectId('64b1fcd1f	✎ 🗐 🗎 🗑
2	ObjectId('682760962d45e5a…	"English"	90	"Fall 2022"	ObjectId('64b1fcd1f	✎ 🗐 🗎 🗑
3	ObjectId('682760962d45e5a…	"Mathematics"	75	"Spring 2022"	ObjectId('64b1fcd1f	✎ 🗐 🗎 🗑
4	ObjectId('682760962d45e5a…	"Statistics"	80	"Fall 2022"	ObjectId('64b1fcd1f	✎ 🗐 🗎 🗑
5	ObjectId('682760962d45e5a…	"Physics"	92	"Fall 2022"	ObjectId('64b1fcd1f	✎ 🗐 🗎 🗑
6	ObjectId('682760962d45e5a…	"Mathematics"	86	"Spring 2023"	ObjectId('64b1fcd1f	✎ 🗐 🗎 🗑
7	ObjectId('682760962d45e5a…	"Engineering"	89	"Fall 2021"	ObjectId('64b1fcd1f	✎ 🗐 🗎 🗑
8	ObjectId('682760962d45e5a…	"Mathematics"	84	"Spring 2022"	ObjectId('64b1fcd1f	✎ 🗐 🗎 🗑
9	ObjectId('682760962d45e5a…	"Biology"	78	"Spring 2021"	ObjectId('64b1fcd1f	✎ 🗐 🗎 🗑
10	ObjectId('682760962d45e5a…	"Chemistry"	82	"Fall 2021"	ObjectId('64b1fcd1f	✎ 🗐 🗎 🗑
11	ObjectId('682760962d45e5a…	"Chemistry"	88	"Fall 2021"	ObjectId('64b1fcd1f	✎ 🗐 🗎 🗑
12	ObjectId('682760962d45e5a…	"Physics"	79	"Spring 2022"	ObjectId('64b1fcd1f	✎ 🗐 🗎 🗑
13	ObjectId('682760962d45e5a…	"Economics"	83	"Spring 2023"	ObjectId('64b1fcd1f	✎ 🗐 🗎 🗑
14	ObjectId('682760962d45e5a…	"English"	89	"Fall 2022"	ObjectId('64b1fcd1f	✎ 🗐 🗎 🗑
15	ObjectId('682760962d45e5a…	"Philosophy"	91	"Fall 2022"	ObjectId('64b1fcd1f	✎ 🗐 🗎 🗑
16	ObjectId('682760962d45e5a…	"History"	77	"Spring 2023"	ObjectId('64b1fcd1f	✎ 🗐 🗎 🗑

3. Find the female students and only display their name, age and gender

db.students.find(

 { gender: "Female" },

 { _id: 0, name: 1, age: 1, gender: 1 }

);

```
>_MONGOSH

> db.students.find(
    { gender: "Female" },
    { _id: 0, name: 1, age: 1, gender: 1 }
  );
< {
    name: 'Alice Johnson',
    gender: 'Female',
    age: 20
  }
  {
    name: 'Clara Lee',
    gender: 'Female',
    age: 19
  }
  {
    name: 'Eva Chen',
    gender: 'Female',
    age: 23
  }
  {
    name: 'Grace Liu',
    gender: 'Female',
    age: 20
  }
  {
    name: 'Ivy Zhang',
    gender: 'Female',
    age: 21
```

4. Find the students who are younger than 22 and enrolled after 2020

db.students.find(

  { age: { $lt: 22 }, enrollmentYear: { $gt: 2020 } }

);

```
>_MONGOSH

> db.students.find(
    { age: { $lt: 22 }, enrollmentYear: { $gt: 2020 } }
  );
< {
    _id: ObjectId('64b1fcd1f4a13a001e3d41a1'),
    name: 'Alice Johnson',
    enrollmentYear: 2021,
    major: 'Computer Science',
    email: 'alice.johnson@example.com',
    gender: 'Female',
    age: 20
  }
  {
    _id: ObjectId('64b1fcd1f4a13a001e3d41a3'),
    name: 'Clara Lee',
    enrollmentYear: 2022,
    major: 'Physics',
    email: 'clara.lee@example.com',
    gender: 'Female',
    age: 19
  }
  {
    _id: ObjectId('64b1fcd1f4a13a001e3d41a4'),
    name: 'Daniel Kim',
    enrollmentYear: 2021,
    major: 'Engineering',
    email: 'daniel.kim@example.com',
    gender: 'Male',
```

```
>_MONGOSH

  {
    _id: ObjectId('64b1fcd1f4a13a001e3d41a4'),
    name: 'Daniel Kim',
    enrollmentYear: 2021,
    major: 'Engineering',
    email: 'daniel.kim@example.com',
    gender: 'Male',
    age: 21
  }
  {
    _id: ObjectId('64b1fcd1f4a13a001e3d41a7'),
    name: 'Grace Liu',
    enrollmentYear: 2022,
    major: 'Economics',
    email: 'grace.liu@example.com',
    gender: 'Female',
    age: 20
  }
  {
    _id: ObjectId('64b1fcd1f4a13a001e3d41aa'),
    name: 'Jack Lee',
    enrollmentYear: 2023,
    major: 'Business',
    email: 'jack.lee@example.com',
    gender: 'Male',
    age: 18
  }
ICA2 >
```

5. Find all grades for "Alice Johnson"

```
const student = db.students.findOne({ name: "Alice Johnson" });

db.grades.find({ studentId: student._id });
```

```
> const student = db.students.findOne({ name: "Alice Johnson" });
  db.grades.find({ studentId: student._id });
< {
    _id: ObjectId('682760962d45e5a3987a2d99'),
    subject: 'Mathematics',
    score: 85,
    term: 'Fall 2022',
    studentId: ObjectId('64b1fcd1f4a13a001e3d41a1')
  }
  {
    _id: ObjectId('682760962d45e5a3987a2d9a'),
    subject: 'English',
    score: 90,
    term: 'Fall 2022',
    studentId: ObjectId('64b1fcd1f4a13a001e3d41a1')
  }
ICA2 >
```

6. Find how many students followed the subject "Mathematics"

db.grades.distinct("studentId", { subject: "Mathematics" }).length;

```
    }
> db.grades.distinct("studentId", { subject: "Mathematics" }).length;
< 4
ICA2 >
```

7. Find all students with grades in the term "Fall 2022"

db.students.aggregate([

  {

    $lookup: {

      from: "grades",

      localField: "_id",

      foreignField: "studentId",

      as: "grades"

    }

  },

```
  {
    $project: {
      name: 1,
      email: 1,
      age: 1,
      gender: 1,
      grades: {
        $filter: {
          input: "$grades",
          as: "grade",
          cond: { $eq: ["$$grade.term", "Fall 2022"] }
        }
      }
    }
  },
  {
    $match: {
      "grades.0": { $exists: true }
    }
  }
]);
```

```
>_MONGOSH
> db.students.aggregate([
    {
      $lookup: {
        from: "grades",
        localField: "_id",
        foreignField: "studentId",
        as: "grades"
      }
    },
    {
      $project: {
        name: 1,
        email: 1,
        age: 1,
        gender: 1,
        grades: {
          $filter: {
            input: "$grades",
            as: "grade",
            cond: { $eq: ["$$grade.term", "Fall 2022"] }
          }
        }
      }
    },
    {
      $match: {
        "grades.0": { $exists: true }
      }
```

```
>_MONGOSH
< {
    _id: ObjectId('64b1fcd1f4a13a001e3d41a1'),
    name: 'Alice Johnson',
    email: 'alice.johnson@example.com',
    gender: 'Female',
    age: 20,
    grades: [
      {
        _id: ObjectId('682760962d45e5a3987a2d99'),
        subject: 'Mathematics',
        score: 85,
        term: 'Fall 2022',
        studentId: ObjectId('64b1fcd1f4a13a001e3d41a1')
      },
      {
        _id: ObjectId('682760962d45e5a3987a2d9a'),
        subject: 'English',
        score: 90,
        term: 'Fall 2022',
        studentId: ObjectId('64b1fcd1f4a13a001e3d41a1')
      }
    ]
  }
  {
    _id: ObjectId('64b1fcd1f4a13a001e3d41a2'),
    name: 'Bob Smith',
    email: 'bob.smith@example.com',
    gender: 'Male',
```

```
>_MONGOSH
  {
    _id: ObjectId('64b1fcd1f4a13a001e3d41a2'),
    name: 'Bob Smith',
    email: 'bob.smith@example.com',
    gender: 'Male',
    age: 22,
    grades: [
      {
        _id: ObjectId('682760962d45e5a3987a2d9c'),
        subject: 'Statistics',
        score: 80,
        term: 'Fall 2022',
        studentId: ObjectId('64b1fcd1f4a13a001e3d41a2')
      }
    ]
  }
  {
    _id: ObjectId('64b1fcd1f4a13a001e3d41a3'),
    name: 'Clara Lee',
    email: 'clara.lee@example.com',
    gender: 'Female',
    age: 19,
    grades: [
      {
        _id: ObjectId('682760962d45e5a3987a2d9d'),
        subject: 'Physics',
        score: 92,
        term: 'Fall 2022',
```

```
>_MONGOSH
    _id: ObjectId('64b1fcd1f4a13a001e3d41a7'),
    name: 'Grace Liu',
    email: 'grace.liu@example.com',
    gender: 'Female',
    age: 20,
    grades: [
      {
        _id: ObjectId('682760962d45e5a3987a2da6'),
        subject: 'English',
        score: 89,
        term: 'Fall 2022',
        studentId: ObjectId('64b1fcd1f4a13a001e3d41a7')
      }
    ]
  }
  {
    _id: ObjectId('64b1fcd1f4a13a001e3d41a8'),
    name: 'Henry Davis',
    email: 'henry.davis@example.com',
    gender: 'Male',
    age: 22,
    grades: [
      {
        _id: ObjectId('682760962d45e5a3987a2da7'),
        subject: 'Philosophy',
        score: 91,
        term: 'Fall 2022',
        studentId: ObjectId('64b1fcd1f4a13a001e3d41a8')
```

```
    age: 22,
    grades: [
      {
        _id: ObjectId('682760962d45e5a3987a2da7'),
        subject: 'Philosophy',
        score: 91,
        term: 'Fall 2022',
        studentId: ObjectId('64b1fcd1f4a13a001e3d41a8')
      }
    ]
  }
  {
    _id: ObjectId('64b1fcd1f4a13a001e3d41a9'),
    name: 'Ivy Zhang',
    email: 'ivy.zhang@example.com',
    gender: 'Female',
    age: 21,
    grades: [
      {
        _id: ObjectId('682760962d45e5a3987a2daa'),
        subject: 'Data Science',
        score: 88,
        term: 'Fall 2022',
        studentId: ObjectId('64b1fcd1f4a13a001e3d41a9')
      }
    ]
  }
ICA2 >
```