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Project – MongoDB

Phase 1: Data Modelling and Creation

-Business / Use Case

The database and application are designed for a University Tutoring System. This system helps students book academic support sessions with tutors based on the subjects they need help in. The university staff and students can use the system to:

- Store and manage student and tutor information
- Track which subjects each tutor can assist with
- Allow students to schedule appointments with available tutors
- View the history of scheduled or completed appointments
- Generate reports on usage and participation

This system is useful for both students seeking academic support and university administrators who need to manage tutoring resources.

-Data to Be Stored

To support the tutoring system, there will be four key types of data:

- Students
 - name, major, year, and email
- Tutors
 - department and the subjects they tutor
- Subjects
 - subjects offered for tutoring, with descriptions and credit hours
- Appointments
 - Scheduled tutoring sessions linking students, tutors, and subjects, along with date/time/location and status

-Data Model

Document-based model in MongoDB with four collections:

- students: stores individual student records
- tutors: stores individual tutor records, including a list of subject names
- subjects: stores subject information with a unique subject ID
- appointments: links students and tutors through the subject being tutored

Each appointment document includes:

- student ID
- tutor ID
- subject ID
- Date, time, location, and status of the appointment

Phase 2: Database Implementation and Querying

Compass

My Queries

CONNECTIONS (2)

- CSC 434
- Project1
 - University_Tutoring
 - Appointments
 - Students
 - Subjects
 - Tutors
 - admin
 - config
 - local

Students

Project1 > University_Tutoring > Students

Documents (20) Aggregations Schema Indexes (1) Validation

Type a query: { field: 'value' } or [Generate query](#).

[ADD DATA](#) [EXPORT DATA](#) [UPDATE](#) [DELETE](#)

25 1 - 20 of 20

_id	ObjectId	sid	Int32	fname	String	lname	String	email	String
1	ObjectId('67f55fad2bf0408...')	1		"Emma"	"Lee"	"Emma@friars.providence.edu"			
2	ObjectId('67f55fad2bf0408...')	2		"Hannah"	"Smith"	"hannah@friars.providence.edu"			
3	ObjectId('67f55fad2bf0408...')	3		"Grace"	"Nguyen"	"grace@friars.providence.edu"			
4	ObjectId('67f55fad2bf0408...')	4		"Alice"	"Gomez"	"alice@friars.providence.edu"			
5	ObjectId('67f55fad2bf0408...')	5		"Emmi"	"Jockey"	"emmi@friars.providence.edu"			
6	ObjectId('67f55fad2bf0408...')	6		"Carla"	"Chen"	"carla@friars.providence.edu"			
7	ObjectId('67f55fad2bf0408...')	7		"Frank"	"Taylor"	"frank@friars.providence.edu"			
8	ObjectId('67f55fad2bf0408...')	8		"Ian"	"Gomez"	"ian@friars.providence.edu"			
9	ObjectId('67f55fad2bf0408...')	9		"Carly"	"Clark"	"carly@friars.providence.edu"			
10	ObjectId('67f55fad2bf0408...')	10		"Brian"	"Martinez"	"brian@friars.providence.edu"			
11	ObjectId('67f55fad2bf0408...')	11		"Julia"	"Martinez"	"julia@friars.providence.edu"			
12	ObjectId('67f55fad2bf0408...')	12		"Jane"	"Lopez"	"jane@friars.providence.edu"			
13	ObjectId('67f55fad2bf0408...')	13		"Niko"	"Clark"	"niko@friars.providence.edu"			
14	ObjectId('67f55fad2bf0408...')	14		"Scarlet"	"Clarke"	"scarlet@friars.providence.edu"			
15	ObjectId('67f55fad2bf0408...')	15		"Eli"	"Martin"	"eli@friars.providence.edu"			
16	ObjectId('67f55fad2bf0408...')	16		"Alex"	"Lopez"	"alex@friars.providence.edu"			
17	ObjectId('67f55fad2bf0408...')	17		"Jared"	"Lee"	"jared@friars.providence.edu"			
18	ObjectId('67f55fad2bf0408...')	18		"Lenna"	"Boston"	"lenna@friars.providence.edu"			
19	ObjectId('67f55fad2bf0408...')	19		"Jake"	"Love"	"jake@friars.providence.edu"			
20	ObjectId('67f55fad2bf0408...')	20		"David"	"Smith"	"david@friars.providence.edu"			

Import completed.
20 documents imported.

Compass

My Queries

CONNECTIONS (2)

- CSC 434
- Project1
 - University_Tutoring
 - Appointments
 - Students
 - Subjects
 - Tutors
 - admin
 - config
 - local

Tutors

Project1 > University_Tutoring > Tutors

Documents (15) Aggregations Schema Indexes (1) Validation

Type a query: { field: 'value' } or [Generate query](#).

[ADD DATA](#) [EXPORT DATA](#) [UPDATE](#) [DELETE](#)

25 1 - 15 of 15

_id	ObjectId	tid	Int32	fname	String	lname	String	email	String
1	ObjectId('67f55fd9b2f0408...')	101		"Jessica"	"Ray"	"jessica@friars.providence.edu"			
2	ObjectId('67f55fd9b2f0408...')	102		"Hannah"	"Nair"	"hannah@friars.providence.edu"			
3	ObjectId('67f55fd9b2f0408...')	103		"Lucky"	"Smith"	"lucky@friars.providence.edu"			
4	ObjectId('67f55fd9b2f0408...')	104		"Jarod"	"Mack"	"jarod@friars.providence.edu"			
5	ObjectId('67f55fd9b2f0408...')	105		"Lia"	"Goncalves"	"lia@friars.providence.edu"			
6	ObjectId('67f55fd9b2f0408...')	106		"Lola"	"Lis"	"lola@friars.providence.edu"			
7	ObjectId('67f55fd9b2f0408...')	107		"Franky"	"Lopez"	"franky@friars.providence.edu"			
8	ObjectId('67f55fd9b2f0408...')	108		"John"	"Connelly"	"john@friars.providence.edu"			
9	ObjectId('67f55fd9b2f0408...')	109		"Lia"	"Lee"	"lia@friars.providence.edu"			
10	ObjectId('67f55fd9b2f0408...')	110		"Aleck"	"Smith"	"aleck@friars.providence.edu"			
11	ObjectId('67f55fd9b2f0408...')	111		"Frank"	"Johnel"	"frank@friars.providence.edu"			
12	ObjectId('67f55fd9b2f0408...')	112		"Gray"	"Smalls"	"gray@friars.providence.edu"			
13	ObjectId('67f55fd9b2f0408...')	113		"Tom"	"Johnson"	"tom@friars.providence.edu"			
14	ObjectId('67f55fd9b2f0408...')	114		"Janey"	"Martinez"	"yaney@friars.providence.edu"			
15	ObjectId('67f55fd9b2f0408...')	115		"Lee"	"Kim"	"lee@friars.providence.edu"			

Import completed.
15 documents imported.

Compass

My Queries

CONNECTIONS (2)

- CSC 434
- Project1
 - University_Tutoring
 - Appointments
 - Students
 - Subjects
 - Tutors
 - admin
 - config
 - local

Project1 > University_Tutoring > Subjects

Documents 12 Aggregations Schema Indexes 1 Validation

Type a query: { field: 'value' } or [Generate query](#).

[ADD DATA](#) [EXPORT DATA](#) [UPDATE](#) [DELETE](#)

_id	ObjectId	subid	String	name	String	description	String	credits	Int32
1	ObjectId('67f56007b2f0408...')	SUB001		"Calculus I"		"Intro to Calculus"		3	
2	ObjectId('67f56007b2f0408...')	SUB002		"Statistics"		"Probability & Statistics"		3	
3	ObjectId('67f56007b2f0408...')	SUB003		"Science"		"General Science"		3	
4	ObjectId('67f56007b2f0408...')	SUB004		"Physics"		"Mechanics & Waves"		4	
5	ObjectId('67f56007b2f0408...')	SUB005		"Computer Networks"		"Networks and Protocols"		4	
6	ObjectId('67f56007b2f0408...')	SUB006		"English II"		"Advanced English Composi..."		3	
7	ObjectId('67f56007b2f0408...')	SUB007		"Sociology"		"Intro to Sociology"		3	
8	ObjectId('67f56007b2f0408...')	SUB008		"Biology"		"Cell & Molecular Biology"		4	
9	ObjectId('67f56007b2f0408...')	SUB009		"Chemistry"		"Inorganic Chemistry"		4	
10	ObjectId('67f56007b2f0408...')	SUB010		"Anatomy"		"Human Anatomy"		3	
11	ObjectId('67f56007b2f0408...')	SUB011		"Thermodynamics"		"Heat and Energy"		4	
12	ObjectId('67f56007b2f0408...')	SUB012		"Engineering"		"Engineering Principles"		3	

Import completed.
12 documents imported.

Compass

My Queries

CONNECTIONS (2)

- CSC 434
- Project1
 - University_Tutoring
 - Appointments
 - Students
 - Subjects
 - Tutors
 - admin
 - config
 - local

Project1 > University_Tutoring > Appointments

Documents 40 Aggregations Schema Indexes 1 Validation

Type a query: { field: 'value' } or [Generate query](#).

[ADD DATA](#) [EXPORT DATA](#) [UPDATE](#) [DELETE](#)

_id	ObjectId	aid	Int32	student_id	Int32	tutor_id	Int32	subject_id	String
1	ObjectId('67f56044b2f0408...')	6001		1		110		SUB008	
2	ObjectId('67f56044b2f0408...')	6002		1		104		SUB008	
3	ObjectId('67f56044b2f0408...')	6003		2		113		SUB003	
4	ObjectId('67f56044b2f0408...')	6004		2		114		SUB004	
5	ObjectId('67f56044b2f0408...')	6005		3		106		SUB002	
6	ObjectId('67f56044b2f0408...')	6006		3		113		SUB003	
7	ObjectId('67f56044b2f0408...')	6007		4		107		SUB001	
8	ObjectId('67f56044b2f0408...')	6008		4		111		SUB011	
9	ObjectId('67f56044b2f0408...')	6009		5		113		SUB011	
10	ObjectId('67f56044b2f0408...')	6010		5		104		SUB009	
11	ObjectId('67f56044b2f0408...')	6011		6		105		SUB006	
12	ObjectId('67f56044b2f0408...')	6012		6		111		SUB012	
13	ObjectId('67f56044b2f0408...')	6013		7		102		SUB004	
14	ObjectId('67f56044b2f0408...')	6014		7		107		SUB010	
15	ObjectId('67f56044b2f0408...')	6015		8		109		SUB004	
16	ObjectId('67f56044b2f0408...')	6016		8		105		SUB009	
17	ObjectId('67f56044b2f0408...')	6017		9		110		SUB010	
18	ObjectId('67f56044b2f0408...')	6018		9		104		SUB009	
19	ObjectId('67f56044b2f0408...')	6019		10		109		SUB004	
20	ObjectId('67f56044b2f0408...')	6020		10		113		SUB003	
21	ObjectId('67f56044b2f0408...')	6021		11		115		SUB005	
22	ObjectId('67f56044b2f0408...')	6022		11		115		SUB005	

Import completed.
40 documents imported.

Query 1: Find how many students there are?

The screenshot shows the Compass MongoDB interface. On the left, the 'Connections' sidebar lists 'CSC 434', 'Project1' (which is expanded to show 'University_Tutoring', 'Students', 'Subjects', and 'Tutors'), 'admin', 'config', and 'local'. The main area is titled 'Project1 > University_Tutoring > Students' and shows a 'Documents' tab with 20 results. A query is being run:

```
Project { field: 0 }
Sort db.students.countDocument({})
Collation { locale: 'simple' }
Index Hint { field: -1 }
```

The results pane displays three student documents:

```
_id: ObjectId('67f55fad2f0408e696043dd')
sid: 1
fname: "Emma"
lname: "Lee"
email: "emma@friars.providence.edu"
major: "Biology"
year: "Senior"

_id: ObjectId('67f55fad2f0408e696043de')
sid: 2
fname: "Hannah"
lname: "Smith"
email: "hannah@friars.providence.edu"
major: "Mathematics"
year: "Sophomore"

_id: ObjectId('67f55fad2f0408e696043df')
sid: 3
fname: "Grace"
lname: "Nguyen"
email: "grace@friars.providence.edu"
major: "Computer Science"
year: "Senior"
```

A message at the bottom left says 'Import completed. 40 documents imported.'

Query 2: Find all tutors who teach "Science"

Compass

My Queries

CONNECTIONS (2)

- CSC-434
- Project1
 - University_Tutoring
 - Appointments
 - Students
 - Subjects
 - Tutors
- admin
- config
- local

Project1 > University_Tutoring > Tutors

Documents (16) Aggregations Schema Indexes (1) Validation

Find (highlighted)

Generate query Explain Reset Options

Max Time MS: 60000

Skip: 0 Limit: 0

Add Data Export Data Update Delete

25 1 - 4 of 4

```

_id: ObjectId('67f55fd9b2f0408e696043fa')
tid: 102
fname: "Hannah"
lname: "Nair"
email: "hannah@friars.providence.edu"
department: "Computer Science"
subjects: Array (3)

_id: ObjectId('67f55fd9b2f0408e696043fa')
tid: 109
fname: "Lia"
lname: "Lee"
email: "lia@friars.providence.edu"
department: "Physics"
subjects: Array (2)

_id: ObjectId('67f55fd9b2f0408e696043fd')
tid: 112
fname: "Gray"
lname: "Smalls"
email: "gray@friars.providence.edu"
department: "Computer Science"
subjects: Array (2)

```

Import completed.
40 documents imported.

Query 3: Find all tutors who teach "Anatomy"

Compass

Project1 > University_Tutoring > Tutors

Documents (15) Aggregations Schema Indexes (1) Validation

Filter: {"subjects": "Anatomy"}
Project: {}
Sort: {}
Collation: { locale: 'simple' }
Index Hint: { field: -1 }
Max Time MS: 60000
Skip: 0 Limit: 0

ADD DATA **EXPORT DATA** **UPDATE** **DELETE**

Import completed.
40 documents imported.

```

_id: ObjectId('67f55fd9b2f0408e696043f8')
tid: 107
fname: "Franky"
lname: "Lopez"
email: "franky@friars.providence.edu"
department: "Biology"
subjects: Array (2)

_id: ObjectId('67f55fd9b2f0408e696043f9')
tid: 108
fname: "John"
lname: "Connelly"
email: "john@friars.providence.edu"
department: "Physics"
subjects: Array (2)

_id: ObjectId('67f55fd9b2f0408e696043fb')
tid: 110
fname: "Aleck"
lname: "Smith"
email: "sleek@friars.providence.edu"
sent: "Biology"
subjects: Array (2)

```

Query 4: How many tutors are in the database?

Compass

Project1 > University_Tutoring > Tutors

Documents (15) Aggregations Schema Indexes (1) Validation

Project: {}
Sort: db.tutors.countDocuments({})
Collation: { locale: 'simple' }
Index Hint: { field: -1 }
Max Time MS: 60000
Skip: 0 Limit: 0

ADD DATA **EXPORT DATA** **UPDATE** **DELETE**

Import completed.
40 documents imported.

```

_id: ObjectId('67f55fd9b2f0408e696043f2')
tid: 101
fname: "Jessica"
lname: "Ray"
email: "jessica@friars.providence.edu"
department: "Mathematics"
subjects: Array (2)

_id: ObjectId('67f55fd9b2f0408e696043f3')
tid: 102
fname: "Hannah"
lname: "Nair"
email: "hannah@friars.providence.edu"
department: "Computer Science"
subjects: Array (3)

_id: ObjectId('67f55fd9b2f0408e696043f4')
tid: 103
fname: "Lucky"
lname: "Smith"
email: "lucky@friars.providence.edu"
sent: "English"
subjects: Array (2)

```

Query 5: Find all students with the major “Biology”

The screenshot shows the Compass MongoDB interface. On the left, the 'Connections' sidebar lists 'Project1' (selected), 'CSC 434', 'admin', 'config', and 'local'. The main area shows a query for 'Students' with the following parameters:

- Documents (20)
- Aggregations
- Schema
- Indexes (1)
- Validation

Query details:

- Projection: { major: "Biology" }
- Project: { field: 0 }
- Sort: { locale: 'simple' }
- Index Hint: { field: -1 }
- Max Time MS: 60000
- Skip: 0
- Limit: 0

Result preview:

```
_id: ObjectId('67f55fad2f0408e696043dd')
sid: 1
fname: "Emma"
lname: "Lee"
email: "emma@friars.providence.edu"
major: "Biology"
year: "Senior"

_id: ObjectId('67f55fad2f0408e696043e1')
sid: 5
fname: "Emmi"
lname: "Jockey"
email: "emmi@friars.providence.edu"
major: "Biology"
year: "Senior"

_id: ObjectId('67f55fad2f0408e696043e2')
sid: 6
fname: "Carla"
lname: "Chen"
email: "carla@friars.providence.edu"
major: "Biology"
year: "Junior"
```

Import status:

Import completed.
40 documents imported.

Query 6: What is the average number of appointments per student

The screenshot shows the MongoDB Compass interface. On the left, the connection sidebar lists 'CSC-434' (selected), 'Project1' (expanded to show 'University_Tutoring' which contains 'Appointments', 'Students', 'Subjects', and 'Tutors'), 'admin', 'config', and 'local'. The main panel shows the 'Aggregations' tab selected under 'University_Tutoring > Appointments'. The query results are displayed in a table with one row:

_id	averageAppointments
null	2

Query 7: Count how many tutors teach each subject

```
{  
  _id: "$subject_id",  
  tutorCount: { $sum: 1 }  
}
```

The screenshot shows the Compass MongoDB interface. On the left, the 'Connections' sidebar lists 'CSC 434' and 'Project1'. Under 'Project1', the 'University_Tutoring' database is selected, showing collections for 'Appointments', 'Students', 'Subjects', and 'Tutors'. The 'Tutors' collection has 15 documents. In the main panel, the 'Aggregations' tab is active, displaying an aggregation pipeline with a single stage: '\$group'. The 'Collation' field is set to '{ locale: 'simple' }'. The results table shows one document: '_id: null' and 'tutorCount : 15'. The interface includes standard MongoDB navigation buttons like 'Run', 'Explain', 'Export', and 'View'.

Query 8: Find the student(s) with the most appointments

The screenshot shows the Compass MongoDB interface. The 'Connections' sidebar lists 'CSC 434' and 'Project1'. Under 'Project1', the 'University_Tutoring' database is selected, showing collections for 'Appointments', 'Students', 'Subjects', and 'Tutors'. The 'Appointments' collection has 40 documents. In the main panel, the 'Aggregations' tab is active, displaying an aggregation pipeline with stages '\$group' and '\$sort'. The 'Collation' field is set to '{ locale: 'simple' }'. The results table shows 10 documents, each with '_id' and 'totalAppointments' fields. The results are as follows:

_id	totalAppointments
13	2
20	2
17	2
7	2
11	2
5	2
6	2
10	2
18	2

```
{
  "_id: "$student_id",
  totalAppointments: { $sum: 1 }
}

{ totalAppointments: -1 }
```

Query 9: Find all appointments for a specific tutor

The screenshot shows the Compass MongoDB interface. On the left, the 'Connections' sidebar lists 'CSC434' and 'Project1'. Under 'Project1', there are collections: 'Appointments', 'Students', 'Subjects', and 'Tutors'. The 'Tutors' collection is currently selected. The main panel displays a query builder for the 'Tutors' collection. The query is:

```

{
  "tid": 115
}

```

The 'Find' button is highlighted in green. To the right of the query, there are fields for 'Max Time MS' (set to 60000), 'Skip' (set to 0), and 'Limit' (set to 0). Below the query, the results pane shows one document:

```

{
  "_id": ObjectId('67f55fd9b2f0408e69604400'),
  "tid": 115,
  "fname": "Lee",
  "lname": "Kim",
  "email": "Lee@friars.providence.edu",
  "department": "Computer Science",
  "subjects": [
    ...
  ]
}

```

Query 10: Find all appointments for a specific student

Compass

My Queries

CONNECTIONS (2)

CSC-434

Project1

University_Tutoring

Appointments

Students

Subjects

Tutors

admin

config

local

Students

Appointments

Tutors

My Queries

+

Project1 > University_Tutoring > Students

Open MongoDB shell

Documents (20) Aggregations Schema Indexes (1) Validation

Find

Generate query Explain Reset Options

Max Time MS 60000

Skip 0 Limit 0

ADD DATA EXPORT DATA UPDATE DELETE

25 1-1 of 1

`{ "sid": 8 }`

`Project { field: 0 }`

`Sort`

`Collation { locale: 'simple' }`

`Index Hint { field: -1 }`

`_id: ObjectId('67f55fad2f0408e696043e4')`
`sid: 8`
`fname: "Ian"`
`lname: "Gomez"`
`email: "ian@friars.providence.edu"`
`major: "Engineering"`
`year: "Freshman"`

