

NoSQL DATABASE WITH MONGODB (CSE3236)

Time Allotted : 2½ hrs

Full Marks : 60

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
any 4 (four) from Group B to E, taking one from each group.*

Candidates are required to give answer in their own words as far as practicable.

Group – A

1. Answer any twelve:

12 × 1 = 12

Choose the correct alternative for the following

- (i) Which is not a characteristic of NOSql database?

(a) Can handle large data volume	(b) Scalable replication and distribution
(c) Schema-less	(d) Not an Open Source development
- (ii) On start-up of each mongod instance, mongoDB engine inserts a document into startup_log collection of local database. What type of collection is it?

(a) Normal	(b) Capped
(c) Expandable	(d) None of the above
- (iii) What is the name of the object returned after bulk inserts in MongoDB?

(a) WriteResult	(b) MultiWriteResult
(c) MultiInsertResult	(d) BulkWriteResult
- (iv) Say you have to track the relationship between the web host and the log message generated by web host. What type of pattern are you going to suggest for this type of data model?

(a) Subset Pattern	(b) Embedding
(c) Parent referencing	(d) Child referencing
- (v) Which pattern(s) is used for modelling Tree structure in MongoDB?

(a) Array of Ancestors	(b) Materialized Paths
(c) Nested Sets	(d) All of them
- (vi) Say you have written following aggregation pipeline :


```
db.orders.aggregate( [
  { $group: { _id: "$cust_id", count: { $sum: 1 } } },
  { $match: { count: { $gt: 5 } } }
])
```

 What will be the equivalent SQL statement?

(a) SELECT cust_id, count(*) FROM orders GROUP BY cust_id HAVING count(*) > 5	(b) SELECT cust_id, count(*) FROM orders WHERE count(*) > 5 GROUP BY cust_id
(c) a and b	
(d) No such equivalence exist	
- (vii) Say in article collection there is a field named subject. You have created a text index on this subject field. Now you have issued following text search:


```
db.articles.find( { $text: { $search: "bake coffee cake" } } )
```

 Which of the following statement is true?

(a) Returns all documents containing either bake or coffee or cake in the indexed subject field.	(b) Returns all documents containing any one of these three search terms in the indexed subject field
(c) Returns all documents containing only first search term in the indexed subject field	
(d) Returns all documents containing either bake or coffee or cake or any stemmed version of these words in the indexed subject field	
- (viii) Say you have defined a schema in Mongoose like :


```
var dpSchema = new Schema({ name: String, department: String });
```

 How can you add a new instance method fndDept() in this schema?

(a) dpSchema.methods.fndDept = function() {....};	(b) dpSchema.statics.fndDept = function() {....};
(c) dpSchema.instance.fndDept = function() {....};	(d) dpSchema.fndDept = function() {....};
- (ix) Say you have written following code snippet in a node.js application using mongoDB native client where MongoClient is the native driver and url is a valid mongoDb database url. What will be the result?


```
MongoClient.connect(url, function(err,db){
  var res = db.collection('Student').find();
  res.each(function(err, doc) {
```

```

        console.log(doc);
    })
}
```

- (a) It will give connection error if mongoDB instance is not running
- (b) Nothing will be displayed in console
- (c) Display all the documents of Student collection if mongoDB instance is running
- (d) a and c

- (x) The geospatial data in MongoDB is stored in which formats?
- (a) GeoJSON
 - (b) Legacy Coordinate Pair
 - (c) Both (a) and (b)
 - (d) None of the above

Fill in the blanks with the correct word

- (xi) You should prefer NoSQL database when support of _____ and _____ are not essential at database level.
- (xii) A write operation _____ or _____ data in the MongoDB instance and is _____ on the level of a single document.
- (xiii) With _____ inserts, if an error occurs during an insert of one of the documents, MongoDB _____ to insert the remaining documents in the array.
- (xiv) Two strengths of Referencing are better _____ and improved _____.
- (xv) TTL in MongoDB index creation option stands for _____ and it permits automatic _____ of documents after a certain time.

Group - B

2. (a) State at least four Key Features of MongoDB. Give some reasons behind current popularity of NoSQL databases over RDBMS in the industry? Write at least five advantages and three limitations of MongoDB over RDBMS. [[C01](Remember/LOCQ)]
- (b) What is Hadoop? Compare Hadoop vs MongoDB. [[C01](Remember/LOCQ)]

(2+ 2+3) + 5 = 12

3. (a) What is cursor? How many documents are returned automatically from a cursor if the returned cursor is not assigned to a variable using the var keyword?
Write a command to know the cursor Information. What information is available in the return object? Cursors that aren't opened under a session automatically close after 10 minutes of inactivity, or if client has exhausted the cursor. Write the instruction to override this behaviour in mongosh.
How can you stop returning the same document more than once in some situations in a cursor?
Write a code snippet to return the first document from a cursor return by a query, if no document exist return null. [[C01,C02](Understand/IOCQ)]

- (b) Say in a collection you have following documents:
- ```

{ "_id": "apples", "qty": 5 }
{ "_id": "bananas", "qty": 7 }
{ "_id": "oranges", "qty": { "in stock": 8, "ordered": 12 } }
{ "_id": "avocados", "qty": "fourteen" }
```
- What are the documents returned by the query `db.collection.find( { qty: { $gt: 4 } } )` ? Why third document is not returned?  
What is the outcome of the following code snippet?
- ```
var myCursor = db.students.find( );
myCursor.forEach(printjson);
```
- Say you have one document in an employee collection:
- ```
{
 "_id" : 3, "type" : "Permanent", "name" : "Bimal Ghosh",
 "classification": { dept: "CSE", category: "Faculty" }
}
```
- Write a query to return only the category of that document (the returned category field remains inside the classification document).

[[C01,C02](Understand/IOCQ)]

**(2 + 3 + 1 + 1 + 1) + (2 + 1 + 1) = 12**

### Group - C

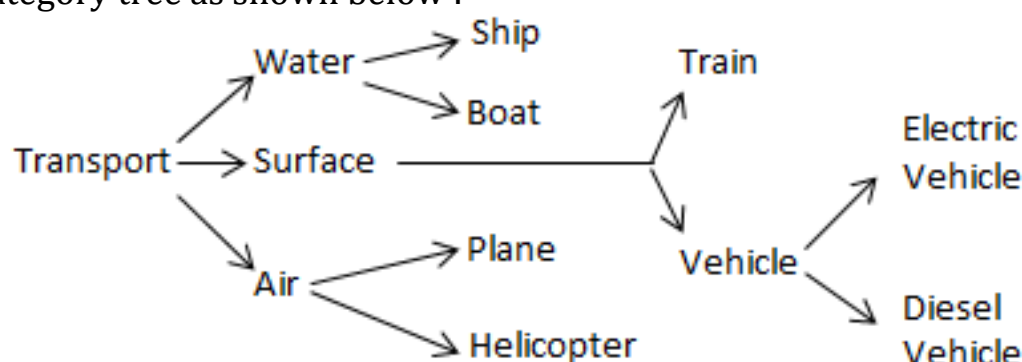
4. (a) How One-to-One relationship is generally established in MongoDB data model? Give short explanation with an example.  
What is the potential problem in the above approach?  
How can you overcome it using Subset Pattern? Explain it with suitable example. [[C03](Analyse/IOCQ)]
- (b) Suppose you have categories collection to describe the relationship between book categories :
- ```
{_id: "MongoDB", parent: "Databases" },
{_id: "dbm", parent: "Databases" },
{_id: "Databases", parent: "Programming" },
{_id: "Languages", parent: "Programming" },
{_id: "Programming", parent: "Books" },
{_id: "Books", parent: null }
```

Create a model for above tree-like structure using Child References.

[[CO3](Analyse/IOCQ)]
(2 + 1 + 6) + 3 = 12

5. Write names of three patterns used for modelling tree structure in MongoDB. Which one of these three patterns is considered fast and efficient and why?

Say you have a Transport category tree as shown below :



Model the above tree structure in MongoDB using any two of the patterns.

You must use abbreviated ids of each node as shown below while defining _id field:

Transport : tr , Water : wt, Surface : sf, Air : ar, Ship : sh, Boat : bt, Plane : pl, Helicopter : hp, Train : tn, Vehicle : vh, Electric Vehicle : ev, Diesel Vehicle : dv.

[[CO3](Analyse/IOCQ)]
[(1 + 5) + (5 + 1)] = 12

Group - D

6. (a) Name at least 4 index types available in MongoDB. Write the syntax of createIndex() method and explain the sparse, TTL, and unique options used in index creation method.
- (b) Say in a people collection the document structure is as follows:
{ "_id": 1, "person": { name: "Dibakar", surname: "Pradhan" }, "age": 34, "city": "Kolkata", "hobbies": ["music", "gardening", "skiing"] }
- Create a multikey index on hobbies field.
- Now you have issued following commands :
- ```
db.people.find({ hobbies: "music" })
db.people.find({ hobbies: "music", hobbies: "gardening" })
```
- Which of the above find command uses the index?

[(CO2) (Remember/LOCQ)]  
(2 + 1 + 2 + 2 + 2) + (2 + 1) = 12

7. (a) Write a code snippet in node.js to connect a MongoDB database myDB in localhost. Which mongoose property contains the connection information after successfully connected? Display the host and port from that property otherwise show error after successfully connected.
- (b) Say asset is an object consists of two properties type and ticker. How can you define it in your Mongoose schema? How can you define a custom validator in Mongoose Schema? Give an example and explain it.
- Say users collection contains two fields firstName and lastName. Define the Mongoose schema for this collection with an instance method which will return full name.

[(CO5) (Remember/IOCQ)]  
(2 + 2) + (2 + 3 + 3) = 12

### Group - E

8. (a) You need to develop a RESTful APIs using Express and Mongoose with MongoDB Atlas for CRUD operation. For simplicity you can assume:
- Node.js development environment is already set up. All the packages including express and mongoose are installed in your project folder.
  - MongoDB database connection string in Atlas is already available to you.
  - Collection named Games is inserted in the database using Atlas service which contains a document  
{ title: "Pac", publisher: "Nintendo", tags: ["adventure", "action"], price: 230 }
- You have to develop following code snippets:
- Routes to perform create, update, delete and find all document operations in gameRoutes.js in Routers subfolder of the project
  - Develop codes for model using Mongoose in gameModel.js in Models subfolder of the project with following validations:
    - title: it is a lowercase string, mandatory and length > 4 and < 200
    - tags: it is mandatory and value may contain more than one value from the list [ 'sports', 'racing', 'action' ]
    - price: it is number, default value 0, if < 0 show error message "Negative prices aren't allowed."
  - server.js for running server to serve client requests.
- (b) Write the urls to be used in Postman or any other tools to test all the operations of this API.

[(CO5,CO6) ((Analyse/HOCQ)]  
10 + 2 = 12

9. (a) What is virtual in Mongoose? State some of its uses. Why it is preferred over Child referencing?  
Say user collection contains two fields firstName and lastName. Define a virtual property fullName using the virtual method on user schema so that when you access fullName it will show the full name of the user using firstName and lastName and when you set the full name it will set firstName and lastName fields of the document accordingly. [[ C06)(Understand/IOCQ)]
- (b) What is Geospatial data ? Give some examples.  
What are the formats used to store Geospatial Data in MongoDB?  
Write the syntax of specifying GeoJSON data in MongoDB. [[C06)(Remember/LOCQ)]
- (4 + 4) + (2 + 1 + 1) = 12**
- 

|                         |       |       |       |
|-------------------------|-------|-------|-------|
| Cognition Level         | LOCQ  | IOCQ  | HOCQ  |
| Percentage distribution | 33.33 | 54.17 | 12.50 |