NOSQL DATABASE WITH MONGODB
(CSEN 4135)

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) Say you have inventory collection with following documents:
{ "_id" : 2, "item" : "belt", "sizes" : [ ] }
{ "_id" : 3, "item" : "pen", "sizes": "M" }
{ "_id" : 4, "item" : "sunglass" }
{ "_id" : 5, "item" : "watch", "sizes" : null }
{ "_id" : 1, "item" : "wallet", "sizes": ["S", "M", "L"] }
How many documents will be returned by following aggregation command?
db.inventory.aggregate([
{ $unwind: { path: "$sizes", preserveNullAndEmptyArrays: true } }
])
(a) 5 (b) 3
(c) 7 (d) Null document

(ii) 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

(iii) When the 'connected' event will fired by Mongoose?
(a) If it successfully connects to the standalone server
(b) If it manages to reconnect to the replica set primary
(c) a and b
(d) If it manages to reconnect to the replica set primary as well as all secondary

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

(v) Which is not considered as weaknesses of Embedding?
(a) Restricted document size.
(b) Large documents mean more overhead if most fields are not relevant.
(c) Data duplication
(d) Retrieve all relevant information in a single query

(vi) What are the properties you should consider while modelling one-to-many relationships in MongoDB?
(a) Cardinality: the size of "many" will affect how you might model the data
(b) Independent access
(c) a and b
(d) Size of the document in many side

(vii) Say the geners collection contains a document { _id: 1, title: "Gener-1", genrelist: ["comedy", "romance", "fiction"]} and the movies collection contains 10 movies of type 'horror'. The generalist filed of geners collection has a relationship with type field of movies collection. If you join these two collection using $lookup how may document will be returned?
(a) 10 (b) 0
(c) 1 (d) 11

(viii) What are the key concepts behind the geospatial queries directly on MongoDB?
(a) the GeoJSON Standard
(b) the creation of MongoDB Geo Indexes
(c) the MongoDB operators like $geoWithin, $geoIntersects, and $nearSphere
(d) all of the above options

(ix) Say you have defined a schema schm1 in Mongoose and then add a static method stMethod. How can you call that static method?
(a) Create a model say mod1 based on schm1 and then call mod1.stMethod
(b) Create a model say mod1 based on schm1 and then create an instance of that model say inst1 and then call inst1.stMethod.
(c) Create a model say mod1 based on schm1 and then call mod1.static.stMethod.
(d) Any of the above option

(x) 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() {….};

Fill in the blanks with the correct word

(xi) TTL in MongoDB index creation option stands for _____ and it permits automatic _____ of documents after a certain time.

(xii) MongoDB _____ is generally recommended to every company who has a significant need in the NoSQL database and do not want to manage their _____.

(xiii) In aggregation pipeline, the _____ pipeline stage provides access to MongoDB queries.

(xiv) On start-up, each mongod instance inserts a document into _____ collection named _____ of local database and this information will be helpful for diagnostic purpose.

(xv) A write operation _____ or _____ data in the MongoDB instance and is _____ on the level of a single document.

Group - B

2. (a) Say you issued following command to update a document :

```
db.inventory.update( { item: "TBD1" },
{
    item: "TBD1",
    details: { "model" : "14Q4", "manufacturer" : "ABC Company" },
    stock: [ { "size" : "S", "qty" : 25 } ],  category: "houseware"
},
{ upsert: true }
)
```

What will happen if no document satisfies the selection criteria? Write the content of WriteResult if no document satisfies the selection criteria. What is the content of the document inserted in the collection after this operation?

[(CO2)Understand/IOCQ)]

(b) Consider an inventory collection that contains the following documents:
{ _id: 6, type: "comp", item: "desktop-2", ratings: [8, 12] }
{ _id: 7, type: "mobile", item: "mobile-1ccc", ratings: [12, 8, 20] }
{ _id: 5, type: "comp", item: "desktop-1", ratings: [8, 12, 20] }
1. Write a query to find the document satisfying ratings 8,12,20 order and the result returned by the query.
2. Write a query to find the documents where at least one ratings array contains 8 and the result returned by the query.
3. Write a query to find the documents where first element of ratings array contains 8 and returned result.

[(CO2) (Understand/IOCQ)]

(c) What will happen when you issues following command?
db.products.save({ item: "book", qty: 30 })

[(CO2)(Remember/LOCQ)]

(1 + 1 + 2) + (2 + 2 + 2) + 2 = 12

3. (a) 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). *[(CO1,CO2)(Understand/IOCQ)]*

(b) Say you have issued following query:

db.users.find({ age: { $gt: 18 } }, { name: 1, address: 1 }).limit(5)

How many documents will be returned? What are the fields returned by matched documents?

Write a query to find user documents where userId > 50 and show only userId, name and email fields.

What is the default behaviour of Cursor opened under a session if you do not perform any activity on it for long time or exhaust the cursor? Write the instruction to override this behaviour in mongosh. *[(CO2)(Understand/IOCQ)]*

(c) Say an item collection contains item information having fields _id (unique integer), type , itemdesc, ratings (an array of integer no.).

- Write a query to find the documents where at least one array element is greater than 12 and less than 20.
- Write a query to find the documents where ratings array contains elements that in some combination satisfy the query conditions >8 and < 12 ; e.g., one element can satisfy the greater than 8 condition and another element can satisfy the less than 12 condition, or a single element can satisfy both. *[(CO2)Understand/IOCQ)]*

(2 + 1 + 1) + (2 + 2 + 1) + (2 + 1) = 12

Group - C

4. Say you have two sample collections, inventory and orders as shown below:

inventory collection - { prodId: 100, price: 20, quantity: 125 }, { prodId: 101, price: 10, quantity: 234 }, { prodId: 102, price: 15, quantity: 432 }, { prodId: 103, price: 17, quantity: 320 }

orders collection - { orderID: 201, custid: 301, prodId: 100, numPurchased: 20 }, { orderID: 202, custid: 302, prodId: 101, numPurchased: 10 }, { orderID: 203, custid: 303, prodId: 102, numPurchased: 5 }, { orderID: 204, custid: 303, prodId: 103, numPurchased: 15 }, { orderID: 205, custid: 303, prodId: 103, numPurchased: 20 }, { orderID: 206, custid: 302, prodId: 102, numPurchased: 1 }, { orderID: 207, custid: 302, prodId: 101, numPurchased: 5 }, { orderID: 208, custid: 301, prodId: 100, numPurchased: 10 }, { orderID: 209, custid: 303, prodId: 103, numPurchased: 30 }

Create a joined View over these two collection using $lookup.

Write a query on that view to find the total amount sold for each product. What will be the output? *[(CO3)(Analyse/HOCQ)]*

6 + 4 + 2 = 12

5. (a) What is bulkWrite operation in MongoDB? Explain its syntax. What is the difference between ordered and unordered option in bulkWrite operation?

What are the operations supported by bulkWrite()? *[(CO3)(Analyse/HOCQ)]*

(b) Say you have pets collection which contains following documents:

{ _id: 1, name: "Wag", type: "Dog", weight: 20 },
{ _id: 2, name: "Bark", type: "Dog", weight: 10 },
{ _id: 3, name: "Meow", type: "Cat" },
{ _id: 4, name: "Scratch", type: "Cat" },
{ _id: 5, name: "Bruce", type: "Bat" }

Perform following operations against that collection using bulkWrite():

- Insert one document { "_id": 6, "name": "Bubbles", "type": "Fish" }
- Update the weight of pet with _id = 2 to 15
- Delete the pet with _id =5
- Replace the pet with _id = 4 with { "name" : "Bite", "type" : "Dog", "weight": 5 }

What result do you expect after above bulkWrite operation? *[(CO3)(Analyse/HOCQ)]*

(2 + 1 + 1) + 8 = 12

Group - D

6. (a) Say you have two collections : Genres contains documents with fields named title, genrelist an array type contains all the genres in that title and Movies contains document with fields named movieName, gener_type, rating. Write a query by joining Genres with movies to show each Genre document along with movies of all genres in genrelist. *[(CO6) (Analyse/HOCQ)]*

(b) Say you have two collections : Orders contains documents with fields named item, price and ordQty and warehouses contains documents with fields named stock_item, whName, inStock. Each warehouse is stocking order items and each item may be available in more than one warehouse. Write a query to find all orders along with warehouse information which can fulfil the ordered quantity. *[(CO6) (Analyse/HOCQ)]*

5 + 7= 12

7. (a) Explain the function of $project and $sortByCount pipeline stages? *[(CO6)(Understand/LOCQ)]*

(b) Say you have airport collection containing following documents. “connects” field contains all the airports which are connected to the that airport. Write a query using aggregation pipeline to show the airports which have only one connection.

```
[ { "_id": 0,"airport": "JFK", "connects": ["BOS","ORD"] },
{ "_id": 1,"airport": "BOS", "connects": ["JFK","PWM"] },
{ "_id": 2,"airport": "ORD", "connects": ["JFK"] },
{ "_id": 3,"airport": "PWM", "connects": ["BOS","LHR"],
{ "_id": 4,"airport": "LHR", "connects": ["PWM"] }  ]
```

[(CO6) (Analyze/HOCQ)]

5 + 7 = 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. Set up an Express web application and develop a RESTful API to perform CRUD operation on Food collection in a database named mydb in a local mongoDB server. Assume that Food collection contains information on each food item like name and calories. You must do the following validations :

- name : type is String, mandatory and lowercase
- calories : type is Number, default value 0 and if calories is –ve you must give error message “Negative calories aren’t real”

[CO5,CO6(Analyze/HOCQ)]

12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	0	25	75