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) In which format MongoDB represents document structure?
(a) BSON (b) .txt
(c) .docx (d) .JSON

(ii) 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

(iii) What document will be save if the command db.products.save({ item: "book", qty: 40 }) is issued?
(a) { "_id" : ObjectId("50691737d386d8fadbd6b01d"), "item" : "book", "qty" : 40 }
(b) { "_id" : 1, "item" : "book", "qty" : 40 }
(c) { "item" : "book", "qty" : 40 }
(d) None of the above

(iv) Which is considered as strength of Referencing?
(a) Better Data consistency
(b) Improved data integrity
(c) Faster writes
(d) All of them

(v) 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

(vi) 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

(vii) 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() {….};

(viii) How to install MongoDB Native driver in Node.js application?
(a) npm install mongodb
(b) install mongodb
(c) need not install explicitly
(d) None of them

(ix) Why Mongoose is preferred over MongoDB native driver?
(a) Mongoose is faster than mongodb native driver for CRUD operations
(b) In Mongoose open and close database connection for each request is optimized so application will not die when serving millions of concurrent requests
(c) Mongoose provides better maintainability of the application
(d) b and c

(x) 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

Fill in the blanks with the correct word

(xi) In _____ database nodes typically store information about people, places, and things while edges store information about the _____ between the nodes.

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

(xiv) The _____ operator limits the contents of a field from the query results to contain only the _____ element matching the $elemMatch condition.

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

Group - B

2. (a) Define the save() method. Write the syntax of the save() method.
What will happen when you issues following command?
db.products.save({ item: "book", qty: 40 }). *[(CO2) (Remember/LOCQ)]*

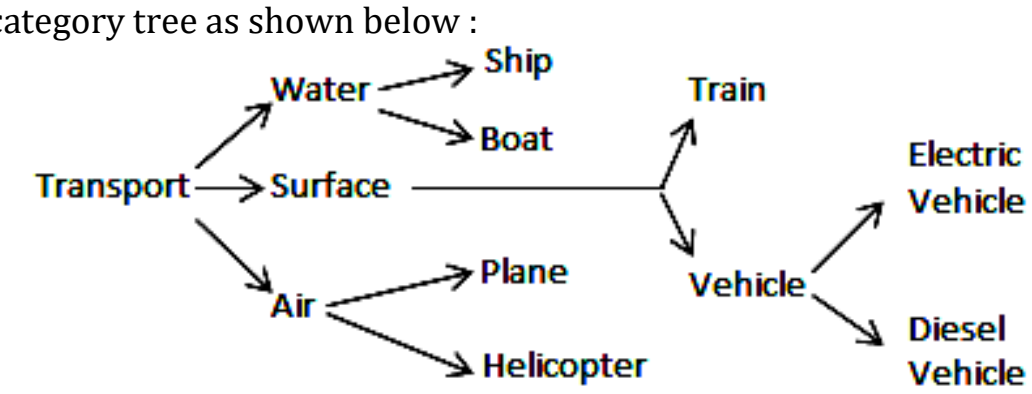
(b) Consider an inventory collection that contains the following documents:
{ _id: 6, type: "comp", item: "desktop-2", ratings: [8, 12] }
{ _id: 7, type: "mobile", item: "mobile-1ccc", ratings: [12, 8, 20] }
{ _id: 5, type: "comp", item: "desktop-1", ratings: [8, 12, 20] }
(i) Write a query to find the document satisfying ratings 8,12,20 order and the result returned by the query.
(ii) Write a query to find the documents where at least one ratings array contains 8 and the result returned by the query.
(iii) Write a query to find the documents where first element of ratings array contains 8 and returned result.
[(CO2) (Understand/IOCQ)]
(2 + 2 + 2) + (2 + 2 + 2) = 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.
[(CO1,CO2)(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).
[(CO1,CO2)(Understand/IOCQ)]
(2 + 3 + 1 + 1 + 1) + (2 + 1 + 1) = 12

Group - C

4. 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

5. 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

Group - D

6. (a) What do you mean by aggregation in MongoDB? What are the different ways to perform aggregations in MongoDB? Write the name of seven important stages used in aggregation framework? Explain the function of $group and $unwind stages.

[(CO2,CO4) (Understand/IOCQ)]

(b) Say you have two collections :
(i) Genres contains documents with fields named title, genrelist an array type contains all the geners in that title and (ii) 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.
Say the genres collection contains a document { _id: 1, title: "Genre-1", genrelist: ["comedy", "romance", "fiction"]} and the movies collection contains 2 movies of type romance, 5 movies of type comedy, 3 movies of type horror. How many movie documents will be returned in the array used in “as” field of above command?

[(CO4)(Amalyse/IOCQ)]

(1 + 1 + 1 + 1.5 + 1.5) + (5 + 1) = 12

7. (a) Compare Mongoose vs MongoDB native driver.
What is schema in Mongoose? Write a schema for modelling breakfast Menu of a restaurant with following properties:
(i) name : must have a lowercase name of string type and maximum length allowed is 40, if no name provided give error message ‘name is required’.
(ii) bread : number type with minimum quantity 2 and maximum quantity 6
(iii) eggs : must be number and minimum quantity 2 and maximum quantity 12. If quantity is less than 2 provide error message ‘Too few egg’
(iv) butter : number type and minimum quantity 10 an d maximum quantity 50. If quantity is more than 50 provide error message ‘More than 50gm not served’
(v) drink : string type, only milk, tea and coffee are served. If no. of egg is more than 4 this property is required.

[(CO5) (Remember/LOCQ)]

(b) What is the main function of Model in Mongoose? Write a node.js code snippet to create a model for student collection which contains student information like name, rollNo, age and save a student (name = ‘Pijus Bose’, RollNo =’362345’, age=24) in MongoDB database.

[(CO5)(Remember/LOCQ)]

(2 + 1 + 5) + (1 + 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) You have a traintime.csv file containing train timings data which contains comma separated values of columns _id, starttime, stoptime, sourceStationId, sourceStationName, destinationStationId, destinationStationName and distance. starttime and stoptime are Date type and _id is unique id column. This file has no header row containing column names. Define the data type of the fields in a separate .txt file and write appropriate mongoimport command to import the data in a collection named timeTable.

What will be the mongoimport command when the .csv file contains the header line? If you use --mode=merge option in the above command what will happen. *[(CO6)(Remember/LOCQ)]*

(b) What is the function of import mode flag available in mongoimport? Describe briefly each of the import modes.

Say you have a json array containing population data of cities. Write the syntax of mongoimport command for importing such data into MongoDB. *[CO6(Remember/LOCQ)]*

(3 + 2 + 2) + (3 + 2) = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	31.25	43.75	25