

CS639.1 - Fall 2024  
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Exam 1 — 15%

(Last) Surname: \_\_\_\_\_ (First) Given name: \_\_\_\_\_

NetID (email): \_\_\_\_\_ @wisc.edu

Fill in these fields (left to right) on the scantron form (use #2 pencil):

1. LAST NAME (surname) and FIRST NAME (given name), fill in bubbles
2. IDENTIFICATION NUMBER is your Campus ID number, fill in bubbles
3. Under **F** of SPECIAL CODES, write **1** and fill in bubble **1**

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**If you miss step 3 above (or do it wrong), the system may not grade you against the correct answer key, and your grade will be no better than if you were to randomly guess on each question. So don't forget and double check it's correct!**

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You may only reference your note sheet. You may not use books, calculators, or other electronic devices during this exam. You may not sit near your friends or look at your neighbors during this exam. Please place your student ID face up on your desk. Turn off and put away portable electronics (including smart watches) now.

**Use a #2 pencil to mark all answers. DO NOT USE PEN on the scantron.**

When you're done, please hand in the exam and note sheet and your filled-in scantron form. The note sheet will not be returned.

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1. Which of the following operators enables us to redirect both `stdout` and `stderr` to some file?  
A. `>`    **B. `&>`**    C. `|`    D. `&`    E. `<`
  2. Which of the following `docker run` command flags is used to specify network port information?  
A. `-d`    B. `-e`    C. `-m`    **D. `-p`**    E. `-v`
  3. Consider the below `products` collection:

```
[
  {
    "_id": 1,
    "productID": 201,
    "name": "Laptop",
    "price": 1200,
    "category": "Electronics",
    "discount": 300,
  },
  {
    "_id": 2,
    "productID": 202,
    "name": "Desk Chair",
    "price": 300,
    "category": "Furniture",
    "discount": 10
  }
]
```

Which of the following MongoDB queries retrieves `products` where the `discount` is greater than 15% of the `price`?

- A. `db.products.find({"$expr": { "$lt": ["discount", { "$multiply": ["price", 0.15]}]}})`
  - B. `db.products.find({"$expr": { "$gt": ["discount", { "$multiply": ["price", 0.15]}]}})`
  - C. `db.products.find({"$expr": { "$lt": ["$discount", { "$multiply": ["$price", 0.15]}]}})`
  - D. `db.products.find({"$expr": { "$gt": ["$discount", { "$multiply": ["$price", 0.15]}]}})`
4. Which of the following commands will take us to the parent directory of the current working directory?  
A. `cd .`    **B. `cd ..`**    C. `cd +`    D. `cd ~`

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5. Which SQL clause enables us to perform selection?

A. SELECT   B. FROM   C. WHERE   D. GROUP BY   E. HAVING

6. Given below are the schemas of SQL tables:

Students:

| student\_id | name | major | gpa |

Enrollments:

| student\_id | course\_id | grade |

What does the following SQL query produce?

```
SELECT name, AVG(grade) AS avgGrade
FROM Enrollments
JOIN Students on Enrollments.student_id = Students.student_id
GROUP BY name
```

- A. computes average grade for all students in the database
- B. computes average grade for each student across all of their courses**
- C. computes average grade for each course
- D. computes count of grades for each student across all of their courses

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7. Consider the below `products` collection:

```
[
  {
    "_id": 1,
    "productID": 201,
    "name": "Laptop",
    "price": 1200,
    "category": "Electronics",
    "discount": 300,
  },
  {
    "_id": 2,
    "productID": 202,
    "name": "Desk Chair",
    "price": 300,
    "category": "Furniture",
    "discount": 10
  }
]
```

Which of the following MongoDB queries retrieves `products` whose `name` starts with “Desk”?

- A. `db.products.find({"name": {"$regex": "Desk$"}})`
- B. `db.products.find({"name": {"$regex": "^Desk"}})`
- C. `db.products.find({"name": {"$regex": ".*Desk.*"}})`
- D. `db.products.find({"name": {"$regex": "Desk"}})`

8. Given below is the schema of a SQL table:

`Students`:

<code>student_id</code>	<code>name</code>	<code>major</code>	<code>gpa</code>
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Which of the following SQL queries will return the names of students whose names contain the substring “John” from the `Students` table?

- A. `SELECT name FROM Students WHERE name LIKE "%John%"`
- B. `SELECT name FROM Students WHERE name = "%John%"`
- C. `SELECT name FROM Students WHERE name CONTAINS "%John%"`
- D. `SELECT name FROM Students WHERE name SUBSTRING "%John%"`
- E. `SELECT name FROM Students WHERE name LIKE "John%"`

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9. Consider the below collection in MongoDB:

```
authors collection:
{
  "_id": 1,
  "author_id": 1001,
  "name": "Jane Austen",
  "books_written": [
    {"book_id": 2001},
    {"book_id": 2002}
  ]
}
```

Which of the following MongoDB queries retrieves the `book_id` corresponding to each author `name`? Please make sure to select the best answer that does not provide more than the requested information.

- A. `db.authors.find({}, {"name": 1, "books_written.book_id": 1})`
- B. `db.authors.find({}, {"name": 1, "books_written.book_id": 1, "_id": 0})`
- C. `db.authors.find({}, {"name": 1, "books_written[book_id]": 1})`
- D. `db.authors.find({}, {"name": 1, "books_written[book_id]": 1, "_id": 0})`

10. Which of the following is **NOT** a type of Database Management System (DBMS)?

- A. Relational   B. NoSQL   C. Graph   D. In-Memory   **E. Cloud**

11. Given below are the schemas of SQL tables:

Students:  
| student\_id | name | major | gpa |

Enrollments:  
| student\_id | course\_id | grade |

Which clause in the below SQL query is incomplete?

```
SELECT student_id, name, AVG(grade) AS avgGrade
FROM Enrollments
JOIN Students ON Enrollments.student_id = Students.student_id
GROUP BY student_id
HAVING avgGrade > 3.0
```

- A. SELECT   B. FROM   C. JOIN   **D. GROUP BY**   E. HAVING

---

12. What type of data do tables in databases store?

**A. structured**   B. semi-structured   C. unstructured

13. Consider the below collections in MongoDB:

```
authors collection:
{
  "_id": 1,
  "author_id": 1001,
  "name": "Jane Austen",
  "books_written": [
    {"book_id": 2001},
    {"book_id": 2002}
  ]
}
books collection:
{
  "_id": 2001,
  "book_id": 2001,
  "title": "Pride and Prejudice",
  "author_ids": [1001],
  "genres": ["Fiction", "Romance"],
  "published_year": 1813
}
```

Which of the following MongoDB queries retrieves books that belong to both the “Fiction” and “Romance” genres?

- A. `db.books.find({"genres": {"$in": ["Fiction", "Romance"]}})`
- B. `db.books.find({"genres": {"$eq": ["Fiction", "Romance"]}})`
- C. `db.books.find({"$genres": {"$any": ["Fiction", "Romance"]}})`
- D. `db.books.find({"$genres": {"$elemMatch": ["Fiction", "Romance"]}})`
- E. `db.books.find({"genres": {"$all": ["Fiction", "Romance"]}})`**

14. MongoDB is an example of a \_\_\_\_\_ non-relational database.

**A. Key / Value**   B. Graph   C. Column   **D. Document**

15. Which one of the following relational algebra expressions enables us to represent renaming operation?

**A.  $\pi$**    B.  $\sigma$    **C.  $\rho$**    D.  $\bowtie$    E.  $\cap$

---

16. Given below is the schema of a SQL table:

Students:  
| student\_id | name | major | gpa |

Which of the following is the correct relational algebra expression for the below SQL query?

```
SELECT name, major
FROM Students
WHERE gpa >= 3.5
```

- A.  $\sigma_{\text{gpa} < 3.5}(\pi_{\text{name, major}}(\text{Students}))$
- B.  $\pi_{\text{name, major}}(\sigma_{\text{gpa} \geq 3.5}(\text{Students}))$
- C.  $\sigma_{\text{gpa} \geq 3.5}(\pi_{\text{name, major}}(\text{Students}))$
- D.  $\pi_{\text{name, major}}(\sigma_{\text{gpa} < 3.5}(\text{Students}))$

17. Which of the following Linux commands can show you the first few lines of a file?

A. top   B. last   C. tail   D. head   E. lsof

18. Consider the below collections in MongoDB. What type of relationship is there between authors and their books?

```
authors collection:
{
  "_id": 1,
  "author_id": 1001,
  "name": "Jane Austen",
  "books_written": [
    {"book_id": 2001},
    {"book_id": 2002}
  ]
}
books collection:
{
  "_id": 2001,
  "book_id": 2001,
  "title": "Pride and Prejudice",
  "author_ids": [1001],
  "genres": ["Fiction", "Romance"],
  "published_year": 1813
}
```

A. Linked   B. Embedded



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19. Which of the following is the correct shebang line for a bash script?
- A. `#!/usr/bin/bash`
  - B. `!# /usr/bin/bash`
  - C. `#! /usr/bin/python3`
  - D. `/bin/bash`
20. Which of the following docker commands will enable us to stop a running container?
- A. `docker rm`
  - B. `docker rmi`
  - C. `docker stop`
  - D. `docker terminate`
21. Given a SQL data type's definition as `float(6, 3)`, which of the following numbers exceeds the allowed precision and scale?
- A. 1.234   B. 12.345   C. 123.45   D. 123.456   **E. 1234.56**
22. Which of the following `docker exec` command flags do we need to use when we want to run `bash` or `mongosh` on an existing docker container?
- A. `-d`   B. `-p`   C. `-it`   D. `-m`   E. `-aq`
23. What type does `find` method return?
- A. `int`   B. `list`   C. `dict`   D. `float`   **E. `cursor`**

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24. Given below are the schemas of SQL tables:

Students:

| student\_id | name | major | gpa |

Enrollments:

| student\_id | course\_id | grade |

Courses:

| course\_id | name | credits |

Which SQL query answers this question: Which students are enrolled in a course named "Data Mgmt for Data Science"?

- A. 

```
SELECT name FROM Students WHERE student_id IN (
    SELECT student_id FROM Enrollments WHERE course_id = ANY (
        SELECT course_id FROM Courses
        WHERE name = "Data Mgmt for Data Science"
    )
)
```
- B. 

```
SELECT name FROM Students WHERE name = "Data Mgmt for Data Science"
```
- C. 

```
SELECT name FROM Students WHERE student_id IN (
    SELECT student_id FROM Enrollments WHERE course_id = (
        SELECT course_id FROM Courses
        WHERE name = "Data Mgmt for Data Science"
    )
)
```
- D. 

```
SELECT name FROM Students WHERE student_id IN (
    SELECT student_id FROM Enrollments WHERE course_id = ALL (
        SELECT course_id FROM Courses
        WHERE name = "Data Mgmt for Data Science"
    )
)
```

---

25. Consider the below `products` collection:

```
[
  {
    "_id": 1,
    "productID": 201,
    "name": "Laptop",
    "price": 1200,
    "category": "Electronics",
    "discount": 20,
  },
  {
    "_id": 2,
    "productID": 202,
    "name": "Desk Chair",
    "price": 300,
    "category": "Furniture",
    "discount": 0
  }
]
```

Which of the following MongoDB queries correctly retrieves `products` that are either in the “Electronics” category or have a price less than 500?

- A. `db.products.find({"category": "Electronics" or {"price": {"$lt": 500}}})`
- B. `db.products.find({"category": "Electronics", "price": {"$lt": 500}})`
- C. `db.products.find({"$and": [{"category": "Electronics"}, {"price": {"$lt": 500}}]})`
- D. `db.products.find({"$not": [{"category": "Electronics"}, {"price": {"$lt": 500}}]})`
- E. `db.products.find({"$or": [{"category": "Electronics"}, {"price": {"$lt": 500}}]})`

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