



Australian
National
University

程序代写代做 CS编程辅导

Week 9 Workshop - Database Security



WeChat: cstutorcs

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<https://tutorcs.com>



程序代写代做 CS编程辅导

Qing Wang



Zoom drop-in session: Friday 1pm-2pm (Week 9 to Week 12)

WeChat: cstutorcs

Board Room 4.15, Building 145

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Research areas: Data management and analytics

Email: tutorcs@163.com

Data mining

Graph machine learning

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Graph algorithms

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程序代写代做 CS编程辅导 Graph Research Lab

(<https://u.github.io/website/>)



u.github.io/website/

Graph Research Lab @ ANU

Home

Projects

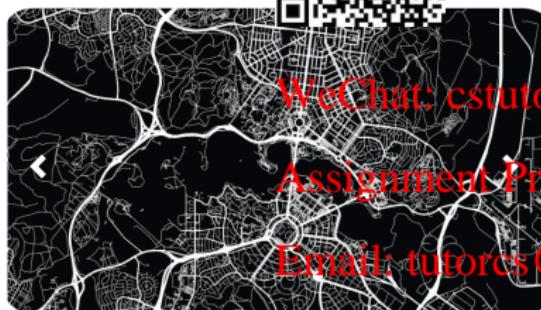
Activities

Code&Datasets

Vacancies

Contact

Welcome to Graph Research



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We are a research team at the [School of Computing](#) in Australian National University. Our overarching research goal is to explore and understand graph-structured data. In today's real-world applications, graphs are ubiquitously used for representing complex objects and their relationships such as cities in a road network, atoms in a molecule, friendships in social networks, connections in computer networks, and data in a web page. We focus on the following research areas:

- Graph theory and algorithms
- Machine learning on graphs
- Bridging between graph theory and machine learning

Check out our [recent research highlights](#) and [research opportunities](#).

News

10 Sep 2021

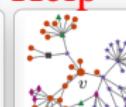
Ghodai's paper "Deep Graph Memory Networks for Forgetting-Robust Knowledge Tracing" is accepted for publication at TKDE.

20 June 2022

Buddhi will be joining us soon.
Welcome!



Deep Learning for Graph Isomorphism



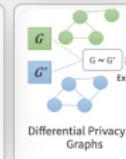
Geometric Graph Learning



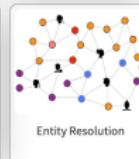
Deep Knowledge Tracing



Shortest-Path Algorithms



Differential Privacy on Graphs



Entity Resolution

程序代写代做 CS编程辅导
House Keeping



- Assignment 2 (Database Theory) is due is 23:59, Oct 11, 2022.
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House Keeping



- Assignment 2 (Database Theory) is due is 23:59, Oct 11, 2022.
WeChat: cstutorcs
- All the labs on Oct 3 (Monday) this week will be moved to the same venues on Oct 10 (Monday) in Week 10.
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程序代写代做 CS编程辅导
House Keeping



- Assignment 2 (Database Theory) is due is 23:59, Oct 11, 2022.
WeChat: cstutorcs
- All the labs on Oct 3 (Monday) this week will be moved to the same venues on Oct 10 (Monday) in Week 10.
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- Lab 8 is optional and runs from Oct 11 to Oct 14 (Tuesday to Friday) next week. There is a separate sign-up page on the Wattle course site.
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“Hardware is easy to protect: lock it in a room, chain it to a desk, or buy a spare. Information poses more of a problem. It can exist in more than one place; be transported halfway across the planet in seconds; and be stolen without your knowledge.”

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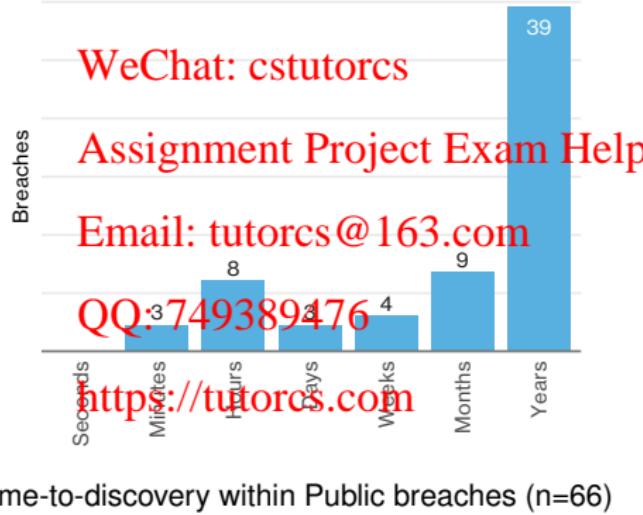
– Bruce Schneier

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程序代写代做 CS编程辅导 Data Breaches

- In 80% of cases, attackers are able to compromise an organization within minutes. However, in 20% of cases, it takes years to learn that they have been breached



¹Verizon 2016&2017 Data Breach Investigation Reports



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程序代写代做 CS编程辅导 Data Breaches

ABC NEWS

Just In Queen's death Watch Live Coronavirus

Business Analysis Sport Science Health Arts Fact Check Other

Canberra Change location 9°C NFeels like 9°C N

Anna [REDACTED] bought her first home - but then her details were leaked in the Optus data breach and everything changed.

By Widia Jalal
Posted 16h ago, updated 10h ago

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Optus customers affected by the data hack have been left to mitigate cyber security risks on their own. (Unsplash: Elisa Ventur)

Top Stories

Putin signs Russia's annexation of four Ukrainian regions into law

Treated with disdain: Affected families query Hawthorn review's independence

McLachlan says AFL 'doing what we were asked' in naming panel to conduct Hawthorn review

Brittany Higgins told police she took pregnancy test after alleged rape

After tax U-turn, UK PM Liz Truss pledges to steer Britain through 'stormy days'

Nobel Prize goes to three chemists who made molecules 'click'

Alleged killers of Danielle Easey admitted their role in her death to friends, court told

Which banks are passing on the interest rates to borrowers? What

程序代写代做 CS编程辅导
Data Breaches

- June 2019, ANU consumers were notified of a data breach.



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程序代写代做 CS编程辅导 Data Breaches

- June 2019, ANU computer systems notified of a data breach.



“It's shocking in its scale”



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“While we cannot confirm exactly what data was taken, we know it was much less than the 19 years' worth we originally reported”

from VC's message - Release of the data breach incident report, 2nd October 2019

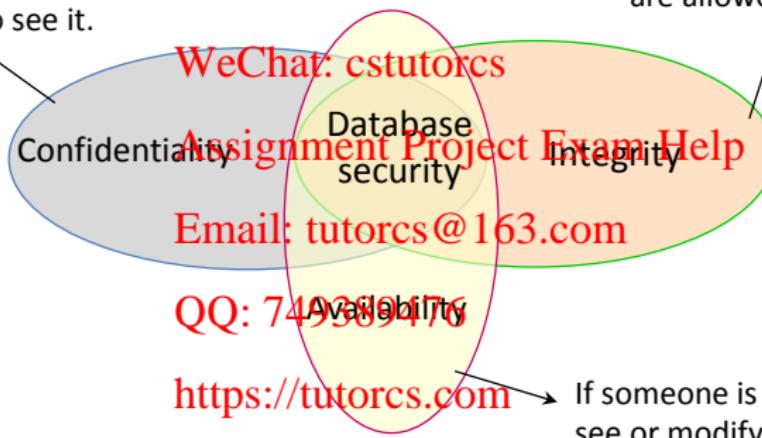


程序代写代做 CS编程辅导 Objectives of Database Security



Data should only be shown to people who are allowed to see it.

Data should only be modified by people who are allowed to modify it.



If someone is allowed to see or modify data, they should be able to do so.



程序代写代做 CS编程辅导
Database Security - Examples

1 A health-care inform



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程序代写代做 CS编程辅导 **Database Security - Examples**



1 A health-care information system

- A patient's medical information should not be improperly disclosed.

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程序代写代做 CS编程辅导 **Database Security - Examples**



1 A health-care information system

- A patient's medical information should not be improperly disclosed.
- A patient's medical information should be correct.

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Database Security - Examples



1 A health-care information system

- A patient's medical information should not be improperly disclosed.
- A patient's medical information should be correct.
- A patient's medical information can be accessed when needed for treatment.

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1 A health-care information system

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- A patient's medical information should be correct.
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2 A military system

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程序代写代做 CS编程辅导 Database Security - Examples



1 A health-care information system

- A patient's medical information should not be improperly disclosed.
- A patient's medical information should be correct.
- A patient's medical information can be accessed when needed for treatment.

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2 A military system

- The target of a missile cannot be given to an unauthorized user.

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程序代写代做 CS编程辅导 Database Security - Examples



1 A health-care information system

- A patient's medical information should not be improperly disclosed.
- A patient's medical information should be correct.
- A patient's medical information can be accessed when needed for treatment.

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2 A military system

- The target of a missile cannot be given to an unauthorized user.
- The target of a missile cannot be arbitrarily modified.

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程序代写代做 CS编程辅导 Database Security - Examples



1 A health-care information system

- A patient's medical information should not be improperly disclosed.
- A patient's medical information should be correct.
- A patient's medical information can be accessed when needed for treatment.

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2 A military system

- The target of a missile cannot be given to an unauthorized user.
- The target of a missile cannot be arbitrarily modified.
- The target of a missile can be accessed when needed.

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程序代写代做 CS编程辅导
Database Security - Core Services

- Confidentiality



- Integrity

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- Availability Assignment Project Exam Help

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程序代写代做 CS编程辅导
Database Security - Core Services



- **Confidentiality**

- E.g. enforcement of access control mechanisms

- **Integrity**

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- **Availability**

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程序代写代做 CS编程辅导
Database Security - Core Services



- **Confidentiality**

- E.g. enforced by access control mechanisms

- **Integrity**

- E.g. enforced by access control mechanisms and integrity constraints specified on schemas

- **Availability**

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程序代写代做 CS编程辅导
Database Security - Core Services



- **Confidentiality**

- E.g. enforced by access control mechanisms

- **Integrity**

- E.g. enforced by access control mechanisms and integrity constraints specified on schemas

- **Availability**

- E.g. enforced by recovery and concurrency control mechanisms

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程序代写代做 CS编程辅导 Database Security - Core Services



- Confidentiality
 - E.g. enforced by access control mechanisms
- Integrity
 - E.g. enforced by access control mechanisms and integrity constraints specified on schemas
- Availability Assignment Project Exam Help
 - E.g. enforced by recovery and concurrency control mechanisms

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Some further services

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- **Encryption:** to protect data when being transmitted across systems and when being stored on secondary storage
- **Query authentication:** to ensure a query result is correct by using signature mechanisms and data structures
- ...

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Access Control Mechanisms
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程序代写代做 CS编程辅导 Access Control Mechanisms



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- Three types:

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① Discretionary access control (DAC)

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② Mandatory access control (MAC)

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③ Role-based access control (RBAC)

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程序代写代做 CS编程辅导 Database Security - DAC

Bob



Alice

You



at your own discretion!

Grant privileges

Revoke privileges

Delegate privileges

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程序代写代做 CS 编程辅导
Granting/Revoking/Delegating Privileges



GRANT privileges

TO users [WITH GRANT OPTION]

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程序代写代做 CS编程辅导
Granting/Revoking/Delegating Privileges



GRANT privileges [TO users [WITH GRANT OPTION]]

REVOKE [GRANT OPTION FOR] privileges ON object FROM users

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[RESTRICT | CASCADE]

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程序代写代做 CS编程辅导 Granting/Revoking/Delegating Privileges



GRANT privileges TO users [WITH GRANT OPTION]

REVOKE [GRANT OPTION FOR] privileges ON object FROM users

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[RESTRICT | CASCADE]

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- Possible privileges:

- SELECT Email: tutorcs@163.com
- INSERT and INSERT (column)
- UPDATE and UPDATE (column) QQ: 740389476
- DELETE
- REFERENCES (column) <https://tutorcs.com>
- ...



程序代写代做 CS编程辅导 Granting/Revoking/Delegating Privileges



- The privileges of an object can be given to a user **with** or **without** the GRANT OPTION

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GRANT SELECT ON SUPPLIER TO Bob;

GRANT SELECT ON SUPPLIER TO Bob **WITH GRANT OPTION**;
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程序代写代做 CS编程辅导 Granting/Revoking/Delegating Privileges



- The privileges of an object can be given to a user **with** or **without** the GRANT OPTION

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GRANT SELECT ON SUPPLIER TO Bob;

GRANT SELECT ON SUPPLIER TO Bob **WITH GRANT OPTION**;
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- The privileges of an object can be taken away from a user. It is also possible to **only** revoke the GRANT OPTION on a privilege.

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REVOKE SELECT ON SUPPLIER FROM Bob;

REVOKE **GRANT OPTION** FOR SELECT ON SUPPLIER FROM Bob;



程序代写代做 CS编程辅导 Question



- In which situations a user can grant a privilege on an object to other users?

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- (1) The user is the owner of the object.
- (2) The user has the privilege on the object without the GRANT OPTION.
- (3) The user is a superuser of the database.
- (4) The user has received the privilege with the GRANT OPTION from the owner of the object.

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程序代写代做 CS编程辅导 Example - Granting Privileges

- Alice owns table Employee

```
(Alice): GRANT SELECT ON Employee TO Bob WITH GRANT OPTION;
```

```
(Alice): GRANT SELECT ON Employee TO Jane WITH GRANT OPTION;
```

```
(Alice): GRANT INSERT ON Employee TO Jane;
```

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```
(Bob): GRANT UPDATE ON Employee TO Tom WITH GRANT OPTION;
```

```
(Jane): GRANT SELECT, INSERT ON Employee TO Tom;
```

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程序代写代做 CS编程辅导 Example - Granting Privileges

- Alice owns table Employee

```
(Alice): GRANT SELECT ON Employee TO Bob WITH GRANT OPTION;
```

```
(Alice): GRANT SELECT ON Employee TO Jane WITH GRANT OPTION;
```

```
(Alice): GRANT INSERT ON Employee TO Jane;
```

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```
(Bob): GRANT UPDATE ON Employee TO Tom WITH GRANT OPTION;
```

```
(Jane): GRANT SELECT, INSERT ON Employee TO Tom;
```

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- Questions: Email: tutorcs@163.com

① What privilege(s) does Jane receive?

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程序代写代做 CS编程辅导 Example - Granting Privileges

- Alice owns table Employee

(Alice): GRANT SELECT ON Employee TO Bob WITH GRANT OPTION;

(Alice): GRANT SELECT ON Employee TO Jane WITH GRANT OPTION;

(Alice): GRANT INSERT ON Employee TO Jane;

(Bob): GRANT UPDATE ON Employee TO Tom WITH GRANT OPTION;

(Jane): GRANT SELECT, INSERT ON Employee TO Tom;

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- Questions: Email: tutorcs@163.com

① What privilege(s) does Jane receive?

② What privilege(s) does Tom receive?

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程序代写代做 CS编程辅导 Example - Granting Privileges

- Alice owns table Employee

```
(Alice): GRANT SELECT ON Employee TO Bob WITH GRANT OPTION;
```

```
(Alice): GRANT SELECT ON Employee TO Jane WITH GRANT OPTION;
```

```
(Alice): GRANT INSERT ON Employee TO Jane;
```

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```
(Bob): GRANT UPDATE ON Employee TO Tom WITH GRANT OPTION;
```

```
(Jane): GRANT SELECT, INSERT ON Employee TO Tom;
```

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- Can these commands be executed?

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程序代写代做 CS编程辅导 Example - Granting Privileges



- Alice owns table EMP

```
(Alice): GRANT SELECT, INSERT ON Employee TO Bob WITH GRANT OPTION;  
(Alice): GRANT SELECT, UPDATE ON Employee TO Jane WITH GRANT OPTION;  
(Alice): GRANT INSERT ON Employee TO Jane;  
(Bob): GRANT UPDATE ON Employee TO Tom WITH GRANT OPTION;  
(Jane): GRANT SELECT, INSERT ON Employee TO Tom;
```

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- Can these commands be executed?

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程序代写代做 CS编程辅导 Example - Granting Privileges

- Alice owns table Employee.



```
(Alice): GRANT SELECT, INSERT ON Employee TO Bob WITH GRANT OPTION;  
(Alice): GRANT SELECT, UPDATE ON Employee TO Jane WITH GRANT OPTION;  
(Alice): GRANT INSERT ON Employee TO Jane;  
(Bob): GRANT UPDATE ON Employee TO Tom WITH GRANT OPTION;  
(Jane): GRANT SELECT, INSERT ON Employee TO Tom;
```

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- Can these commands be executed?

- The first three are fully executed.

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程序代写代做 CS编程辅导 Example - Granting Privileges

- Alice owns table Employee.



```
(Alice): GRANT SELECT, INSERT ON Employee TO Bob WITH GRANT OPTION;  
(Alice): GRANT SELECT, UPDATE ON Employee TO Jane WITH GRANT OPTION;  
(Alice): GRANT INSERT ON Employee TO Jane;  
WeChat: cstutorcs  
(Bob): GRANT UPDATE ON Employee TO Tom WITH GRANT OPTION;  
(Jane): GRANT SELECT, INSERT ON Employee TO Tom,
```

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- Can these commands be executed?

- The first three are fully executed.
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- The fourth one is not executed, because Bob does not have the UPDATE privilege on the table.
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程序代写代做 CS编程辅导 Example - Granting Privileges

- Alice owns table Employee.



```
(Alice): GRANT SELECT, INSERT ON Employee TO Bob WITH GRANT OPTION;  
(Alice): GRANT SELECT, INSERT ON Employee TO Jane WITH GRANT OPTION;  
(Alice): GRANT INSERT ON Employee TO Jane;  
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(Bob): GRANT UPDATE ON Employee TO Tom WITH GRANT OPTION;  
(Jane): GRANT SELECT, INSERT ON Employee TO Tom,
```

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- Can these commands be executed?

- The first three are fully executed.
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- The fourth one is not executed, because Bob does not have the UPDATE privilege on the table.
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- The fifth one is partially executed because Jane has the SELECT and INSERT privileges but no GRANT OPTION for INSERT. Therefore, Tom only receives the SELECT privilege.



程序代写代做 CS编程辅导 Granting/Revoking/Delegating Privileges



- A user can only revoke privileges that the user has granted earlier, with two optional keywords in command:

- **CASCADE**: revoking the privilege from a specified user also revokes the privileges from all users who received the privilege from that user.
- **RESTRICT**: revoking the privilege only from a specified user.

Possible implementations:

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(1) Causing an error message in some DBMS if the revoked privilege is still delegated:

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(2) Revoking the privilege from the specified user in any case.

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- If a user receives a certain privilege from multiple sources, and the user would lose the privilege only after all sources revoke this privilege.



程序代写代做 CS编程辅导 Example - Revoking Privileges



- Again, Alice owns table Employee:

```
(Alice): GRANT SELECT ON Employee TO Bob WITH GRANT OPTION;  
(Alice): GRANT SELECT ON Employee TO Jane WITH GRANT OPTION;  
(Bob): GRANT SELECT ON Employee TO Tom;  
(Jane): GRANT SELECT ON Employee TO Tom;  
(Bob): REVOKE SELECT ON Employee FROM Tom;
```

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- Will Tom lose the SELECT privilege on EMPLOYEE?

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程序代写代做 CS编程辅导 Example - Revoking Privileges



- Again, Alice owns table Employee:

```
(Alice): GRANT SELECT ON Employee TO Bob WITH GRANT OPTION;  
(Alice): GRANT SELECT ON Employee TO Jane WITH GRANT OPTION;  
(Bob): GRANT SELECT ON Employee TO Tom;  
(Jane): GRANT SELECT ON Employee TO Tom;  
(Bob): REVOKE SELECT ON Employee FROM Tom;
```

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- Will Tom lose the SELECT privilege on EMPLOYEE?

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- Tom will still hold the SELECT privilege on EMPLOYEE, since he has independently obtained such privilege from Jane.



程序代写代做 CS编程辅导 Example - Revoking Privileges



- Again, Alice owns table EE:

```
(Alice): GRANT SELECT ON Employee TO Bob WITH GRANT OPTION;  
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(Alice): GRANT SELECT ON Employee TO Jane WITH GRANT OPTION;  
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(Bob): GRANT SELECT ON Employee TO Tom;  
(Jane): GRANT SELECT ON Employee TO Tom;  
Email: Tutors@163.com  
(Alice): REVOKE SELECT ON Employee@163.COM BY CASCADE;
```

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- Will Tom lose the SELECT privilege on EMPLOYEE?

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程序代写代做 CS编程辅导 Example - Revoking Privileges



- Again, Alice owns table Employee:

```
(Alice): GRANT SELECT ON Employee TO Bob WITH GRANT OPTION;  
(Alice): GRANT SELECT ON Employee TO Jane WITH GRANT OPTION;  
(Bob): GRANT SELECT ON Employee TO Tom;  
(Jane): GRANT SELECT ON Employee TO Tom;  
(Alice): REVOKE SELECT ON Employee FROM Bob CASCADE;
```

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- Will Tom lose the SELECT privilege on EMPLOYEE?

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程序代写代做 CS编程辅导 Example - Revoking Privileges



- Again, Alice owns table Employee:

```
(Alice): GRANT SELECT ON Employee TO Bob WITH GRANT OPTION;  
(Alice): GRANT SELECT ON Employee TO Jane WITH GRANT OPTION;  
(Bob): GRANT SELECT ON Employee TO Tom;  
(Jane): GRANT SELECT ON Employee TO Tom;  
(Alice): REVOKE SELECT ON Employee FROM Bob CASCADE;
```

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- Will Tom lose the SELECT privilege on EMPLOYEE?

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- Tom will lose the SELECT privilege on EMPLOYEE.



程序代写代做 CS编程辅导 Delegating Privileges - Propagation



- There are techniques for propagation of privileges.

- Limiting **horizontal propagation**: limits that a user that has been given the GRANT OPTION can grant the privilege to at most n other users;

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- Limiting **vertical propagation**: limits the depth of the granting privileges.

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- How can we keep track of privilege propagation?

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程序代写代做 CS编程辅导 Privilege Propagation

- tuna owns:



STATE(name, state, population)
STATE(name, abbreviation, capital, area, population)

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- The following commands are executed in order:

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(tuna): GRANT SELECT, UPDATE ON CITY TO shark WITH GRANT OPTION;

(tuna): GRANT SELECT ON CITY TO minnow;

(tuna): GRANT SELECT ON STATE TO shark, minnow WITH GRANT OPTION;

(shark): GRANT SELECT ON STATE TO starfish WITH GRANT OPTION;

(shark): GRANT UPDATE (population) ON CITY TO starfish;

(starfish): GRANT SELECT ON STATE TO squid;

(shark): ...

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程序代写代做 CS编程辅导 Privilege Propagation



- A **grant graph** can be used to keep track of privilege propagation.





程序代写代做 CS编程辅导

(tuna): GRANT SELECT, UPDATE ON CITY TO shark WITH GRANT OPTION;

(tuna): GRANT SELECT, UPDATE ON CITY TO minnow;

(tuna): GRANT SELECT, UPDATE ON STATE TO starfish WITH GRANT OPTION;

(shark): GRANT SELECT, UPDATE ON CITY TO starfish WITH GRANT OPTION;

(shark): GRANT UPDATE (population) ON CITY TO starfish;

(starfish): GRANT SELECT ON STATE TO squid;

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shark
SELECT, CITY
(grant)

shark
UPDATE, CITY
(grant)

shark
SELECT, STATE
(grant)

minnow
SELECT, STATE
(grant)

starfish
SELECT, STATE
(grant)

squid
SELECT, STATE

tuna
SELECT, CITY
(grant)

tuna
UPDATE, CITY
(grant)

tuna
SELECT, STATE
(grant)

tuna
UPDATE, STATE
(grant)



程序代写代做 CS编程辅导 Using Views

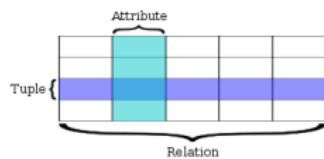
```
CREATE VIEW AS  
SELECT * FROM table_list
```



- Views can be used to create a “window” on a collection of data that is appropriate for some users to access.

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Some examples:
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- QQ: 749389476
- To grant read access to some columns of a table, we can create a view that ...
 - To grant read access to some rows of a table, we can create a view that ...
 - There are more useful scenarios ...

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程序代写代做 CS编程辅导 Using Views



- EXAMS(CourseID, StudentID, Grade, Date)

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(Tom): CREATE VIEW HardCourses AS
SELECT CourseID, AVG(Grade) AS Difficult FROM EXAMS
GROUP BY CourseID
Having AVG(Grade) <= 50;

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(Tom): CREATE VIEW AllCourses AS
SELECT CourseID, Grade FROM EXAMS;
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程序代写代做 CS编程辅导 Database Security - DAC

Bob



You can do it your own discretion!



Grant privileges
Revoke privileges
Delegate privileges
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Alice



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National
University

程序代写代做 CS编程辅导 Database Security - DAC

Bob



You



at your own discretion!

Grant privileges

Revoke privileges

Delegate privileges

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Alice



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– GRANT SELECT ON tableB TO Alice;

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程序代写代做 CS编程辅导 Database Security - DAC

Bob



You



can set your own discretion!

Grant privileges

Revoke privileges

Delegate privileges

WeChat: cstutorcs

Alice



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– GRANT SELECT ON tableB TO Alice;

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– REVOKE SELECT ON tableB FROM Alice;

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程序代写代做 CS编程辅导 Database Security - DAC

Bob



You



at your own discretion!

Grant privileges

Revoke privileges

Delegate privileges

WeChat: cstutorcs

Alice



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- GRANT SELECT ON tableB TO Alice;
- REVOKE SELECT ON tableB FROM Alice;
- GRANT SELECT ON tableB TO Alice
WITH GRANT OPTION;

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程序代写代做 CS编程辅导 Database Security - DAC

Bob



You



at your own discretion!

Grant privileges

Revoke privileges

Delegate privileges

WeChat: cstutorcs

Alice



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- GRANT SELECT ON tableB TO Alice;
- REVOKE SELECT ON tableB FROM Alice;
- GRANT SELECT ON tableB TO Alice
WITH GRANT OPTION;
- REVOKE GRANT OPTION FOR SELECT
ON tableB FROM Alice;

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程序代写代做 CS编程辅导 Database Security - DAC



You can do it your own discretion!

Grant privileges

Revoke privileges

Delegate privileges

WeChat: cstutorcs

Bob



Alice



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– GRANT SELECT ON tableB TO Alice;

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– GRANT SELECT ON tableA TO Bob;

– REVOKE SELECT ON tableB FROM Alice;

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– GRANT SELECT ON tableB TO Alice

WITH GRANT OPTION;

– REVOKE GRANT OPTION FOR SELECT

ON tableB FROM Alice;



程序代写代做 CS编程辅导 Database Security - DAC



Bob



You

at your own discretion!

Grant privileges

Revoke privileges

Delegate privileges

WeChat: cstutorcs



Alice



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– GRANT SELECT ON tableB TO Alice;

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GRANT SELECT ON tableA TO Bob;

– REVOKE SELECT ON tableB FROM Alice;

– REVOKE SELECT ON tableA FROM Bob;

– GARNT SELECT ON tableB TO Alice

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WITH GRANT OPTION;

– REVOKE GRANT OPTION FOR SELECT

ON tableB FROM Alice;



程序代写代做 CS编程辅导 Database Security - DAC



Bob



Alice

You can do it your own discretion!



Grant privileges

Revoke privileges

Delegate privileges

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- GRANT SELECT ON tableB TO Alice;
 - REVOKE SELECT ON tableB FROM Alice;
 - GRANT SELECT ON tableB TO Alice
- QQ: 749389476
- GRANT SELECT ON tableA TO Bob;
 - REVOKE SELECT ON tableA FROM Bob;
 - GRANT SELECT ON tableB TO Tom;
- WITH GRANT OPTION;
- REVOKE GRANT OPTION FOR SELECT
- ON tableB FROM Alice;



程序代写代做 CS编程辅导 Database Security - DAC



Bob



You can do it your own discretion!

Grant privileges

Revoke privileges

Delegate privileges

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Alice



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- GRANT SELECT ON tableB TO Alice;
- REVOKE SELECT ON tableB FROM Alice;
- GRANT SELECT ON tableB TO Alice
WITH GRANT OPTION;
- REVOKE GRANT OPTION FOR SELECT
ON tableB FROM Alice;
- GRANT SELECT ON tableA TO Bob;
- REVOKE SELECT ON tableA FROM Bob;
- GRANT SELECT ON tableB TO Tom;
- REVOKE SELECT ON tableB FROM Tom;

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程序代写代做 CS编程辅导 Database Security - MAC

<p>Security Clearance</p>  <p>Bob (Top secret)</p>	 <p>WeChat: cstutores</p>	 <p>Alice (Secret)</p>  <p>Jane (Confidential)</p>	 <p>Tom (Unclassified)</p>
---	--	--	--

<p>Security Class</p>  <p>QQ: 749389476 (Top secret)</p>	 <p>(Secret)</p>	 <p>(Confidential)</p>	 <p>(Unclassified)</p>
---	---	--	---

<https://tutorcs.com>

System-wide policies govern controlled access to classified information.



程序代写代做 CS编程辅导 **Mandatory Access Control**

- It is based the **Bell-L** model (originally developed for U.S. Department of Defense security policy).
 - Subjects (e.g. users) are assigned *security clearances*;
 - Objects (e.g. rows, tables, views) are assigned *security classes*.

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$$TS \geq S \geq C \geq U$$

(TS: Top secret, S: Secret, C: Confidential, U: Unclassified)

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QQ: 749389476

<https://tutorcs.com>



程序代写代做 CS编程辅导 Mandatory Access Control



- It is based the **Bell-L** model (originally developed for U.S. Department of Defense security policy).
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 - Objects (e.g. rows, tables, views) are assigned *security classes*.

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$$TS \geq S \geq C \geq U$$

(TS: Top secret, S: Secret, C: Confidential, U: Unclassified)

- Two MAC rules are enforced by the model:
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 - 1 Subject X can read object Y only if $clearance(X) \geq class(Y)$.
→ **Read down** QQ: 749389476
 - 2 Subject X can write object Y only if $clearance(X) \leq class(Y)$.
→ **Write up** <https://tutorcs.com>



程序代写代做 CS编程辅导 Mandatory Access Control



- It is based the **Bell-L** model (originally developed for U.S. Department of Defense security policy).
 - Subjects (e.g. users) are assigned *security clearances*;
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→ **Read down** QQ: 749389476
 - 2 Subject X can write object Y only if $clearance(X) \leq class(Y)$.
→ **Write up** <https://tutorcs.com>
- The key idea is “**preventing information in high level objects from flowing to low level subjects**”.



程序代写代做 CS编程辅导 Mandatory Access Control

● Multilevel relations:

Then users with different clearances see a different collection of rows when they access the table.



at each row is assigned a security class.

clearances see a different collection of rows when they access the table.

city	rating	security class
Paris	4	secret (S)
Canberra	5	confidential (C)

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QQ: 749389476
<https://tutorcs.com>



程序代写代做 CS编程辅导 Mandatory Access Control



- **Multilevel relations:**

Then users with different clearances see a different collection of rows when they access the table.

at each row is assigned a security class. They see a different collection of rows when they access the table.

city	rating	security class
Paris	4	secret (S)
Canberra	5	confidential (C)

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- Bob with C clearance can only access the second tuple.
- Peter with S clearance can access both tuples.
- Suppose that city is the primary key, and Bob with C clearance wishes to add a row (*Paris, 4, confidential(C)*).
 - 1 What would happen?

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程序代写代做 CS编程辅导 Mandatory Access Control



- **Multilevel relations:**

Then users with different clearances see a different collection of rows when they access the table.

at each row is assigned a security class. They see a different collection of rows when they access the table.

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程序代写代做 CS编程辅导 Mandatory Access Control



- **Multilevel relations:**

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- Suppose that city is the primary key, and Bob with C clearance wishes to add a row (*Paris, 4, confidential(C)*).
 - 1 What would happen? The first record may be (partial) inferred.
 - 2 How to solve the potential security issues?



程序代写代做 CS编程辅导 Mandatory Access Control



• Multilevel relations:

Then users with different clearances see a different collection of rows when they access the table.

at each row is assigned a security class.

city	rating	security class
Paris	4	secret (S)
Canberra	5	confidential (C)

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- Bob with C clearance can only access the second tuple.
- Peter with S clearance can access both tuples.
- Suppose that city is the primary key, and Bob with C clearance wishes to add a row (*Paris, 4, confidential(C)*).
 - 1 What would happen? The first record may be (partial) inferred.
 - 2 How to solve the potential security issues? Treating security class as part of the primary key.



程序代写代做 CS编程辅导 Database Security - MAC



Security
Clearance

Bob
(Top secret)



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Alice

Secret

Jane

Confidential



Tom
(Unclassified)

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Security
Class

Email: tutores@163.com



(Top secret)



(Secret)



(Confidential)



(Unclassified)

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- **Read down:** Subject X can read object Y only if $\text{clearance}(X) \geq \text{class}(Y)$.
- **Write up:** Subject X can write object Y only if $\text{clearance}(X) \leq \text{class}(Y)$.

程序代写代做 CS编程辅导
DAC vs MAC

- How do DAC and MAC interact with each other?



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程序代写代做 CS编程辅导 DAC vs MAC



- How do DAC and MAC differ from each other?

- **DAC is very flexible but complex.**

- Owners decide how their data is shared.
 - A user may have different privileges on different objects.
 - Different users may have different privileges on the same object.
 - ...

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程序代写代做 CS编程辅导 DAC vs MAC



- How do DAC and MAC differ from each other?

- **DAC is very flexible but complex.**

- Owners decide how their data is shared.
- A user may have different privileges on different objects.
- Different users may have different privileges on the same object.
- ...

- **MAC is comparatively rigid.**

- The system decides how data is shared.
- Each object is given a security class, and each user is given a security clearance.
- An object can then be accessed by users with the appropriate clearance.
- ...

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程序代写代做 CS编程辅导 DAC - Limitations



- Suppose that Alice owns a table R .

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- Alice gives Bob the SELECT privilege to read it, but not Steve. However, Steve may steal the information in R from Bob.

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- How? QQ: 749389476

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程序代写代做 CS编程辅导 DAC - Limitations



- Suppose that Alice owns a table R .

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- Alice gives Bob the SELECT privilege to read it, but not Steve. However, Steve may steal the information in R from Bob.

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- How? Trojan Horse attacks

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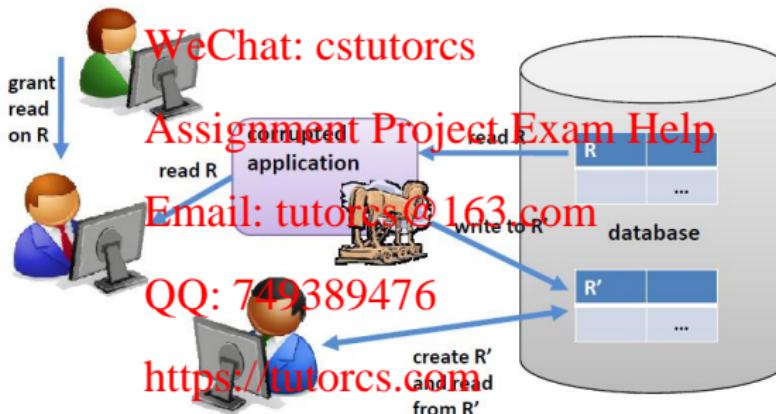


程序代写代做 CS编程辅导 DAC - Limitations



- **Trojan Horse attack**

tricks Bob into copying data from table R into table R' , then the control on table R doesn't apply to the copy of the data in table R' .



- Can this problem occur in MAC?



程序代写代做 CS编程辅导 **DAC - Limitations**



- DAC does not impose any restriction on the usage once data has been obtained by a user, i.e., the dissemination of data is not controlled.

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- MAC prevents illegitimate flow of information by attaching security classes to objects and security clearances to subjects.

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SQL Injection Attacks
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程序代写代做 CS编程辅导 **SQL Injection Attacks**



- SQL injection is one of the basic and oldest tricks hackers use to get into websites and their backend databases.

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程序代写代做 CS编程辅导 **SQL Injection Attacks**



- SQL injection is one of the basic and oldest tricks hackers use to get into websites and their backend databases.

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- How do web applications access a database?

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程序代写代做 CS编程辅导 **SQL Injection Attacks**



- SQL injection is one of the basic and oldest tricks hackers use to get into websites and their backend databases.

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- How do web applications access a database?

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① Connect to the database;

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程序代写代做 CS编程辅导 **SQL Injection Attacks**



- SQL injection is one basic and oldest tricks hackers use to get into websites and their backend databases.

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- How do web applications access a database?

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① Connect to the database;

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② Send SQL statements to the database;

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程序代写代做 CS编程辅导 **SQL Injection Attacks**



- SQL injection is one basic and oldest tricks hackers use to get into websites and their backend databases.

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- How do web applications access a database?

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① Connect to the database;

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② Send SQL statements to the database;

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③ Fetch the result and display data from the database;

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程序代写代做 CS编程辅导 SQL Injection Attacks



- SQL injection is one basic and oldest tricks hackers use to get into websites and their backend databases.

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- How do web applications access a database?

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② Send SQL statements to the database;

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③ Fetch the result and display data from the database;

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④ Close the connection.



程序代写代做 CS编程辅导 **SQL Injection Attacks**



- SQL injection is one basic and oldest tricks hackers use to get into websites and their backend databases.

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- How do web applications access a database?

Assignment Project Exam Help

① Connect to the database;

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② Send SQL statements to the database; ↪ **SQL Injection!**

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③ Fetch the result and display data from the database;

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④ Close the connection.

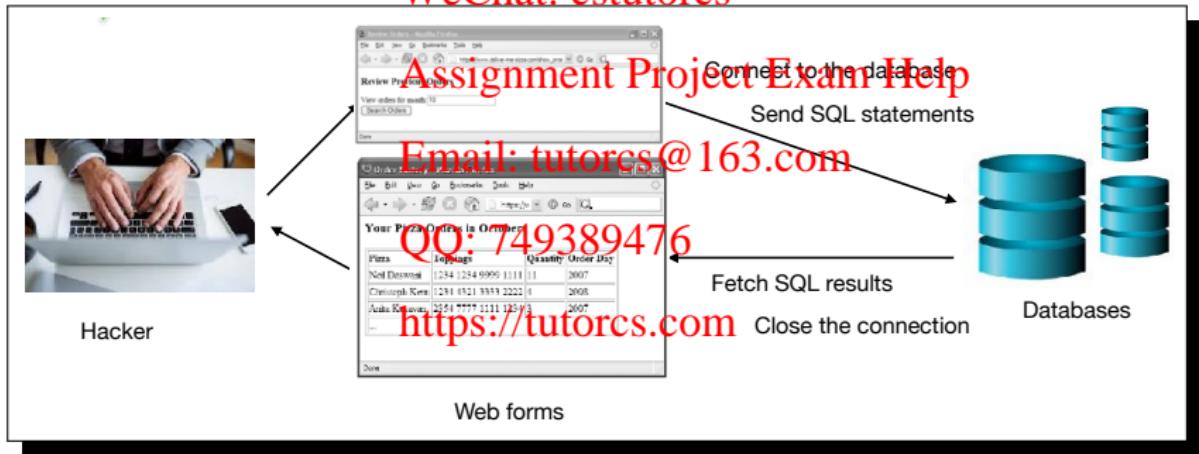


程序代写代做 CS编程辅导 SQL Injection Attacks



- Many web applications accept user input from a form.
- A user input is used to construct a SQL query submitted to a database.
- A SQL injection attack involves manipulating queries through the user input.

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程序代写代做 CS编程辅导 SQL Injection - Example



- Consider a pizza-ordering application that allows users to review the orders they have made in a month.

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Review Previous Orders

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View orders for month:

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Done

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The pizza order review form



程序代写代做 CS编程辅导 **SQL Injection - Example**



- When the form is submitted, it results in an HTTP request to the application:

`https://www.deliver-me-pizza.com/show_orders?month=10`

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程序代写代做 CS编程辅导 SQL Injection - Example



- When the form is submitted, it results in an HTTP request to the application:

https://www.deliver-me-pizza.com/show_orders?month=10

- When receiving such a request, the application constructs an SQL query:

```
sql_query = "SELECT pizza, toppings, quantity, order_id "
           + "FROM orders "
           + "WHERE userid=" + session.getCurrentUserId() + " "
           + "AND order_month=" + request.getParameter("month");
```

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程序代写代做 CS编程辅导 SQL Injection - Example



- When the form is submitted, it results in an HTTP request to the application:

`https://www.deliver-me-pizza.com/show_orders?month=10`

- When receiving such a request, the application constructs an SQL query:

```
sql_query = "SELECT pizza, toppings, quantity, order_day "
           + "FROM orders "
           + "WHERE userid=" + session.getCurrentUserId() + " "
           + "AND order_month=" + request.getParameter("month");
```

- Assuming that the current user's userid is 1234, we have:

`https://tutorcs.com`

```
SELECT pizza, toppings, quantity, order_day
```

```
FROM orders
```

```
WHERE userid=1234 AND order_month=10
```



程序代写代做 CS编程辅导 SQL Injection - Example



- The application then executes the query and retrieves the result set.

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Assignment Project Exam Help
Your Pizza Orders in October.

Pizza	Toppings	Quantity	Order Day
Diavola	Tomato, Mozzarella, Pepperoni, ...	2	12
Napoli	Tomato, Mozzarella, Anchovies, ...	1	17

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QQ: 749389476
Pizza order history

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- How can this application be attacked?



程序代写代做 CS编程辅导 SQL Injection - Example

- What would happen if user replaces '10' with '0 OR 1=1'?

The screenshot shows a Mozilla Firefox browser window with the title "Review Orders - Mozilla Firefox". The address bar displays the URL https://www.deliver-me-pizza.com/show_order. The page content is a login form for "WeChat: cstutorcs". The "View orders for month:" dropdown is set to "Assignment Project Exam Help". Below it is a "Search Orders" button. The text "Email: tutorcs@163.com" and "QQ: 749389476" are overlaid in red on the page.

QQ: 749389476

<https://tutorcs.com>



程序代写代做 CS编程辅导 SQL Injection - Example

- What would happen if the user replaces '10' with '0 OR 1=1'?

The screenshot shows a Mozilla Firefox browser window with the title "Review Orders - Mozilla Firefox". The address bar shows the URL https://www.deliver-me-pizza.com/show_orders. The page content is displayed in red text:

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Review Previous Orders

View orders for month: Assignment Project Exam Help

Email: tutorcs@163.com

Done

At the bottom of the page, there is a yellow highlighted area containing the URL <https://tutorcs.com>.

- Alternatively, the attacker may modify the HTTP request, e.g.,

<https://tutorcs.com>

https://www.deliver-me-pizza.com/show_orders?month=0%20OR%201%3D1

Then `request.getParameter("month")` extracts '0%20OR%201%3D1' and returns the string '0 OR 1=1'.



程序代写代做 CS编程辅导 SQL Injection - Example



- The SQL query that is now becomes:

```
SELECT pizza, toppings, quantity, order_day  
FROM orders
```

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```
WHERE userid=4123 AND order_month=0 OR 1=1
```

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程序代写代做 CS编程辅导 SQL Injection - Example



- The SQL query that is now becomes:

```
SELECT pizza, toppings, quantity, order_day  
FROM orders
```

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```
WHERE userid=4123 AND order_month=0 OR 1=1
```

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- Since the operator precedence of the AND operator is higher than that of OR, the WHERE condition is equivalent to

```
WHERE (userid=4123 AND order_month=0) OR 1=1
```

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程序代写代做 CS编程辅导 SQL Injection - Example



- The SQL query that the application constructs and sends to the database now becomes:

```
SELECT pizza, toppings, quantity, order_day  
      FROM orders
```

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```
WHERE userid=4123 AND order_month=0 OR 1=1
```

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- Since the operator precedence of the AND operator is higher than that of OR, the WHERE condition is equivalent to

```
WHERE (userid=4123 AND order_month=0) OR 1=1
```

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- What happened?

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The (malicious) user supplied a parameter that, once inserted into the SQL query string, actually altered the meaning of the query!



程序代写代做 CS编程辅导 SQL Injection - Example

- However, the attacker is able to do even more damage, e.g., making a request such that the parameter month evaluates to:

0 AND 1=0



UNION

SELECT cardholder, number, expMonth, expYear

FROM creditcards

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QQ: 749389476

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程序代写代做 CS编程辅导 SQL Injection - Example

- However, the attacker is able to do even more damage, e.g., making a request such that the parameter month evaluates to:

0 AND 1=0



UNION

```
SELECT cardholder, number, exp_month, exp_year  
FROM creditcards
```

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- Then, the SQL query that the application constructs and sends to the database becomes: Email: tutorcs@163.com

```
SELECT pizza, toppings, quantity, order_day
```

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FROM orders

```
WHERE userid=4123 AND order_month=0 AND 1=0
```

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UNION

```
SELECT cardholder, number, exp_month, exp_year
```

FROM creditcards



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- As a result, the attacker can get an HTML page that contains the entire content of the credit card table.



Firefox

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Your Pizza Orders in October

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Pizza	Toppings	Quantity	Order Day
Neil Daswani	1234 1234 9999 1111	11	2007
Christoph Kent	1234 4301 2363 0222	4	2008
Anita Kesavan	2354 7777 1111 1234	3	2007
...			

Done

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程序代写代做 CS编程辅导 **SQL Injection Attacks**

- How can we prevent SQL injection attacks?



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程序代写代做 CS编程辅导 **SQL Injection Attacks**



- How can we prevent SQL injection attacks?
- Can SQL injection attacks be prevented by any of the following security solutions?

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程序代写代做 CS编程辅导 SQL Injection Attacks



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① Firewall

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i.e., monitors and controls the incoming and outgoing network traffic based on predetermined security rules

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i.e., monitors a network or systems for malicious activity or policy violations

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③ Authentication

i.e., the process by which a system can identify users



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SQL Injection Attacks - Protection Techniques



- Several techniques of protection:

- **Blacklisting?**

i.e., blacklist quotes, semicolons, etc. from the input string. However, if you forget to blacklist just one type of dangerous character, it could give rise to a successful attack.

- **Whitelisting? Assignment Project Exam Help**

i.e., explicitly test whether a given input is within a well-defined set of values that are known to be safe, e.g., the parameter month is a string that represents a non-negative integer.

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- **Escaping?**

i.e., transform dangerous input characters to turn a potentially dangerous input string into a sanitized one, e.g., escape(o'connor)=o“connor (the double quote is the escaped version of the single quote).



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SQL Injection Attacks - Protection Techniques

- The recommended solution is Parameterized Queries



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程序代写代做 CS编程辅导 SQL Injection Attacks - Protection Techniques

- The recommended solution is Parameterized Queries

The key idea is “separate control from data”!



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SQL Injection Attacks - Protection Techniques

- The recommended solution is Parameterized Queries

The key idea is “separate control and data”!



- Two steps:

- The statement is prepared (parsed and compiled), in which ? is used as place-holders for the actual parameters.

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SQL Injection Attacks - Protection Techniques

- The recommended solution is Parameterized Queries

The key idea is “separate between control and data”!



- Two steps:

- The statement is prepared (parsed and compiled), in which ? is used as place-holders for the actual parameters.

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```
PreparedStatement stmt=conn.prepareStatement(  
    "SELECT pizza, toppings, quantity, order_day "  
    + "FROM orders WHERE userid=? AND order_month=?");
```

- The actual parameters are passed to the prepared statement for execution.

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```
stmt.setInt(1, session.getAttribute("userId"));
```

```
stmt.setInt(2, Integer.parseInt(request.getParameter("month")));
```

```
ResultSet res = ps.executeQuery();
```

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Research Topics
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- Differential privacy



- What Apple's differential privacy means for your data and the future machine learning: <https://techcrunch.com/2016/06/14/differential-privacy/>
- Learning with privacy at scale: <https://machinelearning.apple.com/research/learning-with-privacy-at-scale>