

Week 5 Workshop

ment Project Exam Help

Alice: Your model reduces the most interesting information

to something flat and boring.

Vittorio: You're right, and this causes a lot of problems.

pesigning we schedal for a complex application is tough, and it is easy to make mistakes when updat-

ing a database.

Also, the system knows so little about the data that it

s/hand to outperforman Are you telling me that the model is

Vittorio: No, wait, we are going to fix it!

(Foundations of Databases, S. Abiteboul, R. Hull, V. Vianu, Addison-Wesley, 1995)



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Which directors have collaborated with at least two different writers?
 (Clarification: two different writers, not including director themselves)

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Which directors have collaborated with at least two different writers?
 (Clarification: two different writers, not including director themselves)
 Among those directors who have never won any director award, who directed the largest unite of moves (Clarification). A hong ...)



- Which directors have collaborated with at least two different writers?
 (Clarification: two different writers, not including director themselves)
 Among those directors who have never won any director award, who directed the largest number of moves to Clarification. Along...)
- Pay attention to which attributes you need to list, whether you need to order the tuples, syntax issues,etc. (Partial marks may be awarded)
- Do not wait until the last minute to check/submit your solution.

 Refer to the instructions in heat signment specification.



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- More consultation hours in Week 6
 - Aug 30 (Mon) 2-3 pm
 - Aug 31 (Tue) 2-3 pm
 - Sep 1 (Wed) 8-9 pm



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	Name	StudentID	DoB	<u>CourseNo</u>	<u>Semester</u>	Unit
	Tom	123456	25/01/1989	COMP2400	2010 S2	6
1	4Tom	128456	25/01/1989	COMP8740	2011 S2	12
I	I (it is te	123453	11/01/1985	COMP2 400	200 32	6
	Michael	123458	21/04/1985	COMP8740	2011 S2	12
	Fran	123457	11/09/1987	COMP2400	2009 S2	6



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	Fran	123457	11/09/1987	COMP2400	2009 S2	6

Ansettion at Contract power ourse COMP30100, then ... Power in a new course COMP30100, then ...



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Ansettion anomalies in the entire a new course COMP3000, then ... Cournot Mental Lyalles into Course to the entire integrity constraint).



	Name	StudentID	DoB	<u>CourseNo</u>	<u>Semester</u>	Unit
	Tom	123456	25/01/1989	COMP2400	2010 S2	6
1	4 Tom	128456	25/01/1989	COMP8740	2011 S2	12
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	Michael	123458	21/04/1985	COMP8740	2011 S2	12
	Fran	123457	11/09/1987	COMP2400	2009 S2	6

- Anse tigh anomalies if inserting a new course COMP3010, then ... A Carnot Merity L values into Colos Levaus of the entry integrity constraint).
- Deletion anomalies: If deleting the enrolled course COMP2400 of Fran, then ...



	Name	StudentID	DoB	<u>CourseNo</u>	<u>Semester</u>	Unit
Tom 123456		25/01/1989	COMP2400	2010 S2	6	
1	4 Tom	128456	25/01/1989	COMP8740	2011 S2	12
I	Nich e	1/23/45	11/01/1985	COMP2400	200) \$2	6
	Michael	123458	21/04/1985	COMP8740	2011 S2	12
	Fran	123457	11/09/1987	COMP2400	2009 S2	6

- Ansettion anomalies in the entire a new course COMP3000, then ...

 A course two walks into course COMP3000, then ...

 A course two walks of the entire integrity constraint).
- Deletion anomalies: If deleting the enrolled course COMP2400 of Fran, then ... the personal information of Fran, such as DoB, will be lost as well.



	Name	StudentID	DoB	<u>CourseNo</u>	<u>Semester</u>	Unit
Tom 123456		25/01/1989	COMP2400	2010 S2	6	
1	4 Tom	128456	25/01/1989	COMP8740	2011 S2	12
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- Ansettion anomalies in the ering a new course COMP3000, then ... Course to the entry integrity constraint).
- Deletion anomalies: If deleting the enrolled course COMP2400 of Fran, then ... the personal information of Fran, such as DoB, will be lost as well.
- Modification anomalies: If changing the DoB of Michael, then ...



	Name	StudentID	DoB	<u>CourseNo</u>	Semester	Unit
	Tom	123456	25/01/1989	COMP2400	2010 S2	6
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- Ansettion anomalies in the entire a new course COMP3000, then ...

 A course two walks into course COMP3000, then ...

 A course two walks of the entire integrity constraint).
- Deletion anomalies: If deleting the enrolled course COMP2400 of Fran, then ... the personal information of Fran, such as DoB, will be lost as well.
- Modification anomalies: If changing the DoB of Michael, then ... update every tuple that records the DoB of this student.



ENROLMENT Help Cour eNo COMP2400 25/01/1988 2010 S2 Tom 123456 25/01/1988 COMP8740 2011 S2 12 COMP2400 2009 S2 Michael 123458 21/04/1985 6 21/04/1985 2011 S2 Michael 12345/8 COMP8740 12 20 9 52 6

STUDENT									
Name	Name StudentID								
Tom	28456	2 5/ 1 1988							
Michael	123458	21/04/1985							
Fran	123457	11/09/1987							

Course					
CourseNo	Unit				
COMP2400	6				
COMP8740	12				

		ENROL 1	
	4		
l	Stu de (ID)	VC(urs en t	Se nester
Ĭ	123456	COMP2400	2010 S2
	123456	COMP8740	2011 S2
	123458	COMP2400	2009 S2
	123458	COMP8740	2011 S2
	123457	COMP2400	2009 S2



Why Functional Dependencies?

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FDs tell us "relationship between and among attributes"!

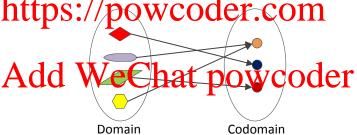
- FDs are unveloped to define the goodness and badness of relational) database design in a formal way.
 - Top down: start with a relation schema and FDs, and produce smaller delation schemas incertain normal form (cated/normalisation)
 - **Bottom up**: start with attributes and FDs, and produce relation schemas (*not popular in practice*).



What is "Functional" about Functional Dependencies?

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A (total) function f: X → Y describes a relationship between two sets X and Y such that each element of X is mapped to a unique element of Y.

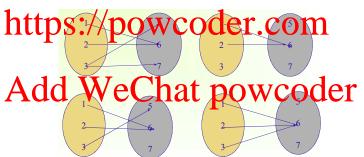




What is "Functional" about Functional Dependencies?

A SSA (panumate 1) 1 - Posscribe Clation Hippoches we be seen possession that each element of X is mapped to a unique element of Y.

Exercise: which of them represent a function?

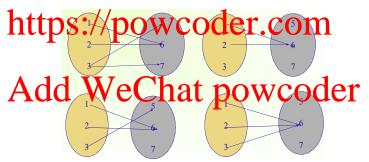




What is "Functional" about Functional Dependencies?

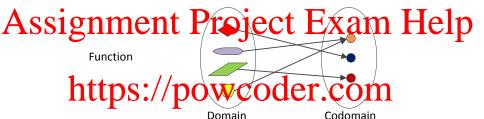
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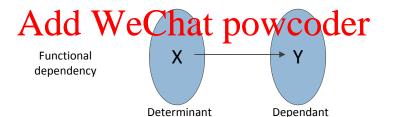
• Exercise: which of them represent a function?



Answer: The ones at the bottom.





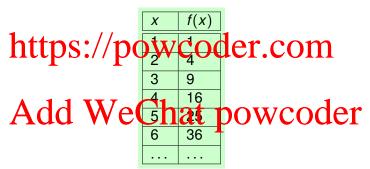




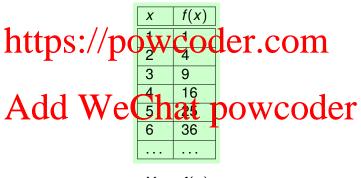
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$$X \rightarrow f(x)$$



Formal Definition

Assignment a relation scheme project in European Y Help A relation Y A relation Y A relation Y A relation Y on Y if, for any two tuples

A relation r(H) satisfies $X \to Y$ on H if, for any two tuples $t_1, t_2 \in r(R)$, whenever the tuples t_1 and t_2 coincide on values of X, they also coincide on values of Y.

they also coincide on values of Y. https://pow.coder.com

$$\downarrow t_1[Y] = t_2[Y]$$

- A FAS clid if it was sharted, powcoder
 - $\bullet \ \{A,B\} \to \{A\}$
 - $\bullet \ \{A,B,C\} \rightarrow \{A,B,C\}$
- Syntactical convention: (1) Instead of $\{A, B, C\}$, we may use ABC. (2) A, B, \ldots for individual attributes and X, Y, \ldots for sets of attributes.



Assairements Parsionant Threatment p

 Consider the following relation with attributes {A,B,C,D,E}. Do they satisfy the given FDs?





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 \bigcirc ABC \rightarrow AB



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Yes.



Assitocianine interest series in the team of the property of t

Consider the following relation with attributes {A,B,C,D,E}. Do they satisfy the given FDs?

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Add Well-late and the given FDs?

Add Well-late and the late and the late

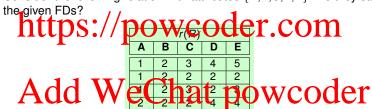
- lacktriangle ABC ightarrow AB
- 2 $ABC \rightarrow D$

Yes.



Assing an an times.

 Consider the following relation with attributes {A,B,C,D,E}. Do they satisfy the given FDs?



lacktriangle ABC o AB

Yes.

2 ABC \rightarrow D

No.



Assitocianine interest series in the team of the property of t

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lacktriangle ABC ightarrow AB

Yes.

2 ABC \rightarrow D

No.



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 Consider the following relation with attributes {A,B,C,D,E}. Do they satisfy the given FDs?

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	1	2	3	4	5	
A 11 TT7	- 1	2	2	2	2	1
Add W	e (2	าว	2 -	70	wcode
1100	2	<u> </u>	121	4	M4 Y) W COGC

lacktriangle ABC ightarrow AB

Yes.

2 ABC \rightarrow D

No.

 \bigcirc $E \rightarrow ABCD$

Yes.



Assing an inner property begins a control of the property begins and the property begins are property begins and the property begins and the property begins are property begins and the property begins are property begins and the property begins are property begins and the property begins and the property begins are property begins and the property begins and the property begins are property begins and the property begins and the property begins are property begins and the property begi

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https://	рe	W	In G	0	de	r.com
1 .	Α	В	C	D	E	
	1	2	3	4	5	
A 11 TT7	- 1	2	2	2	2	1
Add W	e (2	าว	2 -	70	wcode
1100	2	<u> </u>	121	4	M4 Y) W COGC

lacktriangle ABC ightarrow AB

Yes.

2 ABC \rightarrow D

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Yes.



Assignment Project Exam Help A functional dependency specifies a constraint on the relation schema that

A functional dependency specifies a constraint on the relation schema that must hold at all times.

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Assignment Project Exam Help A functional dependency specifies a constraint on the relation schema that

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• In hittps: ai/nspotweroteberrapoorm



Assignment Project Exam Help • A functional dependency specifies a constraint on the relation schema that

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- In hittps: attions portwere the rape of the
 - (1) Analyse data requirements

 Can be provided in the form of discussion with application users

 And relate entrement specifications OWCODET



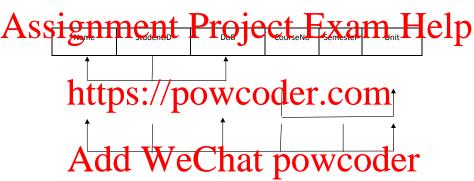
Assignment Project Exam Help A functional dependency specifies a constraint on the relation schema that

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- In hittps: attions portwere the rape of the
 - (1) Analyse data requirements
 Can be provided in the form of discussion with application users
 And relata equirement specifications
 (2) Analyse sample data
 - Useful when application users are unavailable for consultation and/or the document is incomplete.



(1) Analyse Data Requirements and FD Diagram



- StudentID → Name, DoB;
- CourseNo → Unit;
- StudentID, CourseNo, Semester → Name, DoB, Unit.



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	Name	<u>StudentID</u>	DoB	<u>CourseNo</u>	<u>Semester</u>	Unit
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1.	Tom	128456	25/01/1988	COMP8740	2011 S2	12
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* We may have We Chat powcoder



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Ť	Mich el	123453	21/04/1985	COMP8740	2011 S2	12
	Fran	123457	11/09/1987	COMP2400	2009 S2	6

We may have that powcoder



Oan you find some FDs or ENROLMENT based with e sample data?

	Name	StudentID	DoB	<u>CourseNo</u>	<u>Semester</u>	Unit
	Tom	123456	25/01/1988	COMP2400	2010 S2	6
1	Tom	128456	25/01/1988	COMP8740	2011 S2	12
r	I lik h le	123453	21V04/1985	COI 11-2 400	200132	6
1	Mich lel	123453	21/04/1985	COMP8740	2011 S2	12
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We may have:



Assignment Project Exam Help

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Ī	Mich lel	123453	21/04/1985	COMP8740	2011 S2	12
	Fran	123457	11/09/1987	COMP2400	2009 S2	6

- We may have that powcoder
 - {StudentID, Name} → {DoB};
 - $\{Name\} \rightarrow \{StudentID\} \times;$
 -



Assignment Project Exam Help

	Name	<u>StudentID</u>	DoB	<u>CourseNo</u>	<u>Semester</u>	Unit
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We may have that powcoder

- {StudentID, Name} → {DoB};
- $\{Name\} \rightarrow \{StudentID\} \times;$
-

Limitations:

- (1) Sample data needs to be a true representation of **all possible values** in the database.
- (2) Do we need all FDs?



Inference?

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Example:

```
If A = \{S = \{S = S \} \} of \{S = \{S = S \} \} of \{S = S = S \} of \{S = S \} of \{S = S = S \} of \{S = S = S \} of \{S = S = S \} of \{
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Inference?

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Example:

```
If Attorno S , Arrive Arri
```

If each student works on one project and each project has one supervisor, the page of students that e or experient supervisor ${\rm COCC}$



Inference?

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Example:

If each student works on one project and each project has one supervisor, the page of students that e or experient supervisor ${\rm COCC}$

Can we systematically infer all possible FDs?





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The Armstrong's inference rules consist of the following three rules:

• Augmentation rule: $\{X \rightarrow Y\} \models XZ \rightarrow YZ$

$$\{X \to Y\} \models XZ \to YZ$$

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• We use the notation $\Sigma \models X \rightarrow Y$ to denote that $X \rightarrow Y$ is **inferred** from the set Σ of functional dependencies.



Rule 1 – Reflexive Rule

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		ENROLMENT				
	Name	StudentID	DoB	<u>CourseNo</u>	<u>Semester</u>	Unit
1	Tom	123456	25/01/1988	CQMP2400	2010 S2	6
ľ	Ton)	12/3/5p	P3401/1988	CC)MIR8740	2011 72	12
1	Mich tel	12345	21/04/1985	COMP2400	2009 52	6
	Michael	123458	21/04/1985	COMP8740	2011 S2	12
	Fran	123457	11/09/1987	COMP2400	2009 S2	6

StudentID, CourseNo, Semester} + {CourseNo, Semester},

where

- X={StudentID};
- Y={CourseNo, Semester}.



Rule 2 – Augmentation Rule

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	LINGUMENT					
	Name	StudentID	DoB	<u>CourseNo</u>	<u>Semester</u>	Unit
4	Tom	123456	25/01/1988	CQMP2400	2010 S2	6
ľ		1 <i>4</i> 3456	P5/01/1988	COMM8740	201132	12
1	Michiter	12345	21/04/1985	COMP2400	2009 52	6
	Michael	123458	21/04/1985	COMP8740	2011 S2	12
	Fran	123457	11/09/1987	COMP2400	2009 S2	6

- X={CourseNo};
- Y={Unit};
- Z={Semester}.



Rule 3 - Transitive Rule

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		ENROLMENT				
	Name	StudentID	DoB	<u>CourseNo</u>	<u>Semester</u>	Unit
4	Tom	123456	25/01/1988	CQMP2400	2010 S2	6
ľ		12/3456	P5/01/1988	CC)MB8740	201132	12
_	Michiter	12345	21/04/1985	COMP2400	2009 52	6
	Michael	123458	21/04/1985	COMP8740	2011 S2	12
	Fran	123457	11/09/1987	COMP2400	2009 S2	6



- X={StudentID, CourseNo};
- Y={CourseNo};
- Z={Unit}.



Other Derived Rules

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Other Derived Rules

Assign Amphogo prior Profesive and me talian, appring rules p

- Union rule: If $X \to Y$ and $X \to Z$, then $X \to YZ$
- Example: If StudentID \rightarrow Name and StudentID \rightarrow DoB hold, then we have SugentyD Dan Wos, while C1. C011
 - X=StudentID;
 - Y=Name;
 - Z=DoB.



Other Derived Rules

Assign Amphogo pions Direflerive augmentation, manstine rule ed p

- Union rule: If $X \to Y$ and $X \to Z$, then $X \to YZ$
- **Example:** If StudentID \rightarrow Name and StudentID \rightarrow DoB hold, then we have SudentID \rightarrow DoB hold, then we have SudentID \rightarrow DoB hold, then we have SudentID \rightarrow DoB hold, then we
 - X=Studentl;
 - Y=Name;
 - Z=DoB.

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- ullet **Example:** If StudentID o Name, DoB holds, then we have StudentID
 - \rightarrow Name and StudentID \rightarrow DoB, where
 - X=StudentID;
 - Y=Name;
 - Z=DoB.



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 If each student works on one project and each project has one supervisor, does each student have one project supervisor?

```
\begin{array}{ll} & \text{Nttps://powcoder.com} \\ & \{\{\text{StudentID}\} \rightarrow \{\text{ProjectNo}\}, \\ & \{\text{ProjectNo}\} \rightarrow \{\text{Supervisor}\} \} \end{array} \models \quad \{\text{StudentID}\} \rightarrow \{\text{Supervisor}\} \end{array}
```

```
Add WeChat powcoder
```

Assignment Project Exam Help

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```

This can be proven by using the Transitive rule:

$${X \rightarrow Y, Y \rightarrow Z} \models X \rightarrow Z$$



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Yes, using the Augmentation rule.

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Assignment Project. Exam? Help

Yes, using the Augmentation rule.

https://powcoder.com



Assignment Project. Exam? Help

Yes, using the Augmentation rule.

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Assignment Project. Exam? Help

Yes, using the Augmentation rule.



Assignment Project. Exam? Help

Yes, using the Augmentation rule.

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eChat powcoder $(3) \quad \{X \to Y\} \models Y \to X$

No. See the counter-example below:

Χ	Y
0	2
1	2



Assignment Project Exam Help Two questions:

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Two questions:

Are all the FDs inferred using the Armstrong's inference rules correct?



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- Two questions:
 - Are all the FDs inferred using the Armstrong's inference rules correct?
 - Can we use the Armstrong's inference rules to infer all possible FDs?
 completeness (you can prove anything that is right)



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- Two questions:
 - Are all the FDs inferred using the Armstrong's inference rules correct?
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 completeness (you can prove anything that is right)
- The Andrew Wister Charact powcoder
 - The Armstrong's inference rules are both sound and complete.



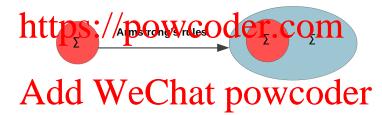
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Σ* can be computed using the Armstrong's inference rules.





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 \bullet Σ^* can be computed using the Armstrong's inference rules.



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Σ* can be computed using the Armstrong's inference rules.



Add We Chat powcod

why can we compute \(\Sigma^* \) using the Armstrong's inference re

Because the Armstrong's inference rules are both **sound** and **complete**.



Assignment Project Exam Help

Σ* can be computed using the Armstrong's inference rules.



Add We Chat powcoo why can we compute \(\Sigma^* \) using the Armstrong's inference

- - Because the Armstrong's inference rules are both **sound** and **complete**.
- Nonetheless, computing Σ^* using the Armstrong's inference rules is **not** efficient



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Example: Consider a relation schema $R = \{A, B, C, D, E\}$ and a set of FDs $\Sigma = \{AB \to CD, B \to E, DE \to A\}$. How can we use the Armstrong rules to show that $DB \to A \notin \Sigma^*$?

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Example: Consider a relation schema $R = \{A, B, C, D, E\}$ and a set of FDs $\Sigma = \{AB \to CD, B \to E, DE \to A\}$. How can we use the Armstrong rules to show that $DB \to A \notin \Sigma^*$?

https://pow<u>eo</u>der.com

 $DB \xrightarrow{D} E$





Assignment Project ExameHelp

Example: Consider a relation schema $R = \{A, B, C, D, E\}$ and a set of FDs $\Sigma = \{AB \to CD, B \to E, DE \to A\}$. How can we use the Armstrong rules to show that $DB \to A \subset \Sigma^*$?

"https://poweoder.com

 $DB \rightarrow E$

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 $DB \rightarrow A$

• How can we derive the proof more efficiently?



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² See Algorithm 15.1 on Page 538 in [Elmasri & Navathe, 7th edition] or Algorithm 1 on Page 555 in [Elmasri & Navathe, 6th edition]



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https://powcoder.com

² See Algorithm 15.1 on Page 538 in [Elmasri & Navathe, 7th edition] or Algorithm 1 on Page 555 in [Elmasri & Navathe, 6th edition]



Assite has the Project Exams? Help

Ompute the set of all attributes that are dependent on X, which is called the closure of X under Σ and is denoted by X^+ .

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² See Algorithm 15.1 on Page 538 in [Elmasri & Navathe, 7th edition] or Algorithm 1 on Page 555 in [Elmasri & Navathe, 6th edition]



Assignment Project Exam? Help

- ① Compute the set of all attributes that are dependent on X, which is called the closure of X under Σ and is denoted by X^+ .
- https://powcoder.com

² See Algorithm 15.1 on Page 538 in [Elmasri & Navathe, 7th edition] or Algorithm 1 on Page 555 in [Elmasri & Navathe, 6th edition]



Assignment Project Exam? Help

- Ompute the set of all attributes that are dependent on X, which is called the closure of X under Σ and is denoted by X^+ .
- Algorithms://powcoder.com
 - $X^+ := X$; • for each $Y \to Z \in \Sigma$ with $Y \subseteq X^+$, add all the attributes in Z to X^+ , i.e., replace X^+ by $X^+ \cup Z$.

² See Algorithm 15.1 on Page 538 in [Elmasri & Navathe, 7th edition] or Algorithm 1 on Page 555 in [Elmasri & Navathe, 6th edition]



Assignment Project Exam Help

• Decide whether or not $\Sigma \models AC \rightarrow DE$ holds.

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Assign property Assign Help

• Decide whether or not $\Sigma \models AC \rightarrow DE$ holds.



Assignment Project Exam Help

• Decide whether or not $\Sigma \models AC \rightarrow DE$ holds.

 $(AC)^{+} \supseteq AC$ $\supseteq ACB$ initialisation using $AC \rightarrow B$



Assignment Project Exam Help

$$\begin{array}{c} \text{Matip Sild the powe oder.com} \\ (AC)^+ &\supseteq AC & \text{initialisation} \\ &\supseteq ACB & \text{using } AC \to B \\ \text{Add WeChat powcoder} \end{array}$$



Assign property Assign Help

$$\begin{array}{c} \textbf{Metips bild/the power oder.com} \\ (AC)^+ \supseteq AC & \text{initialisation} \\ \supseteq ACB & \text{using } AC \to B \\ \textbf{Add} & \textbf{WBD-Chat} \\ \textbf{using } & \textbf{B} \to \textbf{CD} \\ \textbf{using } & \textbf{B} \to \textbf{CD} \\ \textbf{Add} & \textbf{WBD-Chat} \\ \textbf{using } & \textbf{B} \to \textbf{CD} \\ \textbf{vs.} & \textbf{OWCODER} \\ \end{array}$$



Assign property Assign Help





Assignment Project Exam Help

• Decide whether or not $\Sigma \models AC \rightarrow DE$ holds.

$$\begin{array}{ccc} \textbf{Add} & \textbf{A$$

2 Then we check that $DE \subseteq (AC)^+$. Hence $\Sigma \models AC \rightarrow DE$.



Assignment Project Exam Help

$$\begin{array}{ccc} \textbf{Add} & \textbf{A$$

- 2 Then we check that $DE \subseteq (AC)^+$. Hence $\Sigma \models AC \rightarrow DE$.
- Can you quickly tell whether or not $\Sigma \models AC \rightarrow EF$ holds?



Assignment Project Exam Help

• Decide whether or not $\Sigma \models AC \rightarrow DE$ holds.

$$\begin{array}{ccc} \text{Mattip Sild the power oder.com} \\ (AC)^+ &\supseteq AC & \text{initialisation} \\ &\supseteq ACB & \text{using } AC \to B \\ \text{Add} & \text{Well-Chatus now coder} \\ \end{array}$$

- **2** Then we check that $DE \subset (AC)^+$. Hence $\Sigma \models AC \rightarrow DE$.
- Can you quickly tell whether or not $\Sigma \models AC \rightarrow EF$ holds?

 $\Sigma \models AC \rightarrow EF$ does not hold because $EF \nsubseteq (AC)^+$



Exercise – Implied Functional Dependencies

A Sological Telephone temp R = 0 ($E \in \mathbb{R}$) and $E \in \mathbb{R}$ on $E \in \mathbb{R}$

Decide whether or not

https://powcoder.com



Exercise – Implied Functional Dependencies

A SSO GRAPH COLLEGE FOR A SOURCE PROPERTY ASSOCIATION OF THE PROPERTY ASSOCIATION OF

Decide whether or not

- We Ail the dos water the coef partition to the control of the co
 - (AD)⁺ = $(ACD)^+$ = $(ACDE)^+$ = ACDE and $CE \subseteq (AD)^+$, hence $\Sigma \models AD \rightarrow CE$.
 - ② $(BD)^+ = (BCD)^+ = (BCDE)^+ = BCDE$ and $AC \not\subseteq (BD)^+$, hence $\Sigma \not\models BD \rightarrow AC$.



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• Let A but $\Sigma_1^* = \Sigma_2^* = \{X \to Y, Y \to Z, X \to Z\}$ (Σ_1 and Σ_2 are equivalent)



Assignment Project Exam Help

- Let A but $\Sigma_1^* = \Sigma_2^* = \{X \to Y, Y \to Z, X \to Z\}$ (Σ_1 and Σ_2 are equivalent)
- If $\Sigma_1 \models \Sigma_2$ and $\Sigma_2 \models \Sigma_1$, are Σ_1 and Σ_2 equivalent?



Assignment Project Exam Help

- Let A but $\Sigma_1^* = \Sigma_2^* = \{X \to Y, Y \to Z, X \to Z\}$ (Σ_1 and Σ_2 are equivalent)
- If $\Sigma_1 \models \Sigma_2$ and $\Sigma_2 \models \Sigma_1$, are Σ_1 and Σ_2 equivalent? Yes.



Assignment Project Exam Help

- Let A but $\Sigma_1^* = \Sigma_2^* = \{X \to Y, Y \to Z, X \to Z\}$ (Σ_1 and Σ_2 are equivalent)
- If $\Sigma_1 \models \Sigma_2$ and $\Sigma_2 \models \Sigma_1$, are Σ_1 and Σ_2 equivalent? Yes.
- Questions: Can we find the minimal one among equivalent sets of FDs?



Minimal Cover - The Hard Part!

Assignment Project Exam Help

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Minimal Cover - The Hard Part!

Assignment Project Exam Help

 $\begin{array}{l} \sum_{\textit{m}} \text{ is equivalent to } \Sigma, \text{ i.e., start with } \Sigma_{\textit{m}} = \Sigma; \\ \textbf{https://powcoder.com} \end{array}$



Minimal Cover – The Hard Part!

Assignment Project Exam Help

- Σ_m is equivalent to Σ , i.e., start with $\Sigma_m = \Sigma$;

 Dependent each FD in Σ_m has only a single attribute on its right hand side, i.e., replace each FD $X \to \{A_1, \dots, A_k\}$ in Σ_m with $X \to A_1, \dots, X \to A_k$;
- Add WeChat powcoder



Minimal Cover – The Hard Part!

Assignment Project Exam Help Let Doe a set of FDs. A minimal odver Σ_m of Σ is a set of FDs such that

- Σ_m is equivalent to Σ , i.e., start with $\Sigma_m = \Sigma$;

 The product each Σ_m has only a single attribute on its right hand side, i.e., replace each Σ_m for Σ_m with $\Sigma_$
- **Section and variety** has a sew a tribute XY be let by X does as possible, i.e., for each FD $X \to A$ in X, check each attribute B of X to see if we can replace $X \to A$ with $(X B) \to A$ in X.



Minimal Cover - The Hard Part!

Assignment Project Exam Help Let Doe a set of FDs. A minimal over Σ_m of Σ is a set of FDs such that

- $\mathbf{Q} \Sigma_m$ is equivalent to Σ , i.e., start with $\Sigma_m = \Sigma$;
- hand side, i.e., replace each FD $X o \{A_1, \ldots, A_k\}$ in Σ_m with $X o A_1, \ldots, X o A_k$;
- **Sector many each FD** has a sew a tribute. An the letting of de as possible, i.e., for each FD $X \to A$ in Σ_m , check each attribute B of X to see if we can replace $X \to A$ with $(X B) \to A$ in Σ_m ;
- **a** Remove a FD from Σ_m if it is redundant.



Assignment Broject Exame Help minimal cover of Σ as follows:

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Assignment Project Exame Help

minimal cover of Σ as follows:

 \bigcirc start from Σ ;

https://powcoder.com



Assignment Project Exame Help minimal cover of Σ as follows:

 \bigcirc start from Σ ;

hand side (look good). Ehave on bone attribute on the right



Assignment Project Exame Help

- \bigcirc start from Σ ;
- hand side (look grea). There of bone attribute on the right
- 3 check if $AB \rightarrow D$ can be replaced by $A \rightarrow D$?



Assignment Project Exame Help

- start from Σ;
- hand side (look good); Ehave on the attribute on the right
- **3** check if $AB \rightarrow D$ can be replaced by $A \rightarrow D$?

$$Add \overset{\Sigma}{W} \overset{\{\mathcal{B} \rightarrow \mathcal{A}, \mathcal{D} \rightarrow \mathcal{A}, \mathbf{AB} \rightarrow \mathbf{D}\}, \ \Sigma_1 = \{\mathcal{B} \rightarrow \mathcal{A}, \mathcal{D} \rightarrow \mathcal{A}, \mathbf{A} \rightarrow \mathbf{D}\}}{powcoder}$$



Assignment Project Exame Help

- \bigcirc start from Σ ;
- Thand side (look good); Thave on the pre-attribute on the right
- **3** check if $AB \rightarrow D$ can be replaced by $A \rightarrow D$?

$$\begin{array}{c} \textbf{A} \overset{\Sigma}{\text{dolick}} \overset{\{\mathcal{B} \rightarrow \mathcal{A}, \, \mathcal{D} \rightarrow \mathcal{A}, \, \mathbf{AB} \rightarrow \mathbf{D}\}, \, \Sigma_1 = \{\mathcal{B} \rightarrow \mathcal{A}, \, \mathcal{D} \rightarrow \mathcal{A}, \, \mathbf{A} \rightarrow \mathbf{D}\} \\ \textbf{A} \overset{\Sigma}{\text{dolick}} \overset{\{\mathcal{B} \rightarrow \mathcal{A}, \, \mathcal{D} \rightarrow \mathcal{A}, \, \mathbf{A} \rightarrow \mathbf{D}\}}{\text{that } powcoder} \end{aligned}$$



Assignment Project Exame Help

- \bigcirc start from Σ ;
- Thand side (look good), The charge of the property of the control of the control
- **3** check if $AB \rightarrow D$ can be replaced by $A \rightarrow D$?



Assignment Project Exame Help minimal cover of Σ as follows:

- \bigcirc start from Σ ;
- hand side (look good); There of bone attribute on the right
- **3** check if $AB \rightarrow D$ can be replaced by $A \rightarrow D$?



Assignment-Project Exam. Help minimal cover of Σ as follows:

- start from Σ :
- hand side (look great). There of bone attribute on the right
- **3** check if $AB \rightarrow D$ can be replaced by $A \rightarrow D$?

$$\begin{array}{c} \Sigma = \{B \rightarrow A, D \rightarrow A, AB \rightarrow D\}, \ \Sigma_1 = \{B \rightarrow A, D \rightarrow A, A \rightarrow D\} \\ \text{Check } \Sigma \models A \rightarrow D, \ \text{then } \Sigma \models \Sigma_1 \ \text{and } \Sigma_1 \models \Sigma, \ \text{indicating } \Sigma^* = \Sigma_1^*. \end{array}$$

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Assignment_Project Exam.Help

- \bigcirc start from Σ ;
- Thand side (look good), The charge of the property of the control of the control
- **3** check if $AB \rightarrow D$ can be replaced by $A \rightarrow D$?

If $\Sigma \models \mathbf{A} \to \mathbf{D}$, then $\Sigma \models \Sigma_1$ and $\Sigma_1 \models \Sigma$, indicating $\Sigma^* = \Sigma_1^*$. If $\Sigma \nvDash \mathbf{A} \to \mathbf{D}$, then $\Sigma^* \neq \Sigma_1^*$.



Assignment Project Exam Help

- \bigcirc start from Σ ;
- Thand side (look good), The charge of the property of the control of the control
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If $\Sigma \models A \to D$, then $\Sigma \models \Sigma_1$ and $\Sigma_1 \models \Sigma$, indicating $\Sigma^* = \Sigma_1^*$. If $\Sigma \nvDash A \to D$, then $\Sigma^* \neq \Sigma_1^*$.

- $\Sigma \nvDash A \to D$ because $D \not\subseteq (A)^+$.
- No. $AB \rightarrow D$ cannot be replaced by $A \rightarrow D$.



Assignment Project Exame Help

- \bigcirc start from Σ ;
- hand side (look grea). There of bone attribute on the right
- 3 check if $AB \rightarrow D$ can be replaced by $B \rightarrow D$?



Assignment Project Exame Help

- \bigcirc start from Σ ;
- check whether all the 50s in Ethere of Bone attribute on the right hand side (look good);
- **3** check if $AB \rightarrow D$ can be replaced by $B \rightarrow D$?

$$Add \overset{\Sigma}{W} \overset{\{\mathcal{B} \rightarrow \mathcal{A}, \mathcal{D} \rightarrow \mathcal{A}, B \rightarrow D\}, \ \Sigma_2 = \{\mathcal{B} \rightarrow \mathcal{A}, \mathcal{D} \rightarrow \mathcal{A}, B \rightarrow D\}}{Powcoder}$$



- \bigcirc start from Σ ;
- Thand side (look good); Thave on the attribute on the right
- **3** check if $AB \rightarrow D$ can be replaced by $B \rightarrow D$?

$$Add^{\Sigma} = \{ \underset{l}{B} \rightarrow \underset{d}{A}, \underset{d}{D} \rightarrow \underset{d}{A} \underset{d}{B} \rightarrow \underset{d}{D} \}, \ \Sigma_{2} = \{ \underset{l}{B} \rightarrow \underset{d}{A}, \underset{d}{D} \rightarrow \underset{d}{A}, \underset{d}{B} \rightarrow \underset{d}{D} \}$$



- \bigcirc start from Σ ;
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$$Add^{\Sigma} = \{ \underset{l}{B} \rightarrow \underset{d}{A}, \underset{d}{D} \rightarrow \underset{d}{A} \underset{d}{B} \rightarrow \underset{d}{D} \}, \ \Sigma_{2} = \{ \underset{l}{B} \rightarrow \underset{d}{A}, \underset{d}{D} \rightarrow \underset{d}{A}, \underset{d}{B} \rightarrow \underset{d}{D} \}$$



Assignment Project Exame Help

- \bigcirc start from Σ ;
- Thand side (look good), The charge of the property of the control of the control
- **3** check if $AB \rightarrow D$ can be replaced by $B \rightarrow D$?



Assignment Project Exame Help

- start from Σ;
- Thand side (look groo); Thave on the pre-attribute on the right
- **3** check if $AB \rightarrow D$ can be replaced by $B \rightarrow D$?



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- \bigcirc start from Σ ;
- Thand side (look good), The charge of the property of the control of the control
- **3** check if $AB \rightarrow D$ can be replaced by $B \rightarrow D$?

$$\begin{array}{c} \Sigma = \{B \rightarrow A, D \rightarrow A, AB \rightarrow D\}, \ \Sigma_2 = \{B \rightarrow A, D \rightarrow A, B \rightarrow D\} \\ \text{Crieck} \ \Sigma \models B \rightarrow P, \ \text{then} \ \Sigma \models \Sigma_2 \ \text{and} \ \Sigma_2 \models \Sigma, \ \text{indicating} \ \Sigma^* = \Sigma_2^*. \end{array}$$

 $12 \vdash 2$ 7 2, then $2 \vdash 2$ and $2 \not= 2$, indicating 2 = 2.



Assignment Project ExameHelp

- \bigcirc start from Σ ;
- Thand side (look good), The charge of the property of the control of the control
- **3** check if $AB \rightarrow D$ can be replaced by $B \rightarrow D$?

If $\Sigma \models \mathbf{B} \to \mathbf{D}$, then $\Sigma \models \Sigma_2$ and $\Sigma_2 \models \Sigma$, indicating $\Sigma^* = \Sigma_2^*$. If $\Sigma \nvDash \mathbf{B} \to \mathbf{D}$, then $\Sigma^* \neq \Sigma_2^*$



Assignment Project Exam Help

- \bigcirc start from Σ ;
- That girde (look good), The rechloope attribute on the right
- **3** check if $AB \rightarrow D$ can be replaced by $B \rightarrow D$?

If $\Sigma \models \mathbf{B} \to \mathbf{D}$, then $\Sigma \models \Sigma_2$ and $\Sigma_2 \models \Sigma$, indicating $\Sigma^* = \Sigma_2^*$. If $\Sigma \nvDash \mathbf{B} \to \mathbf{D}$, then $\Sigma^* \neq \Sigma_2^*$

- $\Sigma \models \mathbf{B} \to \mathbf{D}$ because $D \subseteq (B)^+$.
- Yes. $AB \rightarrow D$ can be replaced by $B \rightarrow D$.



- start from Σ;

 Check Disther all the FDW. Charles attributed the right hand side (look good);
- $\begin{array}{c} \text{ AB} \rightarrow \textit{D} \text{ can be replaced by } \textit{B} \rightarrow \textit{D}; \\ Add \ WeChat \ powcoder \\ \end{array}$



- start from Σ;

 Outcopistoer all the DW Charles To be attributed in the right hand side (look good);
- 3 $AB \rightarrow D$ can be replaced by $B \rightarrow D$;
- Addrewechatpowooder



- start from Σ;

 Out Charles the fall the DW Charles the attributing the right hand side (look good);
- 3 $AB \rightarrow D$ can be replaced by $B \rightarrow D$;
- Add reverentate poweoder
 - check whether $B \rightarrow A$ is redundant?



- start from Σ;

 Octob Distor All the DW Charles To he attributed in the right hand side (look good);
- **3** $AB \rightarrow D$ can be replaced by $B \rightarrow D$;
- Add Webhat powoder
 - check whether B → A is redundant?
 - $B \rightarrow A$ is redundant because $\{D \rightarrow A, B \rightarrow D\} \models B \rightarrow A$;



Assignment Project Exam Help

minimal cover of Σ as follows:

- start from Σ;

 Outcopistoer all the FDW Charles To be attributed the right hand side (look good);
- **3** $AB \rightarrow D$ can be replaced by $B \rightarrow D$;

Add Webhat powoder

- check whether $B \rightarrow A$ is redundant?
- $B \rightarrow A$ is redundant because $\{D \rightarrow A, B \rightarrow D\} \models B \rightarrow A$;

Therefore, the minimal cover of Σ is $\{D \to A, B \to D\}$.



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The minimal cover of a set of functional dependencies $\boldsymbol{\Sigma}$ always exists but is not necessarily unique.

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Assignment Project Exam Help

The minimal cover of a set of functional dependencies $\boldsymbol{\Sigma}$ always exists but is not necessarily unique.

https://powcoder.com

• Examples: Consider the following set of functional dependencies:



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The minimal cover of a set of functional dependencies $\boldsymbol{\Sigma}$ always exists but is not necessarily unique.

https://powcoder.com

• Examples: Consider the following set of functional dependencies:

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 Σ has two different minimal covers:

$$\bullet \ \Sigma_1 = \{A \to B, B \to C, C \to A\}$$

•
$$\Sigma_2 = \{A \rightarrow C, C \rightarrow B, B \rightarrow A\}$$



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The minimal cover of a set of functional dependencies $\boldsymbol{\Sigma}$ always exists but is not necessarily unique.

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• **Examples:** Consider the following set of functional dependencies:

Add WeChat poweoder

 Σ has two different minimal covers:

$$\bullet \ \Sigma_1 = \{A \rightarrow B, B \rightarrow C, C \rightarrow A\}$$

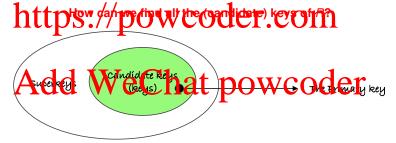
•
$$\Sigma_2 = \{A \rightarrow C, C \rightarrow B, B \rightarrow A\}$$

ullet The algorithm in the previous slide can find one, but not all minimal covers of a set of functional dependencies Σ .



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• Given a set Σ of FDs on a relation R, the question is:





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Assignment Project Exam Help

• Algorithm³:

output: In pass of all keys of Wcoder.com



Assignment Project Exam Help

• Algorithm³:

output: In pass of all keys of Wcoder.com



Assignment Project Exam Help

• Algorithm³:

output: In Section of All keys of WCoder.com

for every subset X of the relation R, compute its closure X⁺

 $^{^3}$ It extends Algorithm 15.2(a) in [Elmasri & Navathe, 7th edition, pp. 542], or Algorithm 2(a) or in Algorithm 2(a) in [Elmasri & Navathe, 6th edition pp. 558] to finding all keys of R



Assignment Project Exam Help

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output: In Section of All keys of WCoder.com

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Assignment Project Exam Help

• Algorithm³:

output: In Set of all keys of WCOder.com

for every subset X of the relation R, compute its closure X⁺

 $A^{+} = R$, then X is a superkey. A cooper subset of X with t = P, the X calculates X is a superkey.

 $^{^3}$ It extends Algorithm 15.2(a) in [Elmasri & Navathe, 7th edition, pp. 542], or Algorithm 2(a) or in Algorithm 2(a) in [Elmasri & Navathe, 6th edition pp. 558] to finding all keys of R



Assignment Project Exam Help

• Algorithm³:

output: In Section of All keys of WCoder.com

for every subset X of the relation R, compute its closure X⁺

of $X^+ = R$, then X is a superkey. According to the of X with $X^+ = R$, then X is a superkey.

 A prime attribute is an attribute occurring in a key, and a non-prime attribute is an attribute that is not a prime attribute.

 $^{^3}$ It extends Algorithm 15.2(a) in [Elmasri & Navathe, 7th edition, pp. 542], or Algorithm 2(a) or in Algorithm 2(a) in [Elmasri & Navathe, 6th edition pp. 558] to finding all keys of R



PANTE-TOUTILD, COMMON CONTROL TO THE PARTY OF THE PARTY O

- {CustID} → {CustName}
- {PropertyNo, StartDate} → {CustID} der.com
- {CustID, StartDate} → {PropertyNo}

- Questions:
 - What are the keys of RENTAL?
 - What is a minimal cover of Σ ?



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https://powcoder.com

What are the keys of RENTAL?



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• R={C, N, P, D, O}, and https://powcoder.com

- What are the keys of RENTAL?
- Solution: Check (X) for every subset of {C, N, P, D, O}.

 A carrier for every subset of {C, N, P, D, O}.

 A carrier for every subset of {C, N, P, D, O}.

 A carrier for every subset of {C, N, P, D, O}.

 A carrier for every subset of {C, N, P, D, O}.

 A carrier for every subset of {C, N, P, D, O}.



A S'Sciograp Properties, Parking Properties, Palastan Mary and the 1p

• R={C, N, P, D, O}, and https://powcoder.com

- What are the keys of RENTAL?
- Solution: Check (X) to for every subset of {C, N, P, D, O}.

 Restrappears in the department of any DV fourth clark if each key.
 - $(O)^+ = OP$



A S'Sciograp Protection, Parking Proceeding, Palagram 1997 and the 1p

• R={C, N, P, D, O}, and https://powcoder.com

- What are the keys of RENTAL?
- Solution: Check (X) to for every subset of {C, N, P, D, O}.

 Restrappears in the department of any DV fourth clark if each key.
 - $(O)^+ = OP$
 - $(CO)^+ = CPNDO, (DO)^+ = CPNDO...$
 - Thus, {CustID, Owner} and {Owner, DateStart} are the keys.



ASSED Sin the abbreviated form as the Property No. Date Start Owner | Annual Date Start Owner |

- R={C, N, P, D, O}, and
- $\Sigma = \{ C \to N, \, PD \to C, \, CP \to D, \, CD \to P, \, O \to P \}$ What the Sale of POWCOder. COM



ASSED Sin the abbreviated form as the Property No. Date Start Owner | Annual Date Start Owner |

- R={C, N, P, D, O}, and
- $\Sigma = \{ C \to \mathsf{N}, \, \mathsf{PD} \to \mathsf{C}, \, \mathsf{CP} \to \mathsf{D}, \, \mathsf{CD} \to \mathsf{P}, \, \mathsf{O} \to \mathsf{P} \}$ What the Sales of Coder. Com
- Solution:
 - And We Chat powcoder



Sconsider BENTAL-(CutID, DetName PropertyNo, DateStart Owner) In its 1p

- R={C, N, P, D, O}, and
- $\Sigma = \{ C \to \mathsf{N}, \, \mathsf{PD} \to \mathsf{C}, \, \mathsf{CP} \to \mathsf{D}, \, \mathsf{CD} \to \mathsf{P}, \, \mathsf{O} \to \mathsf{P} \}$ What the Sales of Coder. Com
- Solution:
 - Astart fresh SW GC Latve DION VILLE College hand side (look good);



Consider RENTAL-(CuttlD, DetName PropertyNo, DateStart Owner) and its 1p

- R={C, N, P, D, O}, and
- $\Sigma = \{ C \to \mathsf{N}, \, \mathsf{PD} \to \mathsf{C}, \, \mathsf{CP} \to \mathsf{D}, \, \mathsf{CD} \to \mathsf{P}, \, \mathsf{O} \to \mathsf{P} \}$ What the Sales of Coder. Com
- Solution:
 - Astart fresh SW GC Land tve DION VICTOR CITY of Land Control City of Land Control City of Land Control City of Land City o hand side (look good);
 - 3 determine if PD \rightarrow C, CP \rightarrow D and CD \rightarrow P have any redundant attribute on the left hand side (look good);



Consider RENTAL-{CustID, OstName PropertyNo, DateStart Owner} and its 1p

- R={C, N, P, D, O}, and
- $\Sigma = \{ C \to \mathsf{N}, \, \mathsf{PD} \to \mathsf{C}, \, \mathsf{CP} \to \mathsf{D}, \, \mathsf{CD} \to \mathsf{P}, \, \mathsf{O} \to \mathsf{P} \}$ What the Sales of Coder. Com
- Solution:
 - Astart fresh SW GC Land tve DION VICTOR CITY of Land Control City of Land Control City of Land Control City of Land City o hand side (look good);
 - **3** determine if PD \rightarrow C, CP \rightarrow D and CD \rightarrow P have any redundant attribute on the left hand side (look good);
 - look for a redundant FD in Σ (none of FDs in Σ are redundant):



Consider RENTAL-(CuttlD, DetName PropertyNo, DateStart Owner) and its 1p

- R={C, N, P, D, O}, and
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- Solution:
 - Astart fresh SW GC Land tve DION VICTOR CITY of Land Control City of Land Control City of Land Control City of Land City o hand side (look good);
 - **3** determine if PD \rightarrow C, CP \rightarrow D and CD \rightarrow P have any redundant attribute on the left hand side (look good);
 - look for a redundant FD in Σ (none of FDs in Σ are redundant);

Therefore, Σ is a minimal cover itself.



Accommodation Database

Assignment Project Exam Help

- ROOM(roomNo, hotelNo, type, price) with PK {roomNo, hotelNo}
- GUEST(guestNo, guestName, guestAddress) with PK {guestNo}

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Accommodation Database

Assignment Project Exam Help

- ROOM(roomNo, hotelNo, type, price) with PK {roomNo, hotelNo}
- GUEST(guestNo, guestName, guestAddress) with PK {guestNo}

https://powe.oder.icom

- We have some requirements on BOOKING:
 - R1 A booking cambe made to one day only.

 R2—A quett can Make se eral plokings in high taylor different day.
 - R3 A guest cannot make two or more beokings in the same hotel for the same day.
 - R4 A guest can make two or more bookings in different hotels for the same day.
 - **R5** A room in any hotel can only be booked by one guest on the same date, i.e., no *double-booking*.



Assignment Project Exam Help HOTEL (hotelNo, hotelName, city) with PK {hotelNo}

- ROOM(roomNo, hotelNo, type, price) with PK {roomNo, hotelNo}
- GUEST (guestNo, questName, questAddress) with PK {questNo}
- Which functional dependency does the following requirement imply?





Assignment Project Exam Help HOTEL (hotelNo, hotelName, city) with PK {hotelNo}

- ROOM(roomNo, hotelNo, type, price) with PK {roomNo, hotelNo}
- GUEST (guestNo, questName, questAddress) with PK {guestNo}
- Which functional dependency does the following requirement imply?





Assignment Project Exam Help HOTEL(hotelNo, hotelName, city) with PK {hotelNo}

- ROOM(roomNo, hotelNo, type, price) with PK {roomNo, hotelNo}
- GUEST (guestNo, questName, questAddress) with PK {guestNo}
- Which functional dependency does the following requirement imply?





Assignment Project Exam Help HOTEL(hotelNo, hotelName, city) with PK {hotelNo}

ROOM(roomNo, hotelNo, type, price) with PK {roomNo, hotelNo}

GUEST (guestNo, questName, questAddress) with PK {guestNo}

Which functional dependency does the following requirement imply?

 \hookrightarrow {guestNo, hotelNo, roomNo} \rightarrow {date}? No

guestNo	hotelNo	roomNo	Date
001	H1	R101	28/08/2020
001	H1	R101	29/08/2020



Assignment Project Exam Help

- Consider the following:
 - HOTEL(hotelNo, hotelName, city) with PK {hotelNo}
 - Ploby(roomNo/hotelNortype, price) vith PK (roomNo, hotelNo)
 - GUEST (guestNo, guestName, guestAddress) with PK {guestNo}
 - BOOKING(guestNo, hotelNo, date, roomNo) with PK {?}
- Which in total when the cycles at follow Wiener (in the first total and the company of the compa

R2 A guest can make several bookings in a hotel for different days.



Assignment Project Exam Help

- Consider the following:
 - HOTEL(hotelNo, hotelName, city) with PK {hotelNo}
 - Plobut(roomNo,/hotelNortxpe, price) with PK (roomNo, hotelNo)
 - GÚE⊈T (guestNo, guestName, guestAddress) with PK {guestNo}
 - BOOKING(guestNo, hotelNo, date, roomNo) with PK {?}
- Which in total when the cycles at tolono wile en the total
 - R2 A guest can make several bookings in a hotel for different days.

None



Assignment Project Exam Help

- ROOM(roomNo, hotelNo, type, price) with PK {roomNo, hotelNo}
- GUEST(guestNo, guestName, guestAddress) with PK {guestNo}

https://spoweodericom

Which functional dependency does the following requirement imply?

A guest carne make we by more bookings in the same hotel for the same tay. We chall powcoder



Assignment Project Exam Help

- ROOM(roomNo, hotelNo, type, price) with PK {roomNo, hotelNo}
- GUEST(guestNo, guestName, guestAddress) with PK {guestNo}
- intps://poweoder.com
- Which functional dependency does the following requirement imply?
 - As the day. We can be bookings in the same hotel for the same day.

 \hookrightarrow {guestNo, hotelNo, date} \rightarrow {roomNo}?



Assignment Project Exam Help

- ROOM(roomNo, hotelNo, type, price) with PK {roomNo, hotelNo}
- GUEST(guestNo, guestName, guestAddress) with PK {guestNo}

https://poweoder.com

Which functional dependency does the following requirement imply?

As the day. We can be bookings in the same hotel for the same day.

 \hookrightarrow {guestNo, hotelNo, date} \rightarrow {roomNo}? Yes

guestNo	hotelNo	roomNo	Date
001	H1	R101	29/08/2020
001	H1	R102 ×	29/08/2020



Assignment Project Exam Help

- HOTEL(hotelNo, hotelName, city) with PK {hotelNo}
- BOOM(roomNø, hotelNo, type, price) with PK {roomNo, hotelNo}
- BOOKING(guestNo, hotelNo, date, roomNo) with PK {?}
- Which functional deventaricy diason following requirement in the free participants of the state of the s
 - R4 A guest can make two or more bookings in different hotels for the same day.



Assignment Project Exam Help

- HOTEL(hotelNo, hotelName, city) with PK {hotelNo}
- RODM(roomNø, hotelNo, type, price) with PK {roomNo, hotelNo}
- BOOKING(guestNo, hotelNo, date, roomNo) with PK {?}
- Which functional dependency disease following requirement in the second se
 - R4 A guest can make two or more bookings in different hotels for the same day.

None



Assignment Project Exam Help

- ROOM(roomNo, hotelNo, type, price) with PK {roomNo, hotelNo}
- GUEST(guestNo, guestName, guestAddress) with PK {guestNo}

https://powe.oden:com

Which functional dependency does the following requirement imply?

A roum in a typicitel can only be booked by one guest on the same hale liet no violube booking at DOWCOGET

 \hookrightarrow {hotelNo, date, roomNo} \rightarrow {guestNo}



Assignment Project Exam Help

- ROOM(roomNo, hotelNo, type, price) with PK {roomNo, hotelNo}
- GUEST(guestNo, guestName, guestAddress) with PK {guestNo}

https://poweodericom

Which functional dependency does the following requirement imply?

A roum in any hortel can billy be booked by one guest on the same have leen no would be booked at DOW COGET

 \hookrightarrow {hotelNo, date, roomNo} \rightarrow {guestNo} Yes

guestNo	hotelNo	roomNo	Date
001	H1	R101	29/08/2020
002 ×	H1	R101	29/08/2020



How to Find Candidate Keys?

Assignment Project Exam Help HOTEL (hotelNo, hotelName, oily) with PK {hotelNo}

- ROOM(roomNo, hotelNo, type, price) with PK {roomNo, hotelNo}
- GUEST(guestNo; guestName, guestAddress) with PK {guestNo}
- FDs on BOOKING

Agyresino, hataliace (te) hadmino by R3V COCET {hotelNo, date, roomNo} -> {guestNo} by R5V COCET



How to Find Candidate Keys?

Assignment Project Exam Help HotelNo, hotelName, city) with PK {hotelNo}

- ROOM(roomNo, hotelNo, type, price) with PK {roomNo, hotelNo}
- GUEST(guestNo; guestName, guestAddress) with PK {guestNo}
- FDs on BOOKING

Agyrestylo, hatalyocal (te) ha

- Candidate keys on BOOKING
 - {guestNo, hotelNo, date}
 - {hotelNo, date, roomNo}



Assignment Project Exam Help Consider BOOKING(guestNo, hotelNo, date, roomNo) and the following

Coherder BOOKING(guestNo, hotelNo, date, roomNo) and the following changes:

- R1 A booking carybe made for one day only.
- RIA gues can make several/hooking in a horel for different days.
- R3 A guest cannot make two or more bookings in the same hotel for the same day.
- R4 A guest can make two or more bookings in different hotels for the
- Rs Aredin in any notel can only be booked by one guest on the same date, i.e., no double-booking.
- **R6** A guest is not allowed to make more than one booking for the same day even in the different hotels.



Assignment Project Exam Help

- HOTEL(hotelNo, hotelName, city) with PK {hotelNo}
- BOOM(roomNo, hotelNo, type, price) with PK {roomNo, hotelNo}
- BOOKING(guestNo, hotelNo, date, roomNo) with PK {?}
- tional lengthemics dispositly following requirement in lens

day even in the different hotels.



Assignment Project Exam Help

- HOTEL(hotelNo, hotelName, city) with PK {hotelNo}
- ROOM(roomNø, hotelNo, type, price) with PK {roomNo, hotelNo} with OlduestNo}
- BOOKING(guestNo, hotelNo, date, roomNo) with PK {?}
- Which functional denominatory describe following requirement in light?
 - **R6** A guest is not allowed to make more than one booking for the same day even in the different hotels.
 - \hookrightarrow {guestNo, date} \rightarrow {hotelNo, roomNo}



How to Find Candidate Keys?

Assignment Project Exam Help

- ROOM(roomNo, hotelNo, type, price) with PK {roomNo, hotelNo}
- GUEST(guestNo; guestName, guestAddress) with PK {guestNo}
- FDs on BOOKING

 $\begin{array}{c} \text{Ahotelity, date vocation} & \text{hotelino, roomino} & \text{pressure} \\ \text{guestino, date} & \rightarrow \text{hotelino, roomino} & \text{by R5} & \text{COder} \\ \end{array}$



How to Find Candidate Keys?

Assignment Project Exam Help HOTEL (hotelNo, hotelName, city) with PK {hotelNo}

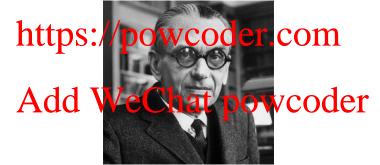
- ROOM(roomNo, hotelNo, type, price) with PK {roomNo, hotelNo}
- GUEST(guestNo; guestName, guestAddress) with PK {guestNo}
- FDs on Booking

Ahotel No, date voom (o) (guestNo) by \$50 COCET (guestNo, date) -> {hotel No, room No) by \$60 COCET

- Candidate keys on BOOKING
 - {hotelNo, date, roomNo}
 - {guestNo, date}



Assignment Project Exam Help



Kurt Gödel (1906-1978)



Armstrong's Inference Rules

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- Two questions:
 - Are all the FDs inferred using the Armstrong's inference rules correct?

• Theorem W. Armstrong Chat powcoder

• The Armstrong's inference rules are both sound and complete.



Hilbert's program (1920s)

- A SS completeness culture mathematical statements of proved TEIP
 - Consistency: no contradiction can be obtained in the formalism
 - Decidability: decide the truth or falsity of any mathematical statement.
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Hilbert's program (1920s)

A SS completeness all true mathematical statements can be proved

- Consistency: no contradiction can be obtained in the formalism
- Decidability: decide the truth or falsity of any mathematical statement.

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David Hilbert (1862-1943)

We must know. We will know.



Kurt Gödel and Incompleteness Theorem

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 Theorem (Kurt Gödel, 1931)
 For any computable axiomatic system that is powerful enough to describe the arithmetic of the natural numbers, there will always be at least one true but unprovable statement.



Kurt Gödel and Gödel Prize



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Kurt Gödel's achievement in modern logic s singular and monumental – indeed it is more than a monument, it is a landmark which will remain visible far in space and time. — John von Neumann



Kurt Gödel and Gödel Prize

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- Kurt Gödel's achievement in modern logic s singular and monumental indeed it is more than a monument, it is a landmark which will remain visible far in space and time. John von Neumann
- The **Gödel prize** became an annual prize for outstanding papers in the area of theoretical computer science since 1993.