

1DV503 Databasteknik och modellering

Ebbe Karlstad

Skolan för datavetenskap, fysik
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Uppgift 1 SQL-frågor med MySQL Workbench DBMS

Fråga 1

SQL: SELECT e.fname, e.lname
-> FROM employee e
-> JOIN works_on w ON e.ssn = w.essn
-> JOIN project p ON w.pno = p.pnumber
-> WHERE p.pname = 'Middleware'
-> OR p.pname = 'DatabaseSystems';

Resultat:

fname	lname
Evan	Wallis
Josh	Zell
Andy	Vile
Tom	Brand
Jenny	Vos
Chris	Carter
Arnold	Head
Red	Bacher
Kim	Grace
Jeff	Chase
Helga	Pataki
Red	Bacher

Fråga 2

SQL: select e.fname, e.lname
-> from employee e
-> join works_on w ON e.ssn = w.essn
-> join project p on w.pno = p.pnumber
-> where p.pname = 'DatabaseSystems' and w.hours > 40;

Resultat:

fname	lname
Josh	Zell

Fråga 3

SQL:
select p.pnumber, d.dnumber, p.plocation, e.lname, e.address,
e.bdate
from project as p
join department as d on p.dnum = d.dnumber
join employee as e on d.mgrssn = e.ssn
where p.plocation = 'Houston';

	Resultat: <table><tr><td></td><td>pnumber</td><td>dnumber</td><td>plocation</td><td>lname</td><td>address</td><td>bdate</td></tr><tr><td>▶</td><td>3</td><td>5</td><td>Houston</td><td>Wong</td><td>638 Voss, Houston, TX</td><td>1945-12-08</td></tr><tr><td></td><td>20</td><td>1</td><td>Houston</td><td>Borg</td><td>450 Stone, Houston, TX</td><td>1927-11-10</td></tr></table>		pnumber	dnumber	plocation	lname	address	bdate	▶	3	5	Houston	Wong	638 Voss, Houston, TX	1945-12-08		20	1	Houston	Borg	450 Stone, Houston, TX	1927-11-10																																																																																																																							
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Fråga 4	SQL: select e.fname, e.lname, s.fname, s.lname from employee as e join employee as s on e.superssn = s.ssn; Resultat: <table><tr><td>fname</td><td>lname</td><td>fname</td><td>lname</td></tr><tr><td>Jon</td><td>Jones</td><td>Jared</td><td>James</td></tr><tr><td>Justin</td><td>Mark</td><td>Jared</td><td>James</td></tr><tr><td>Brad</td><td>Knight</td><td>Jared</td><td>James</td></tr><tr><td>John</td><td>Smith</td><td>Franklin</td><td>Wong</td></tr><tr><td>Josh</td><td>Zell</td><td>Evan</td><td>Wallis</td></tr><tr><td>Andy</td><td>Vile</td><td>Evan</td><td>Wallis</td></tr><tr><td>Tom</td><td>Brand</td><td>Evan</td><td>Wallis</td></tr><tr><td>Jenny</td><td>Vos</td><td>Josh</td><td>Zell</td></tr><tr><td>Chris</td><td>Carter</td><td>Josh</td><td>Zell</td></tr><tr><td>Jeff</td><td>Chase</td><td>Kim</td><td>Grace</td></tr><tr><td>Franklin</td><td>Wong</td><td>James</td><td>Borg</td></tr><tr><td>Bonnie</td><td>Bays</td><td>Alex</td><td>Freed</td></tr><tr><td>Alec</td><td>Best</td><td>Alex</td><td>Freed</td></tr><tr><td>Sam</td><td>Sned...</td><td>Alex</td><td>Freed</td></tr><tr><td>Joyce</td><td>English</td><td>Franklin</td><td>Wong</td></tr></table> <table><tr><td>Joyce</td><td>English</td><td>Franklin</td><td>Wong</td></tr><tr><td>Nandita</td><td>Ball</td><td>John</td><td>James</td></tr><tr><td>Jill</td><td>Jarvis</td><td>Bob</td><td>Bender</td></tr><tr><td>Kate</td><td>King</td><td>Bob</td><td>Bender</td></tr><tr><td>Lyle</td><td>Leslie</td><td>Jill</td><td>Jarvis</td></tr><tr><td>Billie</td><td>King</td><td>Lyle</td><td>Leslie</td></tr><tr><td>Jon</td><td>Kramer</td><td>Lyle</td><td>Leslie</td></tr><tr><td>Ray</td><td>King</td><td>Billie</td><td>King</td></tr><tr><td>Gerald</td><td>Small</td><td>Kate</td><td>King</td></tr><tr><td>Arnold</td><td>Head</td><td>Kate</td><td>King</td></tr><tr><td>Helga</td><td>Pataki</td><td>Kate</td><td>King</td></tr><tr><td>Naveen</td><td>Drew</td><td>Gerald</td><td>Small</td></tr><tr><td>Carl</td><td>Reedy</td><td>Naveen</td><td>Drew</td></tr><tr><td>Sammy</td><td>Hall</td><td>Carl</td><td>Reedy</td></tr><tr><td>Red</td><td>Bacher</td><td>Sammy</td><td>Hall</td></tr><tr><td>Ramesh</td><td>Nara...</td><td>Franklin</td><td>Wong</td></tr><tr><td>Jennifer</td><td>Wallace</td><td>James</td><td>Borg</td></tr><tr><td>Ahmad</td><td>Jabbar</td><td>Jennifer</td><td>Wallace</td></tr><tr><td>Alicia</td><td>Zelaya</td><td>Jennifer</td><td>Wallace</td></tr></table>	fname	lname	fname	lname	Jon	Jones	Jared	James	Justin	Mark	Jared	James	Brad	Knight	Jared	James	John	Smith	Franklin	Wong	Josh	Zell	Evan	Wallis	Andy	Vile	Evan	Wallis	Tom	Brand	Evan	Wallis	Jenny	Vos	Josh	Zell	Chris	Carter	Josh	Zell	Jeff	Chase	Kim	Grace	Franklin	Wong	James	Borg	Bonnie	Bays	Alex	Freed	Alec	Best	Alex	Freed	Sam	Sned...	Alex	Freed	Joyce	English	Franklin	Wong	Joyce	English	Franklin	Wong	Nandita	Ball	John	James	Jill	Jarvis	Bob	Bender	Kate	King	Bob	Bender	Lyle	Leslie	Jill	Jarvis	Billie	King	Lyle	Leslie	Jon	Kramer	Lyle	Leslie	Ray	King	Billie	King	Gerald	Small	Kate	King	Arnold	Head	Kate	King	Helga	Pataki	Kate	King	Naveen	Drew	Gerald	Small	Carl	Reedy	Naveen	Drew	Sammy	Hall	Carl	Reedy	Red	Bacher	Sammy	Hall	Ramesh	Nara...	Franklin	Wong	Jennifer	Wallace	James	Borg	Ahmad	Jabbar	Jennifer	Wallace	Alicia	Zelaya	Jennifer	Wallace
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Fråga 5	SQL: select fname, lname, sex, address from employee where sex = 'F' and address like '%Houston%'; Resultat: <table><tr><td></td><td>fname</td><td>lname</td><td>sex</td><td>address</td></tr><tr><td>▶</td><td>Joyce</td><td>English</td><td>F</td><td>5631 Rice Oak, Houston, TX</td></tr></table>		fname	lname	sex	address	▶	Joyce	English	F	5631 Rice Oak, Houston, TX																																																																																																																																		
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Fråga 6	SQL: select fname, lname, bdate from employee where month(bdate) = 6; Resultat: <table><tr><td></td><td>fname</td><td>lname</td><td>bdate</td></tr><tr><td>▶</td><td>Andy</td><td>Vile</td><td>1944-06-21</td></tr><tr><td></td><td>Bonnie</td><td>Bays</td><td>1956-06-19</td></tr><tr><td></td><td>Alec</td><td>Best</td><td>1966-06-18</td></tr><tr><td></td><td>John</td><td>James</td><td>1975-06-30</td></tr><tr><td></td><td>Lyle</td><td>Leslie</td><td>1963-06-09</td></tr><tr><td></td><td>Carl</td><td>Reedy</td><td>1977-06-21</td></tr><tr><td></td><td>Jennifer</td><td>Wallace</td><td>1931-06-20</td></tr></table>		fname	lname	bdate	▶	Andy	Vile	1944-06-21		Bonnie	Bays	1956-06-19		Alec	Best	1966-06-18		John	James	1975-06-30		Lyle	Leslie	1963-06-09		Carl	Reedy	1977-06-21		Jennifer	Wallace	1931-06-20																																																																																																												
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Fråga 7**SQL:**

```
select d.dname, avg(e.salary) as avg_salary
from department as d
join employee as e on d.dnumber = e.dno
group by d.dname;
```

Resultat:

	dname	avg_salary
▶	Administration	31000.0000
	Hardware	63450.0000
	Headquarters	55000.0000
	Research	33250.0000
	Sales	40821.4286
	Software	60000.0000

Fråga 8**SQL:**

```
select e.fname, e.lname, e.ssn, w.essn
from employee as e
left join works_on as w on e.ssn = w.essn
where w.essn is null;
```

Resultat:

	fname	lname	ssn	essn
▶	Bob	Bender	666666600	NULL
	Kate	King	666666602	NULL

Fråga 9**SQL:**

```
select e.fname, e.lname, d.dnumber, p.pname, e.salary
from employee as e
join department as d on e.dno = d.dnumber
join project as p on p.dnum = d.dnumber
where p.pname = 'LaserPrinters' and d.dnumber = '7' and e.salary > '50000';
```

Resultat:

	fname	lname	dnumber	pname	salary
▶	Evan	Wallis	7	LaserPrinters	92000
	Josh	Zell	7	LaserPrinters	56000
	Andy	Vile	7	LaserPrinters	53000
	Tom	Brand	7	LaserPrinters	62500
	Jenny	Vos	7	LaserPrinters	61000
	Alex	Freed	7	LaserPrinters	89000
	Bonnie	Bays	7	LaserPrinters	70000
	Alec	Best	7	LaserPrinters	60000

Fråga 10**SQL:**

```
select e.fname, e.lname, e.address, d.mgrssn
from employee as e
join department as d on e.dno = d.dnumber
where e.address like '%Houston%' and d.mgrssn = '333445555';
```

Resultat:

	<table><tr><th></th><th>fname</th><th>lname</th><th>address</th><th>mgrssn</th></tr><tr><td>▶</td><td>John</td><td>Smith</td><td>731 Fondren, Houston, TX</td><td>333445555</td></tr><tr><td></td><td>Franklin</td><td>Wong</td><td>638 Voss, Houston, TX</td><td>333445555</td></tr><tr><td></td><td>Joyce</td><td>English</td><td>5631 Rice Oak, Houston, TX</td><td>333445555</td></tr></table>		fname	lname	address	mgrssn	▶	John	Smith	731 Fondren, Houston, TX	333445555		Franklin	Wong	638 Voss, Houston, TX	333445555		Joyce	English	5631 Rice Oak, Houston, TX	333445555																																			
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Fråga 11	<p>SQL:</p> <pre>select e.fname, e.lname, e.salary, d.dname from employee e join department d ON e.dno = d.dnumber where d.dnumber = (select d.dnumber from employee e join department d ON e.dno = d.dnumber group by d.dnumber order by avg(e.salary) desc limit 1);</pre> <p>Resultat:</p> <table><tr><th></th><th>fname</th><th>lname</th><th>salary</th><th>dname</th></tr><tr><td>▶</td><td>Evan</td><td>Wallis</td><td>92000</td><td>Hardware</td></tr><tr><td></td><td>Josh</td><td>Zell</td><td>56000</td><td>Hardware</td></tr><tr><td></td><td>Andy</td><td>Vile</td><td>53000</td><td>Hardware</td></tr><tr><td></td><td>Tom</td><td>Brand</td><td>62500</td><td>Hardware</td></tr><tr><td></td><td>Jenny</td><td>Vos</td><td>61000</td><td>Hardware</td></tr><tr><td></td><td>Chris</td><td>Carter</td><td>43000</td><td>Hardware</td></tr><tr><td></td><td>Alex</td><td>Freed</td><td>89000</td><td>Hardware</td></tr><tr><td></td><td>Bonnie</td><td>Bays</td><td>70000</td><td>Hardware</td></tr><tr><td></td><td>Alec</td><td>Best</td><td>60000</td><td>Hardware</td></tr><tr><td></td><td>Sam</td><td>Snedden</td><td>48000</td><td>Hardware</td></tr></table>		fname	lname	salary	dname	▶	Evan	Wallis	92000	Hardware		Josh	Zell	56000	Hardware		Andy	Vile	53000	Hardware		Tom	Brand	62500	Hardware		Jenny	Vos	61000	Hardware		Chris	Carter	43000	Hardware		Alex	Freed	89000	Hardware		Bonnie	Bays	70000	Hardware		Alec	Best	60000	Hardware		Sam	Snedden	48000	Hardware
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Fråga 12	<p>SQL:</p> <pre>select d.dnumber, d.dname, avg(e.salary) as avg_salary, count(e.ssn) as num_e from department as d join employee as e on d.dnumber = e.dno group by d.dname having avg_salary > '35000';</pre> <p>Resultat:</p> <table><tr><th></th><th>dnumber</th><th>dname</th><th>avg_salary</th><th>num_e</th></tr><tr><td>▶</td><td>7</td><td>Hardware</td><td>63450.0000</td><td>10</td></tr><tr><td></td><td>1</td><td>Headquarters</td><td>55000.0000</td><td>1</td></tr><tr><td></td><td>8</td><td>Sales</td><td>40821.4286</td><td>14</td></tr><tr><td></td><td>6</td><td>Software</td><td>60000.0000</td><td>8</td></tr></table>		dnumber	dname	avg_salary	num_e	▶	7	Hardware	63450.0000	10		1	Headquarters	55000.0000	1		8	Sales	40821.4286	14		6	Software	60000.0000	8																														
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	<p>select e.fname, e.lname, e.address, d.mgrssn, dep.relationship from employee as e join department as d on e.dno = d.dnumber left join dependent as dep on e.ssn = dep.essn where d.mgrssn = '333445555' order by e.fname asc;</p> <p>Resultat:</p> <table><tr><th></th><th>fname</th><th>lname</th><th>address</th><th>mgrssn</th><th>relationship</th></tr><tr><td>▶</td><td>Franklin</td><td>Wong</td><td>638 Voss, Houston, TX</td><td>333445555</td><td>Daughter</td></tr><tr><td></td><td>Franklin</td><td>Wong</td><td>638 Voss, Houston, TX</td><td>333445555</td><td>Spouse</td></tr><tr><td></td><td>Franklin</td><td>Wong</td><td>638 Voss, Houston, TX</td><td>333445555</td><td>Son</td></tr><tr><td></td><td>John</td><td>Smith</td><td>731 Fondren, Houston, TX</td><td>333445555</td><td>Daughter</td></tr><tr><td></td><td>John</td><td>Smith</td><td>731 Fondren, Houston, TX</td><td>333445555</td><td>Spouse</td></tr><tr><td></td><td>John</td><td>Smith</td><td>731 Fondren, Houston, TX</td><td>333445555</td><td>Son</td></tr><tr><td></td><td>Joyce</td><td>English</td><td>5631 Rice Oak, Houston, TX</td><td>333445555</td><td>NULL</td></tr><tr><td></td><td>Ramesh</td><td>Narayan</td><td>971 Fire Oak, Humble, TX</td><td>333445555</td><td>NULL</td></tr></table>		fname	lname	address	mgrssn	relationship	▶	Franklin	Wong	638 Voss, Houston, TX	333445555	Daughter		Franklin	Wong	638 Voss, Houston, TX	333445555	Spouse		Franklin	Wong	638 Voss, Houston, TX	333445555	Son		John	Smith	731 Fondren, Houston, TX	333445555	Daughter		John	Smith	731 Fondren, Houston, TX	333445555	Spouse		John	Smith	731 Fondren, Houston, TX	333445555	Son		Joyce	English	5631 Rice Oak, Houston, TX	333445555	NULL		Ramesh	Narayan	971 Fire Oak, Humble, TX	333445555	NULL
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	Joyce	English	5631 Rice Oak, Houston, TX	333445555	NULL																																																		
	Ramesh	Narayan	971 Fire Oak, Humble, TX	333445555	NULL																																																		
Fråga 14	<p>SQL:</p> <p>select p.pname, sum(w.hours) as worked_hours, count(e.ssn) as num_employees from project as p join works_on as w on p.pnumber = w.pno join employee as e on w.essn = e.ssn group by p.pname;</p> <p>Resultat:</p> <table><tr><th></th><th>pname</th><th>worked_hours</th><th>num_employees</th></tr><tr><td>▶</td><td>Computerization</td><td>55</td><td>3</td></tr><tr><td></td><td>DatabaseSystems</td><td>298</td><td>8</td></tr><tr><td></td><td>InkjetPrinters</td><td>320</td><td>8</td></tr><tr><td></td><td>LaserPrinters</td><td>124</td><td>3</td></tr><tr><td></td><td>Middleware</td><td>136</td><td>4</td></tr><tr><td></td><td>Newbenefits</td><td>55</td><td>3</td></tr><tr><td></td><td>OperatingSystems</td><td>350</td><td>9</td></tr><tr><td></td><td>ProductX</td><td>53</td><td>2</td></tr><tr><td></td><td>ProductY</td><td>38</td><td>3</td></tr><tr><td></td><td>ProductZ</td><td>50</td><td>2</td></tr><tr><td></td><td>Reorganization</td><td>25</td><td>3</td></tr></table>		pname	worked_hours	num_employees	▶	Computerization	55	3		DatabaseSystems	298	8		InkjetPrinters	320	8		LaserPrinters	124	3		Middleware	136	4		Newbenefits	55	3		OperatingSystems	350	9		ProductX	53	2		ProductY	38	3		ProductZ	50	2		Reorganization	25	3						
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	ProductY	38	3																																																				
	ProductZ	50	2																																																				
	Reorganization	25	3																																																				
Fråga 15	<p>SQL:</p> <p>select d.dname, count(distinct p.pnumber) as num_projects, count(distinct e.ssn) as num_employees from department as d left join project as p on d.dnumber = p.dnum left join employee as e on d.dnumber = e.dno group by d.dname</p> <p>Resultat:</p>																																																						

	dname	num_projects	num_employees
►	Administration	2	3
	Hardware	2	10
	Headquarters	1	1
	Research	3	4
	Sales	0	14
	Software	3	8

Uppgift 2 Funktionella beroenden

Uppgift 2.1 Lösning

Primärnyckel: Det finns inte en enda primärnyckel, då alla kolumner i tabellen har dubletter. Dock kan kombinationen av EMPLOYEE_ID och JOB_ID användas som en primärnyckel.

Funktionellt beroende	Förklaring/Exempel
{EMPLOYEE_ID} → {NAME} {JOB_ID} → {JOB_TITLE} {POSTAL_CODE} → {CITY}	Personalens ID kan fastställa namnet. Jobbets ID kan fastställa titeln. Postnumret bestämmer staden.

2.2 Lösning

Primärnyckel: Igen finns det inte en enda primärnyckel, utan här kan en kombination av Product, Part och Type användas som en primärnyckel.

Funktionella beroenden:

- {Product, Part, Type} → {Material}
- {Product, Part, Type} → {Quantity}
- {Product, Part, Type} → {Product_price}
- {Product, Part, Type} → {Part_price}
- {Product, Part, Type} → {Part_supplier}
- {Type} → {Material}
-

Anomali	Motivering/Förklaring
Redundans	Product_price repeteras flera gånger i tabellen, vilket inte är nödvändigt ifall priset på delen i fråga är samma, oberoende av vilken produkt den tillhör.
Uppdatering	Om Product_price behöver uppdateras måste den göra det på flera ställen i tabellen, vilket kan leda till problem ifall

	den inte uppdaterats korrekt på alla ställen.
Radering	Ifall t.ex. alla delar av en produkt raderas från tabellen, tas också priset bort, eftersom priset delvis är beroende av delarna.
Införande	Införande av nya produkter är svårt då de måste innehålla alla delar (product, part, material, type, osv.) för att kunna finnas i tabellen.

Uppgift 3 Normalisering

3.1 Lösning

Finaltabeller/relationer alla i 3NF-formen:

Här har vi i stället för att ha en tabell gjort tre tabeller. Product Table, Parts Table, och Product_Part Table (som används för att länka produkter med deras delar).

Product_ID	Product_name	Product_price
p001	Chair	500
p002	Table	1000
p003	Shelf	200

Part_ID	Part_name	Material	Type	Part_price	Part_supplier
pt001	Screw	Metal	K123	25	Metal AB
pt002	Leg	Wood	Oak	115	Quality Woods
pt003	Apron	Wood	Maple	80	Quality Woods

Product_ID	Part_ID	Quantity
p001	pt001	10
p001	p003	4
p002	pt002	4
p002	pt003	2
p003	pt001	4
p003	pt002	1

3.2 Lösning

Förklaring	Resultat																					
<p>Baserat på den givna primärnyckeln, finns denna relation i 1NF, 2ND eller 3NF?</p> <p><i>Ditt svar här:</i> Relationen finns i 1NF och inte i de andra då discount och commission endast är beroende av delar av primärnyckeln, inte hela. För att konvertera denna till 3NF eliminerar vi dessa partiella beroenden genom att skapa flera tabeller.</p>	<p>Diagram före normalisering:</p> <table><tr><td>car</td><td>date_sold</td><td>salesperson</td><td>commission</td><td>discount</td></tr><tr><td>...</td><td>...</td><td>...</td><td>...</td><td>...</td></tr></table>	car	date_sold	salesperson	commission	discount											
car	date_sold	salesperson	commission	discount																		
...																		
<p><i>Sista Resultat</i></p> <p>Jag delade först upp tabellen för att se till att all information (som provision och rabatt) beror på en hel unik identifierare, och inte bara delar av den. Därefter såg jag till att saker som förändras, som t.ex. rabatter på olika dagar har sina egna rader. Nu när tabellerna är i 3NF kommer inte ändring av ett attribut förstöra för andra.</p>	<p>Det sista diagrammet visar alla tabeller i 3NF:</p> <p>CAR_SALE Table R1</p> <table><tr><td>car</td><td>date_sold</td><td>salesperson</td></tr><tr><td>primary key</td><td>foreign key -> R2</td><td>primary key</td></tr><tr><td>...</td><td>...</td><td>...</td></tr></table> <p>-----</p> <p>DISCOUNT_TABLE R2</p> <table><tr><td>date_sold</td><td>discount</td></tr><tr><td>primary key</td><td></td></tr><tr><td>...</td><td>...</td></tr></table> <p>-----</p> <p>COMMMISION_TABLE R3</p> <table><tr><td>salesperson</td><td>commission</td></tr><tr><td>primary key</td><td></td></tr><tr><td>...</td><td>...</td></tr></table>	car	date_sold	salesperson	primary key	foreign key -> R2	primary key	date_sold	discount	primary key		salesperson	commission	primary key	
car	date_sold	salesperson																				
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