



Data Operation Anomalies

Relational Databases Basics



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Data Operation Anomaly – incorrect data operation or unexpected side effect of data operation, resulting from inadequacy of the database to the subject area.

Simply: we are going to perform some «good» data operation, but it either fails, or produces unexpected side effects.

Data Operation Anomaly

Insertion anomaly

Deletion anomaly

Modification anomaly

Selection anomaly

Non-canonical, rarely mentioned, but nevertheless existing and dangerous.

Insertion anomaly

work

	<u>w_employee</u>	<u>w_project</u>	w_role	w_salary
	Ivanov I.I.	Project "Oak-tree"	Manager	500
	Petrov P.P.	Project "Ash-tree"	Consultant	150
	Sidorov S.S.	Project "Maple-tree"	Manager	900
	Sidorov S.S.	Project "Oak-tree"	Member	300
1	Smith J.J.	?	?	?
2	?	Project "Linden-tree"	?	?
3	?	?	Supervisor	?

Deletion anomaly

work

<u>w_employee</u>	<u>w_project</u>	w_role	w_salary
Ivanov I.I.	Project "Oak-tree"	Manager	500
Petrov P.P.	Project "Ash-tree"	Consultant	150
Sidorov S.S.	Project "Maple-tree"	Manager	900
Sidorov S.S.	Project "Oak-tree"	Member	300

Lost

Deleted

Lost

Deleted

1

3

Lost

Deleted

2

Modification anomaly

work

<u>w_employee</u>	<u>w_project</u>	w_role	w_salary
Ivanov I.I.	Project "Oak-tree"	Coordinator	500
Petrov P.P.	Project "Ash-tree"	Consultant	150
Sidorov S.S.	Project "Maple-tree"	Manager	900
Сидоров С.С.	Project "Oak-tree"	Member	300

1

2

Selection anomaly

work

<u>w_employee</u>	<u>w_project</u>	w_role	w_salary
Ivanov I.I.	Project "Oak-tree"	Coordinator	500
Petrov P.P.	Project "Ash-tree"	Consultant	150
Sidorov S.S.	Project "Maple-tree"	Coordinator ^r	900
Сидоров С.С.	Project "Oak-tree"	Member	300

So, data operation anomalies are bad, and what?

Normalization (and normal forms) helps us to prevent data operation anomalies (and to achieve many other benefits).

How can we fix this database schema?

work

<u>w_employee</u>	<u>w_project</u>	<u>w_role</u>	<u>w_salary</u>
1	1	1	500
2	2	2	150
3	3	1	900
4	1	3	300

role

<u>r_id</u>	r_name
1	Coordinator
2	Consultant
3	Member

employee

<u>e_id</u>	e_name
1	Ivanov I.I.
2	Petrov P.P.
3	Sidorov S.S.
4	Сидоров С.С.

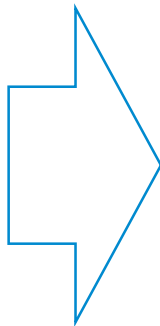
project

<u>p_id</u>	p_name
1	Project "Oak-tree"
2	Project "Ash-tree"
3	Project "Maple-tree"

How to detect an anomaly?

1. Don't store multiple entities in a single relation.

employee
First name
Middle name
Last name
Child name
Phone number



employee
First name
Middle name
Last name
Phone number



child
Child name

How to detect an anomaly?

2. Ask yourself: “What if?”

activity

<u>a_id</u>	a_employee	a_project	a_role	a_start	a_end
115	234	Project “Oak-tree”	11	2017.01.09	2017.11.01
116	12	Project “Ash-tree”	3	2012.12.21	NULL
119	3134	Project “Maple-tree”	6	2015.03.01	2016.04.01
121	12	Project “Oak-tree”	5	2015.03.15	2016.05.20

Imagine, we have such a relation. What if...

How to detect an anomaly?

activity

<u>a_id</u>	<u>a_employee</u>	a_project	a_role	a_start	a_end
115	234	Project "Oak-tree"	11	2017.01.09	2017.11.01
116	12	Project "Ash-tree"	3	2012.12.21	NULL
119	3134	Project "Maple-tree"	6	2015.03.01	2016.04.01
121	12	Project "Oak-tree"	5	2015.03.15	2016.05.20

How can we verify a project exists, if "a_project" is not an FK?

Assuming "a_start" has "NOT NULL" property, how can we assign an employee to a project not knowing the start date?

Can we set "a_start" value greater than "a_end" value?

What if "a_start" and "a_end" values are outside project start/end?

How to detect an anomaly?

activity

a_id	a_employee	a_project	a_role	a_start	a_end
115	234	Project "Oak-tree"	11	2017.01.09	2017.11.01
116	12	Project "Ash-tree"	3	2012.12.21	NULL
119	3134	Project "Maple-tree"	6	2015.03.01	2016.04.01
121	12	Project "Oak-tree"	5	2015.03.15	2016.05.20

If an employee leaves the company, shall we delete his project participation records or just correct the "a_end" value?

If a project is closed, shall we delete all participants' records or just correct the "a_end" value?

And so on, and so forth...



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