شُروع اَللہ کے پاک نام سے جو بڑا مہر بان نہایت رحم والا ہے

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Database Systems

Lecture 22
Schema Refinements , Normalization , 2nd NF and 3rd NF

Today's Lecture

- **Normalization**
  - **2nd Normal Form**
  - **3rd Normal Form**

What is Normalization?

- Normalization is a database design technique that reduces data redundancy and eliminates undesirable characteristics like Insertion, Update and Deletion Anomalies.
- Normalization rules divides larger tables into smaller tables and links them using relationships.
- The purpose of Normalization in SQL is to eliminate redundant (repetitive) data and ensure data is stored logically.

Data Organization: 1NF

PK PK

PROJ_NUM	PROJ_NAME	EMP_NUM	EMP_NAME	JOB_CLASS	CHG_HOUR	HOURS
15	Evergreen	103	June E. Arbough	Elect. Engineer	$84.50	23.8
15	Evergreen	101	John G. News	Database Designer	$105.00	19.4
15	Evergreen	105	Alice K. Johnson *	Database Designer	$105.00	35.7
15	Evergreen	106	William Smithfield	Programmer	$35.75	12.5
15	Evergreen	102	David H. Senior	Systems Analyst	$96.75	23.9
18	Amber Wave	114	Annelise Jones	Applications Designer	$48.10	24.6
18	Amber Wave	118	James J. Frommer	General Support	$18.36	45.3
18	Amber Wave	104	Anne K. Ramoras *	Systems Analyst	$96.75	32.1
18	Amber Wave	112	Darlene M. Smithson	DSS Analyst	$45.95	44.0
22	Rolling Tide	105	Alice K. Johnson	Database Designer	$105.00	64.7
22	Rolling Tide	104	Anne K. Ramoras	Systems Analyst	$96.75	48.9
22	Rolling Tide	113	Delbert K. Joenbrood *	Applications Designer	$48.10	23.6
22	Rolling Tide	111	Geoff B. Wabash	Clerical Support	$26.87	22.5
22	Rolling Tide	106	William Smithfield	Programmer	$35.75	12.1
25	Starflight	107	Maria D. Alonzo	Programmer	$35.75	24.7
25	Starflight	115	Travis B. Bawangi	Systems Analyst	$96.75	45.8
25	Starflight	101	John G. News *	Database Designer	$105.00	56.3
25	Starflight	114	Annelise Jones	Applications Designer	$48.10	33.1
25	Starflight	108	Ralph B. Washington	Systems Analyst	$96.75	23.9
25	Starflight	118	James J. Frommer	General Support	$18.36	30.2
25	Starflight	112	Darlene M. Smithson	DSS Analyst	$45.95	41.4

FIGURE 4.3 DATA ORGANIZATION: FIRST NORMAL FORM

Dependency Diagram

Above: Desired Dependencies

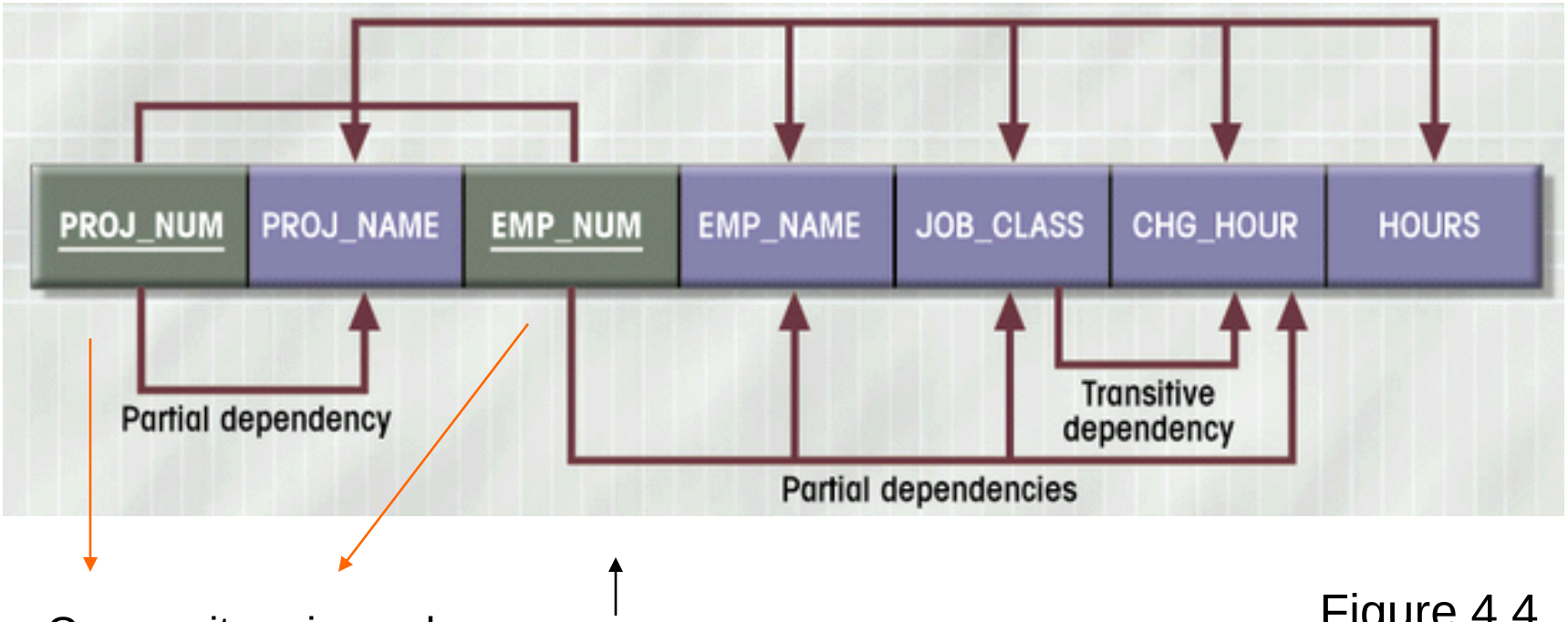
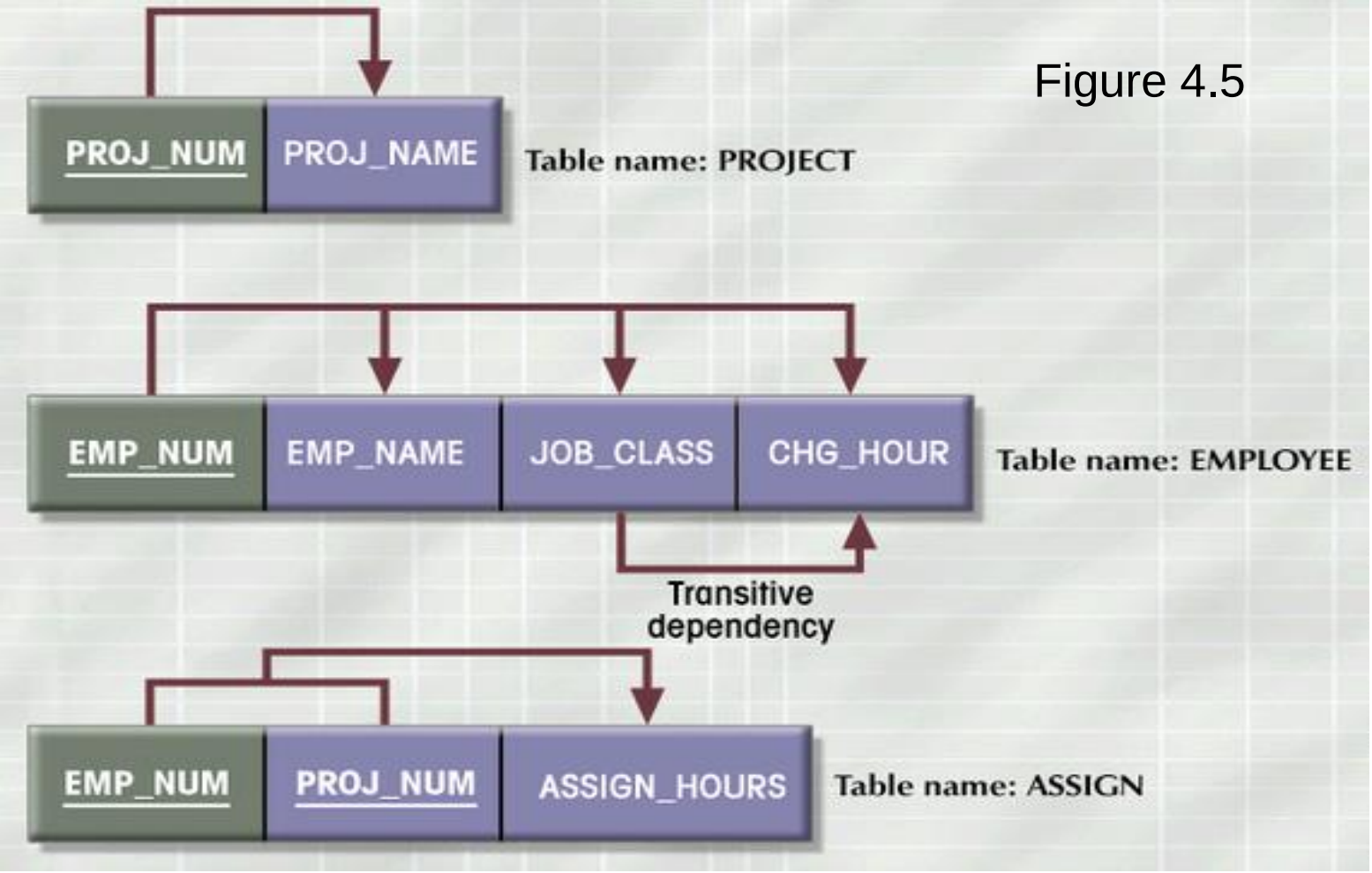


Figure 4.4

Below: Less Desired Dependencies

2NF Conversion Results



Conversion to 2NF

- Start with 1NF format:
- Write each key component on separate line
- Write original key on last line
- Each component is new table
- Write dependent attributes after each key

PROJECT (PROJ_NUM, PROJ_NAME)
EMPLOYEE (EMP_NUM, EMP_NAME, JOB_CLASS, CHG_HOUR)
ASSIGN (PROJ_NUM, EMP_NUM, HOURS)

2NF Summarized

- In 1NF
- Includes no partial dependencies
  - No attribute dependent on a portion of primary key
- Still possible to exhibit transitive dependency
  - Attributes may be functionally dependent on nonkey attributes

Problems in 2nd NF

- **Insertion anomaly**
- **Update anomaly**
- **Deletion anomaly**

PROJECT (PROJ_NUM, PROJ_NAME)
EMPLOYEE (EMP_NUM, EMP_NAME, JOB_CLASS, CHG_HOUR)
ASSIGN (PROJ_NUM, EMP_NUM, HOURS)

Data Organization: 1NF

PK PK

PROJ_NUM	PROJ_NAME	EMP_NUM	EMP_NAME	JOB_CLASS	CHG_HOUR	HOURS
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FIGURE 4.3 DATA ORGANIZATION: FIRST NORMAL FORM

Third Normal Form

- A table is in 3NF if
  - it is in 2NF and
  - all its attributes are determined only by its candidate keys and not by any non-key attributes

Example

- Table BorrowedBooks

BookNo	Patron	Address	Due
B1	J. Fisher	101 Main Street	3/2/15
B2	L. Perez	202 Market Street	2/28/15

  - Candidate key is BookNo
  - Patron → Address

3NF Solution

- Put address in separate Patron table

BookNo	Patron	Due
B1	J. Fisher	3/2/15
B2	L. Perez	2/28/15

Patron	Address
J. Fisher	101 Main Street
L. Perez	202 Market Street

Conversion to 3NF

- Create separate table(s) to eliminate transitive functional dependencies

PROJECT (PROJ_NUM, PROJ_NAME)
ASSIGN (PROJ_NUM, EMP_NUM, HOURS)
EMPLOYEE (EMP_NUM, EMP_NAME, JOB_CLASS)
JOB (JOB_CLASS, CHG_HOUR)

3NF Summarized

- In 2NF
- Contains no transitive dependencies

In Next Lecture

- Transaction Management

Thanks