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Conceptual Design → Logical Design → Physical Design



CSCI 5408

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Content

1. Recap of Lecture #3 & #4
2. EERD
3. Conceptual Modelling **To** Logical Design/logical mapping
4. Normalization or Denormalization

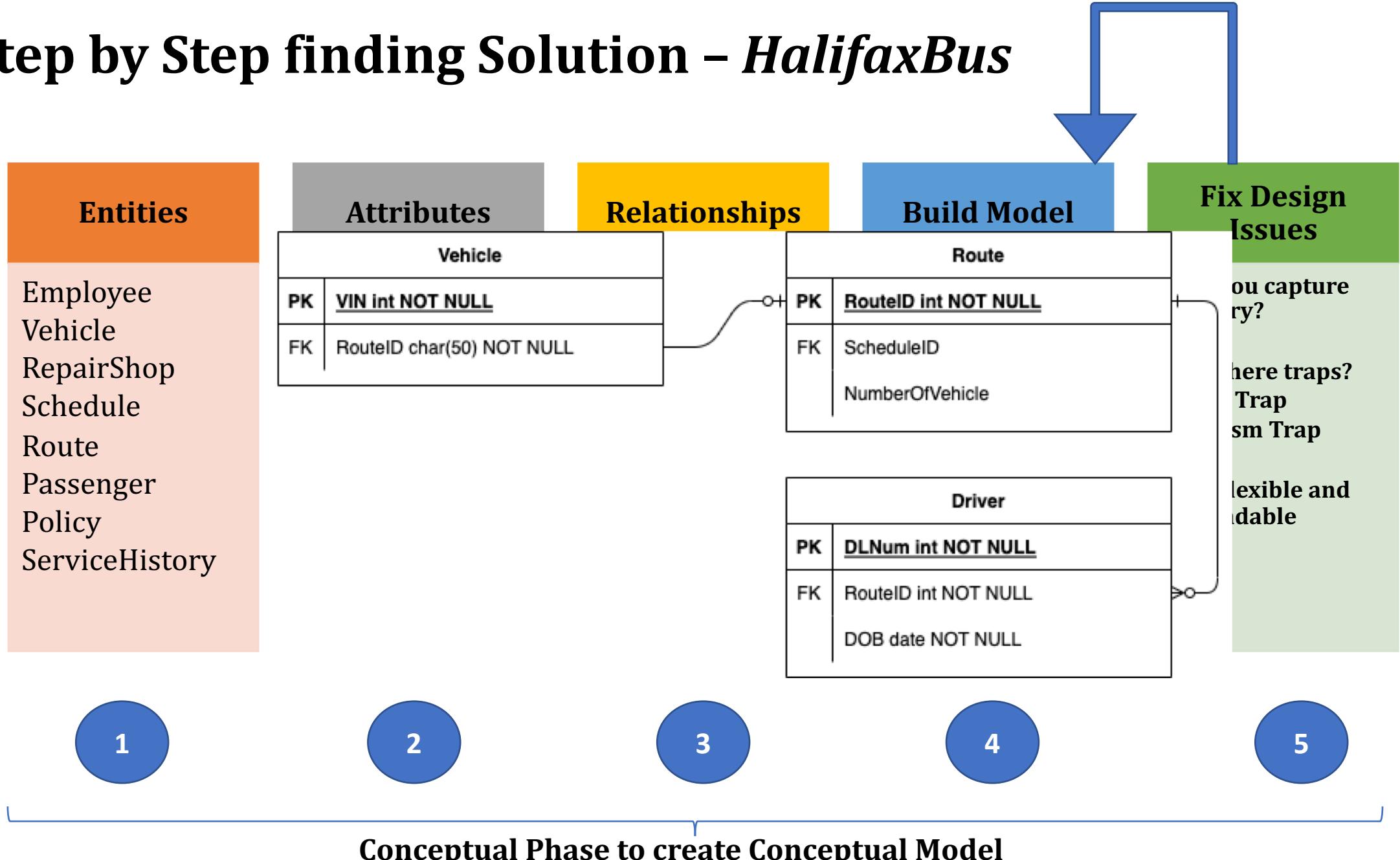
How to design entity-relationship diagram (ERD) from a given problem?

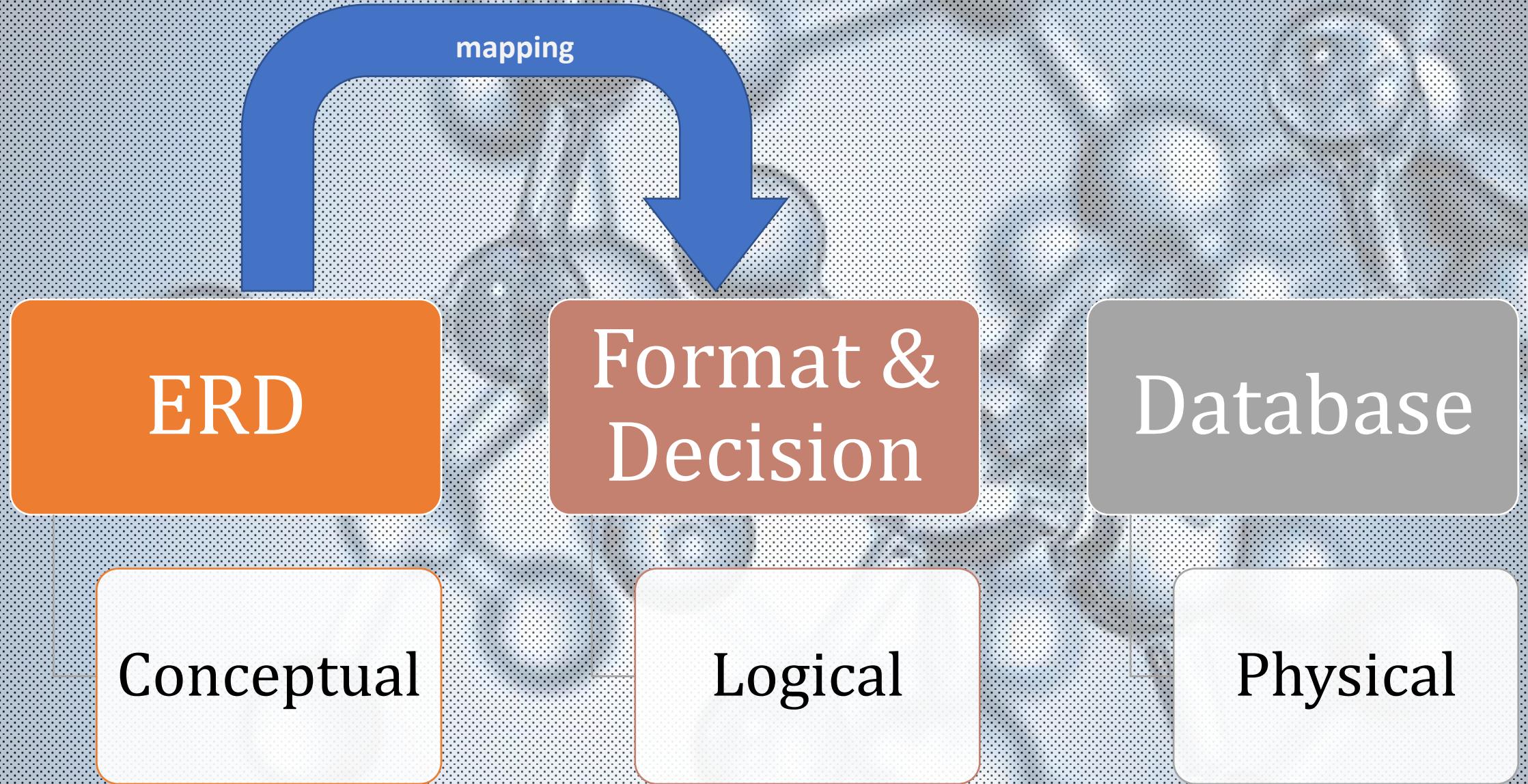
e.g. A new tourism company “HalifaxBus” wants to open office at Halifax, and asked to design their database system. They have limited budget and computational capacity. However, they want to maintain dynamic reservation system and also interested in reviewing their yearly sales record.



- What is the requirement?
- What are the entity types or sets?
- How many attributes?
- Find the unique attribute
- Is there any weak entity?
- What are possible relationships?
- Design an ERD
- Is there any Fan Trap or Chasm Trap?
- Is there any redundancy issue?
- Choose a database system (MSSQL/MySQL etc.)
- Create database and tables

Step by Step finding Solution – *HalifaxBus*





Normalization

- Evaluating and correcting table structures to minimize data redundancies
- Reduces data anomalies
- Assigns attributes to tables based on determination
- Normal forms
 - First normal form (1NF)
 - Second normal form (2NF)
 - Third normal form (3NF)

Table name: RPT_FORMAT**Database name: Ch06_ConstructCo**

<u>PROJ_NUM</u>	<u>PROJECT_NAME</u>	<u>EMP_NUMBER</u>	<u>EMP_NAME</u>	<u>JOB_CLASS</u>	<u>CHARGE_HOUR</u>	<u>HOURS_BILLED</u>
15	Evergreen	103,101,105,106, 102	June E. Arbough, John G. News, Alice K. Johnson *, William Smithfield, David H. Senior	Elec. Engineer, Database Designer, Database Designer, Programmer, System Analyst	85.5, 105., 105., 35.75, 98.75	23.8, 19.4, 35.7, 12.6, 23.8
18	Amber Wave	114, 118, 104, 112	Annelise Jones, James J. Frommer, Anne K. Ramoras *, Darlene M. Smithson	Applications Designer, General Support, Systems Analyst, DSS Analyst	48.1, 18.36, 96.75, 45.95	25.6, 45.3, 32.4, 45.
22	Rolling Tide	105, 104, 113, 111, 106	Alice K. Johnson, Anne K. Ramoras, Delbert K. Joenbrood *, Geoff B. Wabash, William Smithfield	DB Designer, Systems Analyst, Applications Designer, Clerical Support, Programmer	105., 96.75, 48.1, 26.87, 35.75	65.7, 48.4, 23.6, 22., 12.8
25	Star Light	107, 115, 101, 114, 108, 118, 112	Maria D. Alonzo, Travis B. Bawangi, John G. News *, Annelise Jones, Ralph B. Washington, James J. Frommer, Darlene M. Smithson	Programmer, Systems Analyst, Database Design, Applications Designer, Systems Analyst, General Support, DSS Analyst	35.75, 96.75, 105., 48.1, 96.75, 18.36, 45.95	25.6, 45.8, 56.3, 33.1, 23.6, 30.5, 41.4

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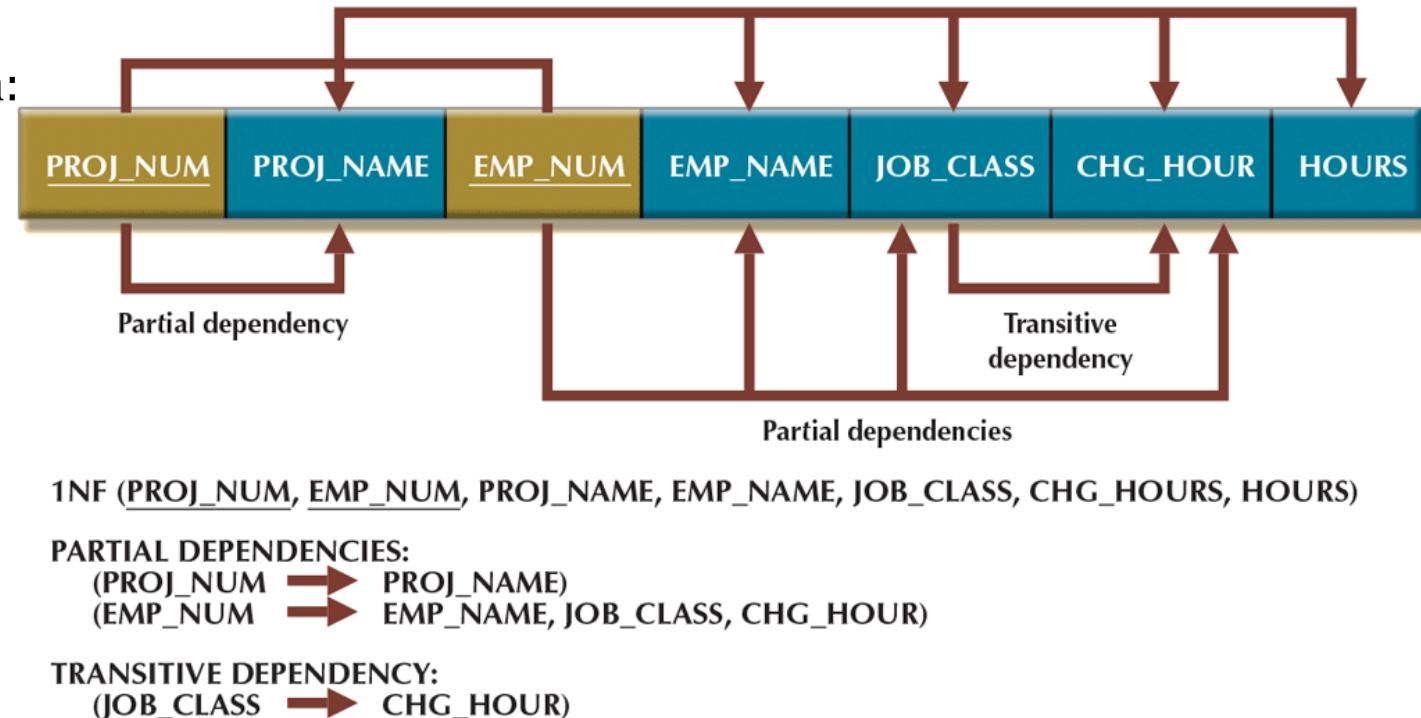
Normalization Process

Objective is to ensure that each table conforms to the concept of well-formed relations

- Each table represents a single subject
- Each row/column intersection contains only one value and not a group of values
- No data item will be unnecessarily stored in more than one table
- All nonprime attributes in a table are dependent on the primary key
- Each table has no insertion, update, or deletion anomalies

1NF describes tabular format in which:

- All key attributes are defined
- There are no repeating groups in the table
- All attributes are dependent on the primary key



All relational tables satisfy 1NF requirements

Some tables contain partial dependencies

- Update, insertion, or deletion

All key attributes are defined

There are no repeating groups in the table

All attributes are dependent on the primary key

Table name: DATA_ORG_1NF

Database name: Ch06_ConstructCo

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	12.6
15	Evergreen	102	David H. Senior	Systems Analyst	96.75	23.8
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	32.4
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	48.4
22	Rolling Tide	113	Delbert K. Joenbrood *	Applications Designer	48.10	23.6
22	Rolling Tide	111	Geoff B. Wabash	Clerical Support	26.87	22.0
22	Rolling Tide	106	William Smithfield	Programmer	35.75	12.8
25	Starflight	107	Maria D. Alonzo	Programmer	35.75	24.6
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	23.6
25	Starflight	118	James J. Frommer	General Support	18.36	30.5
25	Starflight	112	Darlene M. Smithson	DSS Analyst	45.95	41.4

What if we build an ERD?

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25	Starflight	112	Darlene M. Smithson	DSS Analyst	45.95	41.4

Database name: Ch06_ConstructCo



Employee_Project	
PK	<u>Emp_Number</u>
PK	<u>Proj_Num</u>
	<u>Proj_Name</u>
	<u>Emp_Name</u>
	<u>Job_Class</u>
	<u>Charge_Hour</u>
	<u>Hours_Billed</u>

Identify entities and dependencies

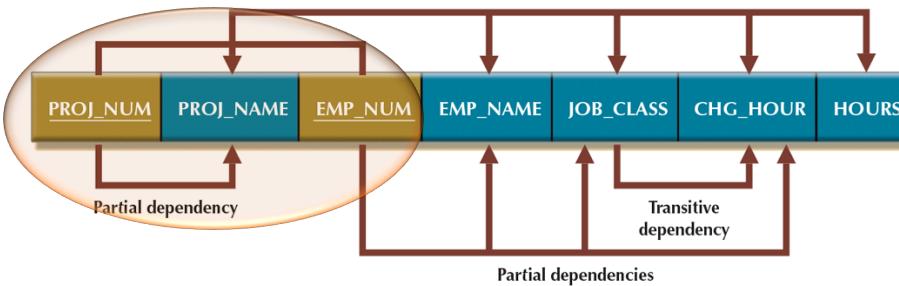
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Database name: Ch06_ConstructCo

Employee	
PK	<u>Emp_Number</u>
	Emp_Name
	Job_Class
	Charge_Hour
	Hours_Billed

Project	
PK	<u>Proj_Num</u>
	Proj_Name



The **1NF-to-2NF** conversion is simple

- Make new tables to eliminate partial dependencies
- Reassign corresponding dependent attributes

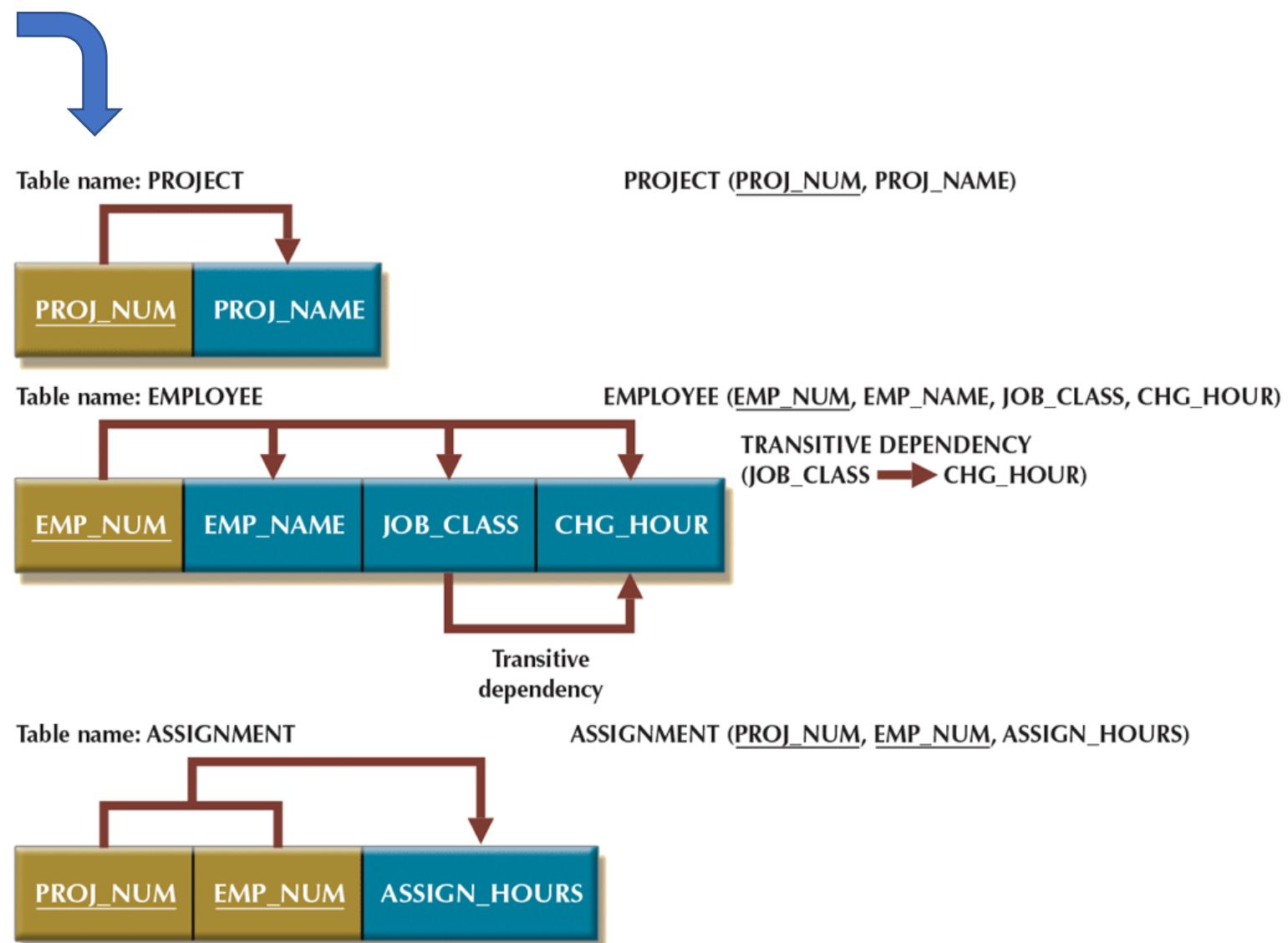


Table is in 2NF when it:

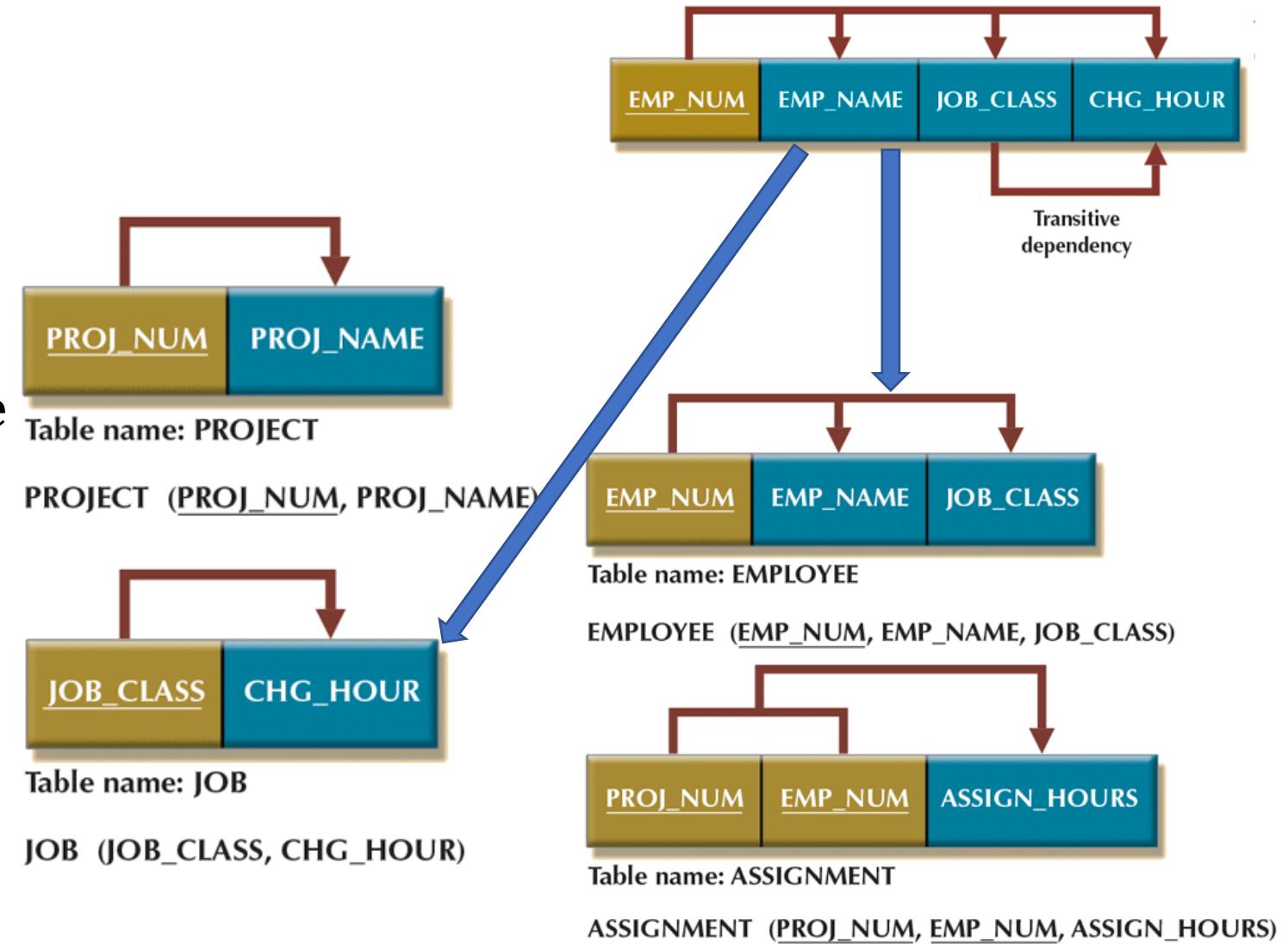
- Is in 1NF
- Includes no partial dependencies

2NF-to-3NF

- Make new tables to eliminate transitive dependencies
- Reassign corresponding dependent attributes

Table is in 3NF when it:

- Is in 2NF
- Contains no transitive dependencies





End of Lecture Questions

1. Do we need to normalize every database?
 2. Can a perfectly designed ERD eliminate the need of normalization?
 3. Does normalization cause problems, which are not related to database performance?
- 