Introduction

• Transform each of the ER diagrams shown on this and the following few pages, into a set of relational schemas which show referential integrity constraints.

Problem #1

EMPLOYEE

Employee_ID
Employee_Name(...)
Payroll_Address(...)
Date_Employed
{Skill}
[Years_Employed]
Solution for Problem #1

EMPLOYEE

<table>
<thead>
<tr>
<th>Employee_ID</th>
<th>Employee_Name</th>
<th>Address</th>
<th>Date_Employed</th>
</tr>
</thead>
</table>

EMPLOYEE SKILL

<table>
<thead>
<tr>
<th>Employee_ID</th>
<th>Skill</th>
</tr>
</thead>
</table>

Multi-valued attribute is contained in a separate table.

Derived attribute is “replaced” with the attribute actually maintained in the database. Transformation technique is not indicated at this level.
Problem #2

FLIGHT

Flight_ID
(Flight_Number, Date)
Number_of_Passengers

...
Solution for Problem #2

FLIGHT

<table>
<thead>
<tr>
<th>Flight_Number</th>
<th>Date</th>
<th>Number_of_Passengers</th>
</tr>
</thead>
</table>

Composite attribute Flight_ID is replaced by both of the sub-component attributes of the original composite attribute. Note that since the original composite attribute was a key attribute that all of the sub-component attributes are now key attributes.
Problem #3

EMPLOYEE
- Employee_ID
- Employee_Name
- Birth_Date

Completes

COURSE
- Course_ID
- Course_Title
  - Topic

Date_Completed
Solution for Problem #3

The M:M relationship is modeled as a table.

The multi-valued attribute is modeled in its own table.
Problem #4

Note that this is the same problem as #3, however, this time the relationship has been modeled with an attribute and as an associative entity rather than as a simple M:M binary relationship.
Solution for Problem #4

When the certificate is modeled as an associative entity and has an identifier (in this case the certificate number), that identifier becomes the key of the relation scheme with the identifiers in the two participating entity sets becoming foreign keys in the associative entity table.
Problem #5

Basic 1:M binary relationship.

MOovie
Movie Name
Star
Year_Produced

dVD
Copy_Number
Solution for Problem #5

```
MOovie
  Movie_Name  Star  Year_Produced

Dvd
  Copy_Number  Movie_Name
```
Problem #6

VEHICLE

Vehicle_ID
Price
Engine_Displacement
Vehicle_Name
(Make, Model)

CAR
No_of_Passengers

TRUCK
Capacity
Cab_Type
Solution for Problem #6
Assuming disjoint constraint

<table>
<thead>
<tr>
<th>Vehicle_ID</th>
<th>Price</th>
<th>Make</th>
<th>Model</th>
<th>Engine_Displacement</th>
<th>Vehicle_type</th>
</tr>
</thead>
</table>

**CAR**

<table>
<thead>
<tr>
<th>C_Vehicle_ID</th>
<th>No_of_Passengers</th>
</tr>
</thead>
</table>

**TRUCK**

<table>
<thead>
<tr>
<th>T_Vehicle_ID</th>
<th>Cab_Type</th>
<th>Capacity</th>
</tr>
</thead>
</table>
Solution for Problem #6

Assuming overlapping constraint

VEHICLE

<table>
<thead>
<tr>
<th>Vehicle_ID</th>
<th>Price</th>
<th>Make</th>
<th>Model</th>
<th>Engine_Displacement</th>
<th>Car ?</th>
<th>Truck ?</th>
</tr>
</thead>
</table>

CAR

<table>
<thead>
<tr>
<th>C_Vehicle_ID</th>
<th>No_of_Passengers</th>
</tr>
</thead>
</table>

TRUCK

<table>
<thead>
<tr>
<th>T_Vehicle_ID</th>
<th>Cab_Type</th>
<th>Capacity</th>
</tr>
</thead>
</table>

Car ?
Truck ?
Problem #7

```
PATIENT
    Patient_ID
    Patient_Name
    Admit_Date

RESPONSIBLE
    Physician_ID

PHYSICIAN

OUTPATIENT
    Checkback_Date

RESIDENT
    Date_Discharged

BED
    Bed_ID
```

Relationships:
- `Is_cared_for` from `PATIENT` to `RESPONSIBLE`
- `Is_assigned` from `RESIDENT` to `BED`
Solution for Problem #7

Assuming disjoint constraint

RESPONSIBLE PHYSICIAN

PATIENT

OUTPATIENT

RESIDENT PATIENT

BED

<table>
<thead>
<tr>
<th>Patient_ID</th>
<th>Admit_Date</th>
<th>Physician_ID</th>
<th>Patient_type</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>O_Patient_ID</th>
<th>Checkback_Date</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>R_Patient_ID</th>
<th>Date_Discharged</th>
<th>Bed_ID</th>
</tr>
</thead>
</table>
Solution for Problem #7

Assuming overlapping constraint

RESPONSIBLE PHYSICIAN

Physician_ID

PATIENT

Patient_ID  Admit_Date  Physician_ID  out_patient  resident_patient

OUTPATIENT

O_Patient_ID  Checkback_Date

RESIDENT PATIENT

R_Patient_ID  Date_Discharged  Bed_ID

BED

Bed_ID
Problem #8

- **PART**
  - Part_No
  - Description
  - Location
  - Qty_on_Hand

- **SUPPLIER**
  - Supplier_ID

- **MANUFACTURED PART**
  - Routing_Number

- **PURCHASED PART**

- **SUPPLIES**
  - Unit_Price
Solution for Problem #8

Assuming Overlapping constraint

<table>
<thead>
<tr>
<th>PART</th>
<th>Description</th>
<th>Location</th>
<th>Manufactured?</th>
<th>Purchased?</th>
<th>Quantity_on_Hand</th>
</tr>
</thead>
<tbody>
<tr>
<td>M_Part_No.</td>
<td>Routing_Number</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PURCHASED PART</th>
<th>P_Part_No.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>SUPPLY LINE</th>
<th>P_Part_No.</th>
<th>Supplier_ID</th>
<th>Unit_Price</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>SUPPLIER</th>
<th>Supplier_ID</th>
<th>Supplier_Name</th>
</tr>
</thead>
</table>

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