

## Tutorial 6 – Data Modeling II

### WITH SUGGESTED SOLUTIONS

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#### Answers to Review Questions

1. Explain the following terms:
  - a. *Supertype*: A generic entity type that has subtypes.
  - b. *Subtype*: A specialization of the supertype entity. Subtypes inherit supertype attributes and relationships and may include additional attributes and relationships.
  - c. *Specialization*: The process of refining a supertype into a subtype by adding attributes and relationships.
  - d. *Subtype discriminator*: An attribute of the supertype that is used to differentiate the subtypes.
  - e. *Generalization*: The process of defining a generalized supertype from a set of specialized subtypes
  - f. *Disjointness condition*: subtype occurrences are disjoint, i.e. each subtype occurrence can belong to only one subtype
  - g. *Completeness condition*: specialization into subtypes is complete, i.e. no additional subtypes can be defined for a given supertype
  
2. Discuss the following:
  - a. *Concept of inheritance as it applies to entity-relationship modelling*: subtypes inherit attributes and relationships from a supertype.
  - b. *Concept of business rules in the context of entity-relationship modelling*: ERD can represent certain types of business rules (e.g. cardinality of relationships, uniqueness constraints, etc.), but there are other types of business rules that cannot be represented by an ERD diagram (e.g. business rule for calculating a discount given to customers)
  - c. *Composite identifiers*: an identifier that consists of multiple attributes
  - d. *Identifying relationship*: a relationship between a parent entity and a corresponding weak entity that forms a part of the identifier of the weak entity
  - e. *One to one relationships, giving examples*: one-to-one relationships are relatively rare, example: employee may be allocated a company car, the car is not shared by any other employee

#### Solutions to Problems and Exercises

This tutorial continues from tutorial 5. Use the information below to refine the NOH ERD.

#### New Oriental Hospital – Extended Case Study

New Oriental Hospital uses a staff form to record personal and employment details about staff. The same form (shown in Figure 3) is used for both doctors and nurses. The specialty and the pager number of each doctor is recorded (all doctors are given a pager for emergency contact). Nurses have various job positions, e.g. trainee, staff nurse or consultant nurse.

<b>NEW ORIENTAL HOSPITAL STAFF FORM</b> <b>Staff ID: <u>s028</u></b>	
<b>PERSONAL DETAILS</b>	
<b>First Name:</b> <u>Gary</u>	<b>Last Name:</b> <u>Walter</u>
<b>Address:</b> <u>49, George Street</u> <u>Broadway</u>	<b>Gender:</b> <u>Male</u> <b>Date of Birth:</b> <u>30/05/1961</u>
<b>Phone:</b> <u>9514 4463</u>	
<b>Salary Scale:</b> <u>A1</u> <b>Job Type:</b> <u>Permanent</u> / Temporary	<b>Current Salary:</b> <u>80,000</u> <b>Start Date:</b> <u>23/01/1981</u>
<b>DOCTOR</b>	<b>NURSE</b>
<b>Pager:</b> <u>4398</u> <b>Specialty:</b> <u>Orthopedics</u>	<b>Position:</b> _____

Figure 3: Staff Form

The hospital has a number of wards; each ward has a unique ward number. Nursing staff are allocated to different wards on a monthly shift rotation (i.e. for a month at the time). Nurses can be allocated for a day or night shift for each rotation (as shown in Figure 4).

<b>NEW ORIENTAL HOSPITAL WARD ALLOCATION FORM</b>																													
<b>Ward No.:</b> <u>12</u>		<b>Ward Capacity:</b> <u>20</u>																											
<b>Ward Name:</b> <u>Orthopaedics</u>		<b>Ward Extension:</b> <u>4499</u>																											
<b>Ward Location:</b> <u>3L</u>																													
<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="padding: 5px;">Staff ID</th> <th style="padding: 5px;">Position</th> <th style="padding: 5px;">Shift</th> <th style="padding: 5px;">Start_Date</th> <th style="padding: 5px;">End_Date</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">s099</td> <td style="padding: 5px;">Staff</td> <td style="padding: 5px;">Night</td> <td style="padding: 5px;">12/03/05</td> <td style="padding: 5px;">11/04/05</td> </tr> <tr> <td style="padding: 5px;">s123</td> <td style="padding: 5px;">Trainee</td> <td style="padding: 5px;">Night</td> <td style="padding: 5px;">11/01/05</td> <td style="padding: 5px;">10/02/05</td> </tr> <tr> <td style="padding: 5px;">s167</td> <td style="padding: 5px;">Consultant</td> <td style="padding: 5px;">Day</td> <td style="padding: 5px;">24/03/05</td> <td style="padding: 5px;">23/04/05</td> </tr> <tr> <td style="padding: 5px;">s099</td> <td style="padding: 5px;">Staff</td> <td style="padding: 5px;">Night</td> <td style="padding: 5px;">01/05/05</td> <td style="padding: 5px;">31/05/05</td> </tr> </tbody> </table>					Staff ID	Position	Shift	Start_Date	End_Date	s099	Staff	Night	12/03/05	11/04/05	s123	Trainee	Night	11/01/05	10/02/05	s167	Consultant	Day	24/03/05	23/04/05	s099	Staff	Night	01/05/05	31/05/05
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s167	Consultant	Day	24/03/05	23/04/05																									
s099	Staff	Night	01/05/05	31/05/05																									

Figure 4: Ward Allocation Form

At the point of discharge from the hospital, patients are issued a bill identified by a unique bill number (shown in Figure 5). The bill lists all the charges including charges for drug prescriptions and miscellaneous items. The total amount of the bill is calculated by summing charges for individual items.

<b>NEW ORIENTAL HOSPITAL PATIENT MEDICAL BILL</b>				
Bill No.: <u>05-03-1132</u>				
Date: <u>25/04/06</u>		Patient Chart No.: <u>13</u>		
Patient ID: <u>p0122</u>		Insurance Company ID: <u>AU-51</u>		
<b>MEDICATION CHARGES</b>				
Drug No.	Drug Name	Amount	Price \$	Charge \$
10223	Morphine	130	2.50	325.00
10334	Tetracycline	105	5.15	540.75
<b>MISCELLANEOUS CHARGES</b>				
Misc. No	Description	Amount	Price \$	Charge \$
m005	Bed Charge	1	99.00	99.00
m111	Gloves	20	3.20	64.00
m023	Consultation	1	153.00	153.00
			<b>Total:</b>	<b>1181.75</b>

**Figure 5: Medical Bill Form**

### Task

1. Document additional business rules.
2. Draw ERD for the extended NOH scenario.

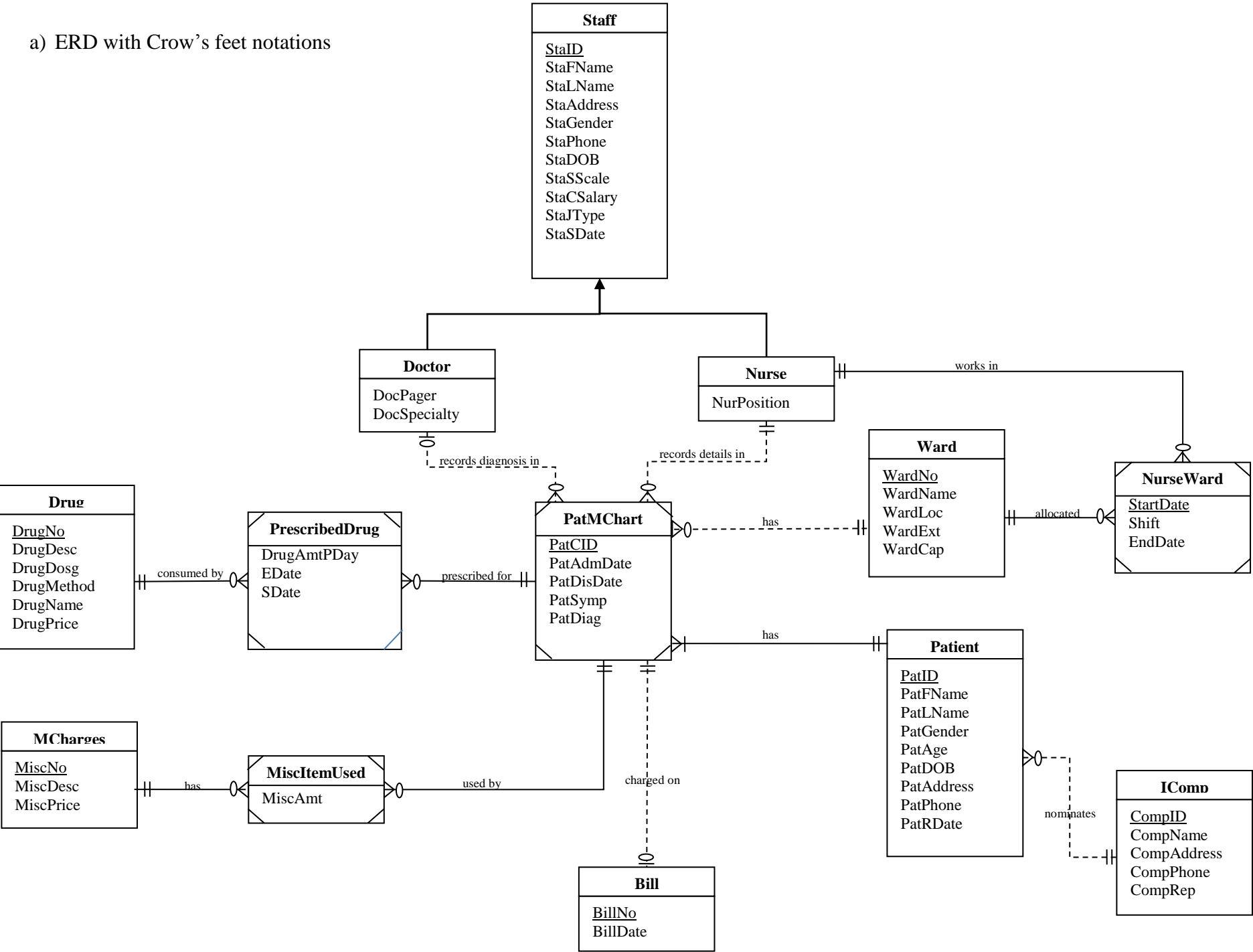
**1. Additional business rules**

- a) The same staff form is used for both doctors and nurses.
- b) Doctors are given a pager for emergency contact.
- c) Nursing staff are allocated to different wards on a monthly shift rotation (i.e. for a month at the time).

**2. NOH ERD**

- a) EDR with lecture note notations
- b) EDR with book notations

a) ERD with Crow's feet notations



b) ERD with textbook notations

