CSC742 HW3 SOLUTION

Please note that these are reference solutions. Some problems don't have unique solutions.

Ex. 1 (Question 9.12)

(1) SHIP (SName, Owner, Ship_Type_Type, State_Name, Port_PName)

Foreign key: Ship_Type_Type (reference to "Type" attribute in SHIP_TYPE),
State_Name (reference to "Name" attribute in STATE_COUNTRY),
Port_PName (reference to "PName" attribute in PORT)

(2) SHIP_MOVEMENT (Ship_SName, Date, Time, Longitude, Latitude)

Foreign key: Ship_SName (reference to "SName" attribute in SHIP)

(3) SHIP_TYPE (Type, Tonnage, Hull)

(4) STATE_COUNTRY (Name, Continent)

(5) SEA_OCEAN_LAKE (Name)

(6) PORT (State_Name, PName, Sea_Name)

Foreign key: State_Name (reference to "Name" attribute in STATE_COUNTRY),
Sea_Name (reference to "Name" attribute in SEA_OCEAN_LAKE)

(7) VISITS (Ship_SName, State_Name, Port_PName, StartDate, EndDate)

Foreign key: Ship_SName (reference to "SName" attribute in SHIP),
State_Name (reference to "Name" attribute in STATE_COUNTRY),
Port_PName (reference to "PName" attribute in PORT)

Ex. 2.

On the original relation R = ABCDEGH, we have:

AB^+ = ABCDEG, AC^+ = ABCDEG, BC^+ = ABCDEG, B^+ = BD, AD^+ = ADEG, E^+ = EG

(a.) ABC

AB^+= ABC, BC^+= ABC, CA^+= ABC

Minimal cover: {AB → C, AC → B, BC → A}

The strongest normal form that is not violated: BCNF

(b.) ABCD

AB^+=ABCD, AC^+=ABCD, BC^+=ABCD, B^+=BD

Minimal cover: {AB → C, AC → B, BC → A, B → D}

The strongest normal form that is not violated: 1NF

Decompose it: {A, B, C} and {B, D}

(c.) ABCEG

AB^+=ABCEG, AC^+=ABCEG, BC^+=ABCEG, E^+=EG

Minimal cover: {AB → C, AC → B, BC → A, E → G, AB → E}

The strongest normal form that is not violated: 2NF
Decompose it: {A, B, C, E} and {E, G}

(d.) DCEGH
E^+=EG
Minimal cover: {E → G}
The strongest normal form that is not violated: 1NF
Decompose it: {D, C, E, H} and {E, G}

(e.) ACEH
AC^+=ACE
Minimal cover: {AC → E}
The strongest normal form that is not violated: 1NF
Decompose it: {A, C, H} and {A, C, E}

Ex. 3.1

1. A^+= AB, BC^+ = BCEA, EC^+ = ECAB, ACD^+ = ABCDE, BCD^+ = ABCDE, ECD^+ = ABCDE
   All keys for R: {A, C, D}, {B, C, D} and {E, C, D}

2. R is in 3NF. Because all the attributes are prime attributes.

3. R is NOT in BCNF. Because for example, we know A → B, but A is not a superkey.

Ex. 3.2

1. "BC → A" does NOT hold over schema S. Because from the first tuple, we know when B=2 and C=3, then A=1; But from the second tuple, we know that when B=2 and C=3, then A=4. So, BC cannot functionally determine A.

2. We CANNOT identify any dependency that holds over S. Because FDs depend on relation schema and its meaning, not on tuples.