CPSC471 - DATABASE MANAGEMENT SYSTEMS

University of Calgary
Assignment 5

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Question 1

{Classid}$^+$ = {Classid, Course#, Instr_name, Credit_hrs, Text, Publisher, Classroom, Capacity}
= CLASS

{Course#, Instr_name}$^+$ = {Course#, Credit_hrs, Text, Publisher, Classroom, Capacity}

Question 2

The set F of functional dependencies in question 1 is not minimal. This is because it violates one of the first rules of minimality, which is every FD must have a single attribute for its right hand side. The following is F_{min}:

F_{min} = {
Classid -> {Course#},
Course# -> {Credit_hrs},
Course# -> {Text},
Course# -> {Publisher},
Course# -> {Classroom},
Course# -> {Capacity},
Classid -> {Instr_name},
}

To show equivalence, we prove that F is covered by F_{min} and vice versa. First we prove F is covered by F_{min}:

{Classid}$^+$ = {Classid, Course#, Instr_name, Credit_hrs, Text, Publisher, Classroom, Capacity} with respect to F_{min} covers Classid -> {Course#, Instr_name} in F and
{Course#, Instr_name}$^+$ = {Credit_hrs, Text, Publisher, Classroom, Capacity} with respect to F_{min} covers {Course#} -> {Credit_hrs, Text, Publisher, Classroom, Capacity} in F.

Second we prove F_{min} is covered by F:

{Classid}$^+$ = {Classid, Course#, Instr_name, Credit_hrs, Text, Publisher, Classroom, Capacity} with respect to F covers Classid -> {Course#}, Classid -> {Instr_name} in F_{min} and
{Course#, Instr_name}$^+$ = {Course#, Credit_hrs, Text, Publisher, Classroom, Capacity} with respect to F covers Course# -> {Credit_hrs}, Course# -> {Text}, Course# -> {Publisher}, Course# -> {Classroom}, Course# -> {Capacity} in F_{min}. This since we have shown both sides, they are equivalent.

Question 3

Since {B,D} -> {E,F} then {A,B,D} -> {A,B,D,E,F}
Since {A,D} -> {G,H} then {A,B,D} -> {A,B,D,G,H}
Since {A,D} -> {G,H} then {A,D} -> {H}. Since also {H} -> {J} then {A,D} -> {J} and so {A,B,D} -> {A,B,D,J}
Since {A,I} then {A,B,D} -> {A,B,D,I}

Finally {A,B,D} -> {A,B,C,D,E,F,G,H,I,J} by union. Thus {A,B,D} is a key of R.

2NF
R1: {A,B,C}
R2: {B,D,E,F}
R3: {A,D,G,H,J}
R4: {A,I}
R5: {A,B,D}

3NF
R1: {A,B,C}
R2: {B,D,E,F}
R3.1: {A, D, G, H}, R3.2: {H, J}
R4: {A, I}
R5: {A,B,D}

Question 4

A) Dependency preservation property:

R1 = {AB -> C}
R2 = {}, no D -> G and D -> H

We can stop at this point and conclude that is NOT dependancy preservation

B) Dependency preservation property:

R1 = {{AB -> C}, {B -> E}, {D -> E}}
R2 = {} No {A -> G} and {D -> H}

We can stop at this point and conclude that is NOT dependancy preservation

C) Dependency preservation property:

No A -> H and no D -> H, we can stop at this point and conclude that is NOT dependancy preservation

A) Lossless join property - check for occurrences

	A	B	C	D	E	F	G	H	I	J
R1	X	X	X							
R2	X			X	X					
R3		X								
R4						X	X	X		
R5				X					X	X

Since no single attribute was in over ⅗ of the spots, it is NOT lossless.

A) Lossless join property - Check for occurrences

	A	B	C	D	E	F	G	H	I	J
R1	X	X	X	X	X					
R2		X				X	X	X		
R3				X					X	X

Since B appears in over 2 of the rows, it is lossless.

	A	B	C	D	E	F	G	H	I	J
R1	X	X	X	X						
R2				X	X					
R3		X				X				
R4						X	X	X		
R5				X					X	X

NOT Lossless

A) Normal form check
D_1 is not in 2NF, and thus it is not in any other form either.

B) Normal form check
D_2 is not in 2NF, and thus it is not in any other form either.

C) Normal form check
D_3 is not in 2NF, and thus it is not in any other form either.