CSCI235: Database Systems

Final Exam

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Question 1

1) A → B; B → AD; transitive A → AD
Therefore A → BD

Minimal Keys: AC, BC

Schema does not satisfy 2NF because:
B → AD and B is a subset of BC
A → B and A is a subset of AC

Therefore schema is 1NF and does not satisfy any higher order Normal Forms

R(B,A,D)
A → B; B → AD; transitive A → AD
Minimal Keys: A, B

R(B,C)
Minimal Keys: BC

All schemas are in BCNF

2) Minimal Keys: BCD

Schema does not satisfy 2NF because:
B → A and B is a subset of BCD

Therefore schema is 1NF and does not satisfy any higher order Normal Forms

R(B,A)
B → A
Minimal Keys: B

R(B,C,D)
Minimal Keys: BCD

All schemas are in BCNF

3) D → A; A → BCD; transitive D → BCD
Therefore D → ABC

Minimal Keys: D

Schema satisfies 2NF as all attributes are fully dependant on primary keys
Schema satisfies 3NF as there are no transitive functional dependencies
Schema satisfies BCNF as all minimal keys are super keys

4) Minimal Keys: ABCD

Schema satisfies 2NF as all attributes are fully dependant on primary keys
Schema satisfies 3NF as there are no transitive functional dependencies
Schema satisfies BCNF as all minimal keys are super keys

Question 2

1)

2) ALTER TABLE CATEGORY
ADD PRODUCT_COUNT NUMBER(9) DEFAULT 0;

UPDATE CATEGORY SET PRODUCT_COUNT = (
SELECT COUNT(*) FROM PRODUCTS
WHERE PRODUCT.CATEGORY_NAME =
CATEGORY.CATEGORY_NAME
);

3)

```
CREATE OR REPLACE TRIGGER UpdateProductCount AFTER INSERT OR DELETE ON
ORDERS FOR EACH ROW

BEGIN

   UPDATE CATEGORY

        SET product_count = product_count + 1

        WHERE :NEW.CATEGORY_NAME = CATEGORY.CATEGORY_NAME;


   UPDATE COUNTRY_ORDERS

   SET order_count = order_count - 1

   WHERE :OLD. CATEGORY_NAME = CATEGORY.CATEGORY_NAME;

END;

/
```

Question 3

1)

Transaction 1	Transaction 2
SELECT COUNT(*) INTO total_suppliers FROM SUPPLIER WHERE COUNTRY = supplier_country;	
	UPDATE SUPPLIER SET COUNTRY = 'An updated country name' WHERE COUNTRY = supplier_country;
	COMMIT;
SELECT COUNT(*) INTO total_products FROM PRODUCT JOIN SUPPLIER ON PRODUCT.SUPPLIER_NAME = SUPPLIER.COMPANY_NAME WHERE COUNTRY = supplier.country;	

IF total_suppliers = 0 THEN
RETURN 0;
ELSE
RETURN total_products/total_suppliers;
END IF;	

COMMIT;	

2) UPDATE statement processed by T2 changed all values in SUPPLIER of the country's name. Therefore once the COMMIT is processed, no SUPPLIERs are left with the same name as when the COUNT was performed by T1.

As the transactions are processed at READ COMMITTED isolation level, the modification is read by the second COUNT of T1, and an inaccurate reading is given where total_products will return a value not corresponding to total_suppliers.

Question 4

1) Run the same SQL script ‘dbcreate.sql’ that was used on the “host server” on the “remote server” to create empty relational tables that correspond to the “host server” database

2) CREATE DATABASE LINK "DB.DATA-PC02" CONNECT TO nm824 IDENTIFIED BY zeb1b4 USING 'data-pc02.adeis.uow.edu.au:1521/db';

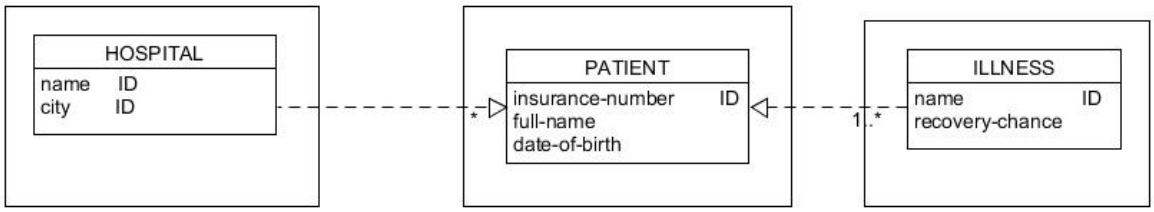
CREATE DATABASE LINK "DB.DATA-PC02" CONNECT TO nm824 IDENTIFIED BY zeb1b4 USING 'data-pc02.adeis.uow.edu.au:1521/db';

```
CREATE SYNONYM remoteCUSTOMER FOR CUSTOMER@"DB.DATA-PC02";
CREATE SYNONYM remoteORDERS FOR ORDERS@"DB.DATA-PC02";
CREATE SYNONYM remoteSUPPLIER FOR SUPPLIER@"DB.DATA-PC02";
CREATE SYNONYM remotePRODUCT FOR PRODUCT@"DB.DATA-PC02";
CREATE SYNONYM remoteORDER_DETAIL FOR ORDER_DETAIL@"DB.DATA-PC02";

INSERT INTO remoteCUSTOMER
   SELECT *
   FROM CUSTOMER
;

INSERT INTO remoteORDERS
   SELECT *
   FROM ORDERS
   WHERE EXTRACT(YEAR FROM ORDER_DATE) = 2021
;

INSERT INTO remoteSUPPLIER
   SELECT *
   FROM SUPPLIER
;

INSERT INTO remotePRODUCT
   SELECT *
   FROM PRODUCT
;

INSERT INTO remoteORDER_DETAIL
   SELECT ORDER_NUM, PRODUCT_NAME, QUANTITY
   FROM ORDER_DETAIL
   WHERE ORDER_NUM IN ( SELECT ORDER_NUM FROM remoteORDERS)
;

DELETE FROM ORDER_DETAIL
WHERE ORDER_NUM IN (SELECT ORDER_NUM FROM remoteORDER_DETAIL)
;
```

```
DELETE FROM ORDERS
WHERE ORDER_NUM IN (SELECT ORDER_NUM FROM remoteORDERS)
;

DELETE FROM CUSTOMERS
WHERE CUSTOMER_CODE IN (SELECT CUSTOMER_CODE FROM remoteORDERS)
;
```

Question 5

1)



2)

```
{"_id":"1",
        "HOSPITAL":{"name":"Sacred Heart",
                "city":"Los Angeles",
                "admits":[ {"PATIENT": {"insurance-number":1234,
                                "full-name":"Bill Johnson",
                                "date-of-birth":Date("1996-09-30"),
                                "diagnosed":[
                                        {"ILLNESS":{"name":"Crohn's Disease",
                                                "recovery-chance":0}},
                                        {"ILLNESS":{"name":"Cancer",
                                                "recovery-chance":0.5}}
                                        ]
                        }, {"PATIENT": {"insurance-number":1234,
                                "full-name":"John Billson",
                                "date-of-birth":Date("1990-10-22"),
                                "diagnosed":[
                                        {"ILLNESS":{"name":"Broken Wrist",
                                                "recovery-chance":0.95}},
                                        {"ILLNESS":{"name":"Broken Rib",
                                                "recovery-chance":0.75}},
                                        {"ILLNESS":{"name":"Broken Leg",
                                                "recovery-chance":0.75}}
                                        ]
                        }]

                }

}
```

Question 6

1) db.driver.aggregate([{$project:{“address.country”:1,”address.city”:1,”_id”:0}}]);

2) db.driver.aggregate([{$and:{ $match:{“first_name”:”James” },
$match:{“last_name”:”Bond” }
}},

$project:{“trips.truck_rego”:1,”_id”:0}]);

3) db.driver.aggregate([{$project:{“first_name”:1,”last_name”:1,”_id”:0}},
{$count: “total number of trips”}]);

4) db.driver.update({“first_name”:”James”,”last_name”:”Bond”,”trips.date”:5},
{$set:{"trips.date”:”28-SEP-2021”}});

5) db.driver.update({“first_name”:”James”,”last_name”:”Bond”,”trips.date”:25},
{$unset:{"trips.number”:””,”trips.truck_rego”:””,”trips.date”:””,”trip
s.legs”:””}});