NATIONAL UNIVERSITY OF SINGAPORE

CS2102 – DATABASE SYSTEMS

(Semester 1 AY2017/2018)

Time Allowed: 2 Hours

INSTRUCTIONS TO CANDIDATES

1. Please write your Student Number only. Do not write your name.
2. This assessment paper contains **THREE (3)** exercises and comprises **NINE (9)** printed pages.
3. Students are required to answer **ALL** questions
4. Students should write the answers on the OCR form or within the space provided, as indicated.
5. This is a **Closed Book** assessment.
6. One double sided page (A4 size) of notes is permitted.
7. Electronic calculators are permitted.

STUDENT NO: | | | | | | | | | | |

This portion is for examiner's use only

EXERCISE		MARKS	REMARK
E I	(12)		OCR
E II	(8)		OCR
E II	(26)		
E III	(14)		
Total	(60)		

```
product(pid, pname, pdesc)
customer(cid, cname, country)
order(pid, cid, qty)
```

Translate the following queries into the indicated language. Use your knowledge of integrity constraints to simplify the queries. Do not use the keyword INNER JOIN. Prefer simpler queries to nested queries, to aggregates, to algebraic queries and other complicated answers, if possible and unless otherwise indicated.

Question 11. (4 marks) (Algebra) Find the name of the customers who have ordered some products and the name of the products. Do not use Join operators ($\bowtie$); prefer Cartesian Product ($\times$). Feel encouraged drawing the query as a tree.

Question 12. (4 marks) (SQL) Find the name of the customers who have ordered on average per order strictly more than the average quantity per order ordered by customers in their country. The average quantity per order is the average of the quantities of individual orders.

```
product(pid, pname, pdesc)
customer(cid, cname, country)
order(pid, cid, qty)
```

Question 13. (4 marks) (TRC) Find the name of the customers in Singapore who ordered all the products with name 'speakers'?

Question 14. (4 marks) (SQL) Find the name of the customers in Singapore who ordered all the products with name 'speakers'? Do not use GROUP BY or aggregate functions.

Question 15. (4 marks) (SQL) For each country, find the total quantity of products with name 'speakers' that have been ordered. The total quantity is the sum of the quantities of individual orders. Consider the possibility that, in some countries, no customer had ordered such products (the total quantity is 0). Print the country and the total quantity.

Question 16. (6 marks) (SQL) Consider the following instances of the tables `customer` and `order`.

customer		
cid	cname	country
1	Agus Suparman	Indonesia
2	Dewi Rendra	Indonesia
3	Made Wijaya	Indonesia
4	Tan Wee Siong	Singapore
5	Siti Bte Mohamad	Singapore

order		
pid	cid	qty
1	1	100
1	5	10
2	5	50
3	4	5

Find the result of the following two queries:

```
SELECT c.cname
FROM customer c LEFT OUTER JOIN order o ON c.cid=o.cid
WHERE c.country ='Indonesia' AND o.cid IS NULL;
```

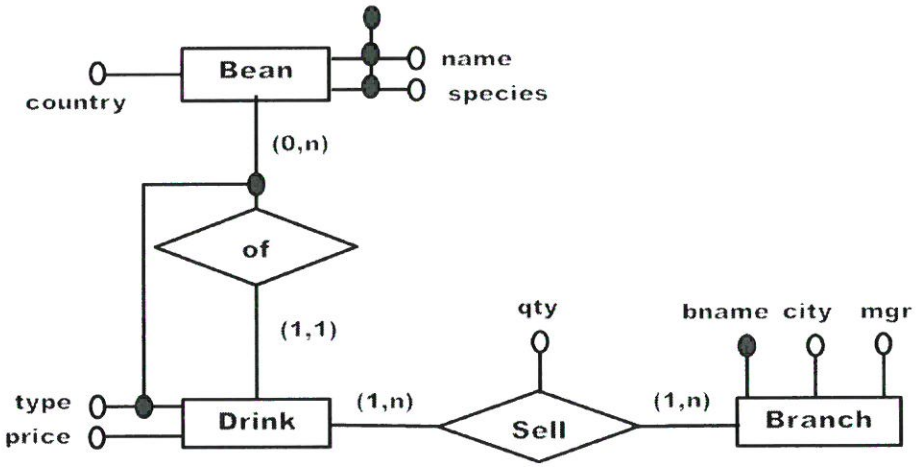
results
c.name

```
SELECT c.cname
FROM customer c LEFT OUTER JOIN order o ON c.cid=o.cid AND c.country ='Indonesia'
WHERE o.cid IS NULL;
```

results
c.name

Exercise III. (14 marks)

Question 17. (4 marks) Consider the following ER diagram of a database for a coffee chain application. Give an extended minimal cover of the set of functional dependencies that hold according to the constraints captured in the diagram.



Let us consider a relation with 5 attributes R(A, B, C, D, E) with the set of functional dependencies $F = \{ \{A, B\} \rightarrow \{C\}, \{D\} \rightarrow \{E\} \}$.

Question 18. (2 marks) Find the candidate key(s) of R with F.

Question 19. (3 marks) Is R with F in 3NF? Justify your answer.

Question 20. (5 marks) Decompose R with F into BCNF. Give the steps. Indicate whether your decomposition is dependency preserving.

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