**NATIONAL UNIVERSITY OF SINGAPORE**

**SCHOOL OF COMPUTING**
**Final Assessment for**
**Semester 2 AY2014/2015**

# CS2102 – DATABASE SYSTEMS

**April 2015** **Time Allowed: 2 Hours**

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**INSTRUCTIONS TO CANDIDATES**

1. This assessment paper contains **THREE (3)** exercises and comprises **EIGHT (8)** printed pages.
2. Students are required to answer **ALL** questions on the OCR form or within the space provided, as indicated.
3. This is a **Closed Book** (with authorized material) examination.
4. One double sided page (A4 size) of hand-written notes is allowed to be used.
5. Electronic calculators are allowed to be used.
6. **Please write your Matriculation Number Below.**

**MATRICULATION NO:** | | | | | | | | | | |

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This portion is for examiner's use only

| EXERCISE | MARKS | REMARK |
|---|---|---|
| E I (20) | | OCR |
| E II (25) | | |
| E III (15) | | |
| Total (60) | | |

**Exercise II. (25 marks)** Consider the following self-describing schema with the underlined primary key and the corresponding foreign keys.

person(pid, name)
read(pid, isbn)
book(isbn, title)

Consider primary and foreign key constraints to simplify your answers. Note that two different books may have the same title but different ISBN. The database does not contain NULL values.

**Question 11. (4 marks) (SQL)** Print the titles of books and the names of persons who read them. Print the result in alphabetical order of titles and persons.

**Question 12. (4 marks) (SQL)** Print the titles of books read by 100 different persons or more.

**Question 13. (4 marks) (Algebra)** Print the titles of books read by more one person.

person(pid, name)
read(pid, isbn)
book(isbn, title)

**Question 14. (4 marks) (SQL)** Find the name of the different persons who read all the books with the word ``Singapore'' in the title. Use aggregates. Assume that there is at least one book with the word ``Singapore'' in the title.

**Question 15. (4 marks) (SQL)** Find the pid of the different persons who read all the books with the word ``Singapore'' in the title. Use NOT EXISTS.

**Question 16. (5 marks) (TRC)** Find the pid of the different persons who read all the books with the title ``Singapore''.

**Exercise III. (15 marks)** Let us consider the relation R with six attributes: {A, B, C, D, E, G} with the set of functional dependencies F = {{A}→{B, C}, {A, B}→{C}, {B} → {C}, {C, D} → {E}, {E}→{A, C}, {G}→{A, B}}.

**Question 17. (3 marks)** Use the Armstrong's Axiom to prove that {B, D} → {E} is in $F^+$. State the axioms used in each step.

**Question 18 (3 marks)** Find the candidate key(s) of R with F. Give the answers only.

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

**Question 20 (6 marks)** Find the minimal cover with F. Give the answer only.

Synthesize a 3NF decomposition of R with F. Indicate the functional dependencies on each fragment. Give the answer only.

**-- END OF PAPER ---**