NANYANG TECHNOLOGICAL UNIVERSITY

SPECIAL TERM I EXAMINATION 2015–2016

MH1812 – Discrete Mathematics

June 2016 TIME ALLOWED: 2 HOURS

INSTRUCTIONS TO CANDIDATES

1. This examination paper contains **FOUR (4)** questions and comprises **THREE (3)** printed pages.
2. Answer **ALL** questions. The marks for each question are indicated at the beginning of each question.
3. Answer each question beginning on a **FRESH** page of the answer book.
4. This **IS NOT** an **OPEN BOOK** exam.
5. Candidates may use calculators. However, they should write down systematically the steps in the workings.

QUESTION 1. **(30 Marks)**

(a) Prove or disprove the following statement:

$$p \wedge (\neg(q \rightarrow r)) \equiv (p \rightarrow r)$$

(b) Decide whether the following argument is valid. Justify your answer:

$(p \vee q) \rightarrow \neg r$;
$\neg r \rightarrow s$;
p;
$\therefore s$

QUESTION 2. **(30 Marks)**

(a) Let R be a relation from $\mathbb{Z}$ to $\mathbb{Z}$ defined by $xRy \Leftrightarrow 2|(x-y)$. Show that if n is odd, then n is related to 1. Here $\mathbb{Z}$ is the set of integers.

(b) For all sets A and B, prove

$$(A \cup B) \cap \overline{(A \cap B)} = (A - B) \cup (B - A)$$

by showing that each side of the equation is a subset of the other.

QUESTION 3. (20 Marks)

Solve the following linear recurrence relation by using the characteristic equation.

$$b_n = 4b_{n-1} - b_{n-2}, \quad b_0 = 2, b_1 = 4.$$

QUESTION 4. (20 Marks)

(a) How many edges are needed to build a complete bipartite graph with 10 and 20 vertices, respectively, on each side ?

(b) Does the graph shown on Figure 1 contain an Euler path? Justify your answer.

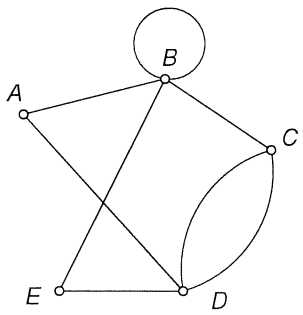

Figure 1: Graph

END OF PAPER

MH1812 DISCRETE MATHEMATICS

Please read the following instructions carefully:

1. **Please do not turn over the question paper until you are told to do so. Disciplinary action may be taken against you if you do so.**

2. You are not allowed to leave the examination hall unless accompanied by an invigilator. You may raise your hand if you need to communicate with the invigilator.

3. Please write your Matriculation Number on the front of the answer book.

4. Please indicate clearly in the answer book (at the appropriate place) if you are continuing the answer to a question elsewhere in the book.