Faculty of Science
Department of Mathematics

MA4198 PROJECT PROPOSAL (PROJECT CUM SEMINAR GROUP)

SUPERVISOR'S INFO

Name:	Loke Hung Yean
Email:	matlhy@nus.edu.sg
Tel number:	65168009
Office location:	S17-06-03

PROJECT ID: PS2320-09

TITLE

Quaternion algebras

BRIEF DESCRIPTION OF PROJECT

In high school, students are taught real numbers in their mathematics course. In university, they are told that there is a larger and a better-behaved number system called the complex numbers. A natural question is if there is an even larger number system. This number system was discovered by W. R. Hamilton called the *quaternion division algebra*. There is an interesting story on how he conceived this algebra. The quaternion division algebra could be expressed in many ways. One common way is to write it as a collection of 2 by 2 matrices. Quaternion division algebra processes some interesting properties. There are many applications of the quaternionic division algebra. One immediate application is to study vector spaces over this algebra. Almost all results and computations in an undergraduate linear algebra course carry over with minimal effort.

EXPECTATION/S

The student is expected to define and describe some basic properties of the quaternionic division algebra. To get a passing grade, the student should explain how to extend computations in real matrices (like elementary row operations or solving linear equations) to matrices over quaternionic division algebras.

Quaternionic division is the simplest example and a gateway to a beautiful theory called central simple algebras. This topic is optional and is only intended for the ambitious student(s).

PREREQUISITE/S (at level 3000 or below, with at most one course at level 3000)

MA1311 or MA2001 or MA1522, MA2101 or MA2101S.
MA2202 and MA3201 are helpful but optional.

READING REFERENCE/S

Kantor and Solodovnikov, *Hypercomplex numbers: An elementary introduction of algebras.* Springer Verlag 1989, ISBN 0-378-96980-2. (We only need Chapters 3 and 4).

R. S. Pierce, *Associative Algebras*. Graduate Texts in Mathematics 88, Springer Verlag 1982. (We only need pages 13 to 19.)

Wikipeidia page: https://en.wikipedia.org/wiki/Quaternion_algebra


NUS
National University
of Singapore