OUTLINE OF MATH7434 (4P4): HONOURS ALGEBRA I

PERMUTATION GROUPS AND LINEAR GROUPS

Unit Coordinator/Lecturer
• Dr Cai Heng Li.
• Room 1.02, School of Mathematics and Statistics
• email: li@maths.uwa.edu.au

Unit Objectives: The course aims to enable the students
(1) Understand and appreciate the role of group theory played in the study of symmetries of an object.
(2) Communicate effectively with others.
(3) Present results in a logical and coherent fashion.
(4) Undertake continuous learning, and doing research in the area of permutation group theory, and algebraic graph theory.

Unit Content
(1) Introduction: permutations and permutation groups
(2) Stabilisers and transitivity
(3) Blocks, block systems and primitivity
(4) Group actions, with lots of examples
(5) Reduction to smaller groups
(6) Suborbits, and orbital graphs
(7) The k-closure of a permutation group
(8) Three actions of a group on its elements
(9) Coset actions
(10) Equivalent actions and coset action representations
(11) Permutation isomorphisms
(12) Normalisers, and centralisers
(13) Diagonal actions of direct product of groups
(14) Quasiprimitive permutation groups
(15) O’Nan-Scott theorem, and applications
(16) Linear groups: basic properties, and small groups
(17) Actions on subspaces and reducible subgroups
(18) Geometric subgroups
(19) Classical groups
(20) Introduction of Aschebacher’s theorem.

Prerequisites
• Linear Algebra, and Abstract Algebra
• 3P5: Groups and Symmetry
Learning Activities
(1) 2 formal Lectures per week (Monday 9am, and Wednesday 10am, in MLR 2 and 1, respectively).
(2) 1 Workshop per week (Thursday 10am, in MLR 2). Workshops will be less formal, aiming to enhance students’ understanding the formal lectures, with content depending largely on student demand.

Assessment
(1) End of Semester Examination worth 70%.
(2) One mid-semester test worth 15% (April 9).
(3) Three Assignments: totalling 15%.

Unit Materials
(1) Some handouts and lecture slides.
(2) Further Reading:
   (i) Group Theory: such as
   \begin{itemize}
   \item \textit{A Course in the Theory of Groups, by Derek J. Robinson}
   \item \textit{Group Theory, vol I, by M. Suzuki}
   \end{itemize}
   (ii) Permutation Groups:
   \begin{itemize}
   \item \textit{Permutation Groups, by J. Dixon and B. Mortimer}
   \item \textit{Finite Permutation Groups, by H. Wielandt}
   \end{itemize}