



INTERNATIONAL CENTRE
OF EXCELLENCE FOR
EDUCATION IN
MATHEMATICS

Quotient Singularities - The Invariant Rings of Finite Groups
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The Vacation Project consisted of three components that lasted six weeks. The first section consisted of some theory on algebraic geometry, the second section consisted of working through a small problem to solidify my understanding of all the theory learnt from the first section, and the last section was analysing a new problem with all this theory in mind.

The first section was mainly based on introducing some of the basic ideas of algebraic geometry including concepts like the Zariski Topology, Co-ordinate Rings, Noetherian Rings, Regular Functions and Maps, and the duality between regular maps on affine varieties and k -algebra homomorphisms on co-ordinate rings of these varieties.

The second section consisted of a simple problem that displayed the concept of duality and served the main purpose of tying all the theory together. This problem also allowed me to get used to dealing with the new terminology I had just learnt, and allowed me to “play around with my new tool box”.

The third component was the largest component of my vacation project. My work mostly became based on analysing the properties of the invariant rings of finite groups. I was trying to find a connection with the group and the embedding dimension of the invariant ring. My work mostly consisted of analysing diagonal groups, although I also looked at dihedral groups, groups with the off-diagonal elements being roots of unity and finite groups generated by arbitrary two by two invertible matrices as well. I used a computer to generate examples of groups that I used to conjecture results before I began proving them algebraically.

For me personally, the object of the vacation project was to get a taste of what research was like. My supervisor, Dr. Daniel Chan, successfully simulated a research environment for me, and this project has positively influenced my decision of continuing my degree with honours in pure mathematics. I did discover some simple facts, they weren't necessarily new, but were difficult to find in the literature in the form that I had discovered them in.

I was also required to give a talk at CSIRO Industrial Centre. I thoroughly enjoyed my time spent at CSIRO and I would recommend anyone to take the same opportunity if it comes their way. I felt that the program was run smoothly and efficiently and it was extremely comforting to meet many other students my age that had similar academic interests to me.