## Discrete Mathematics: Combinatorics

Background

This is a continuation of MAT2612, dealing with counting, relations, functions and partially ordered sets.

**Graph theory**

* isomorphic graphs
* planar graphs
* Euler cycles
* Hamilton circuits
* graph colouring
* trees
* the travelling salesperson problem
* minimal spanning

**Combinatorics**

* basic counting principles
* generating functions
* recurrence relations
* inclusion-exclusion principle.

**Lesson 0**

Introduction to graphs

Simple Graphs are made of two types of objects: vertices & edges

(no loops, multiple edges or directed edges)

[1] Ordered pair with some a finite vertex set V and some Edge set E

[2] Two graphs are equal if they have the same vertex and edge sets

[3] Empty Graph is any graph with some empty Edge set E

But the graph is empty sometimes (Null Graph)

**Adjacent Vertices**

Two vertices are adjacent if they are joined by an edge

Let be a graph and , then and are adjacent in

Let be a graph, then are adjacent in there is an edge in joining a,b

Adjacent

Non-adjacent

**Isolated Vertices**

A vertex is isolated if it not joined by any edge

**Order of a Graph**

- basic definitions & properties of graphs

(simple mathematical models of networks)

- modelling of real-life problems in terms of graphs

- isomorphism

- special types of graphs: connected graphs

- special types of graphs: bipartite graphs