

# COMP 3711

## Design and Analysis of Algorithms

### Introduction to Graph

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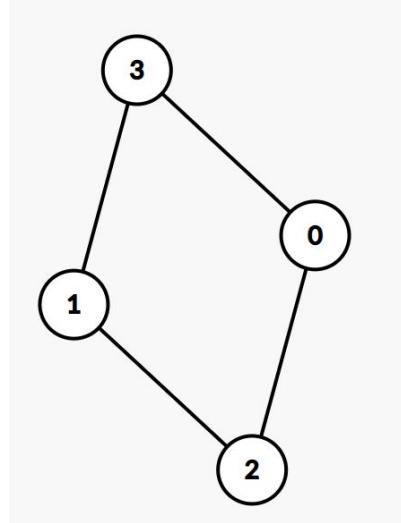
# All paths of size two in a graph

Consider a simple graph  $G=(V,E)$  with degrees  $d_1, d_2, d_3, \dots, d_v$

How many path exists in this graph that has length two?

Four paths exists here with length two:

- 1 3 0
- 3 0 2
- 0 2 1
- 2 1 3



# All paths of size two in a graph (Solution)

**Any path of length two has 3 nodes. One middle node and two ending points. Let's consider the middle node with degree  $d_m$**

It has  $d_m$  edges connected to it. We need to pick two of these edges to create a path of length 3.

This can be done in  $\binom{d_m}{2}$

**For each node  $v$ , count how many path of length two exists such that  $v$  is the middle point.**

**Solution:**  $\binom{d_1}{2} + \binom{d_2}{2} + \dots + \binom{d_v}{2}$  (For  $d_i \geq 2$ )