

# 1 Product Structure of Bounded Degree Planar Graphs

## 1.1 Introduction

The usage of product structure theory to study planar graphs has been a very active area of research since Dujmovic et al first showed that planar graphs have bounded queue number using product structure theory [1]. Since then, this result has gone on to lead to improvements in graph colouring[2], adjacency labelling[3], and more. These results have pushed additional interest into the research of product structure theorems for other graph classes and for more specialized ones. In particular, we focus on bounded-degree planar graphs in hopes of improving the product structure theorem for this highly applicable graph class.

## 1.2 Problem 3

Given a planar graph  $G$  with maximum degree  $\Delta$ , is it true that  $G$  is contained in the product

$$H \boxtimes P \boxtimes K_c$$

for a graph  $H$  with treewidth 3, a path  $P$ , and the complete graph  $K_c$  where  $c$  is bounded by some function of  $\Delta$ ?

## 1.3 Related Work

This problem looks to tighten the bound on  $\text{tw}(H)$  to close the bound on the product structure of bounded-degree planar graphs. The problem was initially shown to be true for  $\text{tw}(H) = 3$  by Dujmovic et al.[1], the same authors continued to show that the case for  $\text{tw}(H) = 1$  is false.

We also know that  $H$  must have treewidth at least 2 as a result of [1].

## References