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Question 1.

Either prove the following is NP complete or P

Input 1: undirected G

• Does G have proper three colouring R,G,B, if B is assigned to only one vertex

Algo G has n vertices and m edges.
for each vertice in n, create a new graph G' which contains {V} - v_i (all vertices minus one)
Run a two-colouring algo on G', if G' is two colourable [RG] v_i can be reintroduced into G' as a third colour, therefore G has a three colouring with only v_i as a B. If no G' has a two colouring, then G cannot have only one B coloured vertice.

The time comlexity is $O(V^2+E)$ for 2 colour since our algo uses this algo V times, the time complexity is

$$O(V \cdot ((V-1)^2+E)) = O(V^3-2V+V+VE) = O(V^3) = \text{therefore are also is in P}$$