

Math 420/720 – Flows on Graphs

Recall that, given a graph G with a fixed orientation, $f_G(n)$ counts the number of flows on G with values in $\mathbb{Z}_n \setminus \{0\}$.

- (1) An edge of G is a **bridge** (or **isthmus**) if its removal increases the number of components. Show that if G has a bridge then $f_G(n) = 0$. (*Hint*: consider the incidence matrix of G .)
- (2) Prove that $f_G(n)$ is independent of the chosen orientation.
- (3) Show that the **Petersen graph** G , pictured below, satisfies $f_G(4) = 0$.

