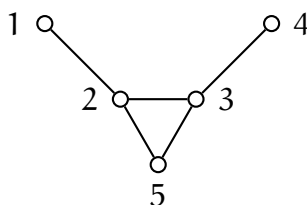


2025F Math585 Midterm2

4 + 1 questions, 20 + 5 total points

Note: Use other papers to answer the problems. Remember to write down your **name** and your **student ID #**.

1. [5pt] Let G be a graph and A its adjacency matrix. Give a combinatorial interpretation of the i, i -entry of A^3 , a combinatorial interpretation of $\text{tr}(A^3)$, and provide an example to demonstrate your ideas.
2. [5pt] Find a tree such that its adjacency matrix A has $\text{rank}(A) = 10$ and $\det(A) = 0$. The answer might not be unique, so you just need to find a tree and verify that it meets the conditions.
3. [5pt] Let G be the graph below and A its adjacency matrix. Find the characteristic polynomial $\det(A - xI)$.



4. [5pt] Find a graph G such that its adjacency matrix A has

$$\det(A - xI) = (-x)^6 - 5(-x)^4 + 5(-x)^2 - 1.$$

The answer might not be unique, so you just need to find a tree and verify that it meets the conditions.

5. [extra 5pt] Let P_{10} be the path graph on 10 vertices. Find s_6 for this graph, that is, the coefficient of $(-x)^4$ in $\det(A - xI)$.