

No late days may be used for this assignment.

1. Problem 6.18
2. Problem 11.3.
3. Problem 11.5.
4. Show that for any d -regular graph, the second largest eigenvalue in absolute value is at least $\sqrt{d(n-d)/(n-1)}$ (which is at least $\sqrt{d/2}$ for $d \leq n/2$).
5. For any $n = d^2 + d + 1$ and d a prime power, there exists a d -regular bipartite graph $G = (U, V, E)$ such that any two distinct vertices in U (or any two in V) have exactly one common neighbor. Let A be the $n \times n$ bipartite adjacency matrix of G , where $|U| = |V| = n$. Show that all eigenvalues of A other than $\pm d$ have absolute value less than \sqrt{d} . Hint: What is $A^T A$?