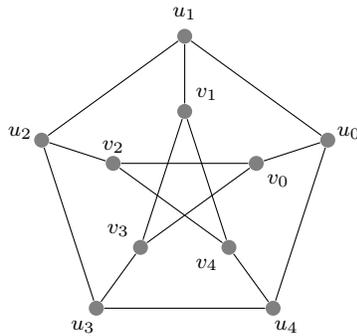
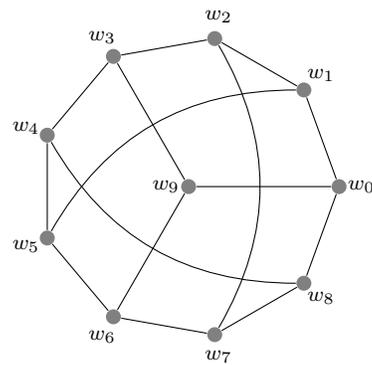


**Directions:** Solve the following problems. All written work must be your own. See the course syllabus for detailed rules.

- [2.2.3] What is the maximum number of edges in an  $n$ -vertex bipartite graph? Prove your answer is correct.
- [2.2.6] Each of 9 users sends three friend requests on a social media platform. Is it possible that each person  $p$  receives exactly 3 friend requests from the same three people to whom  $p$  sent the requests? What if the number of users is 8 instead?
- [2.2.13] Show that the two graphs below are isomorphic.

 $G$  $H$ 

- [2.3.2] Suppose that  $r(4, 5) = 25$ . Let  $G$  be a copy of  $K_{25}$  in which each edge is colored red or blue. Prove that  $G$  either contains a monochromatic copy of  $K_5$  (red or blue), or  $G$  contains both a red copy and a blue copy of  $K_4$ .
- [2.3.8] Prove that  $r(3, 4) > 8$ .