

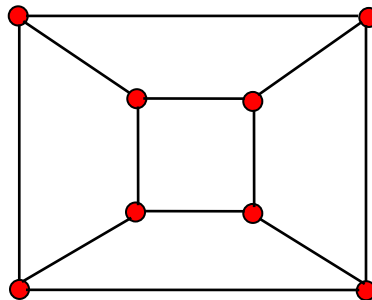
HOMEWORK PROBLEMS #4

4-1 Answer the following True or False questions, with a few words or (counter)examples to support your answers (to avoid trivial cases, assume all network sizes $N \geq 3$):

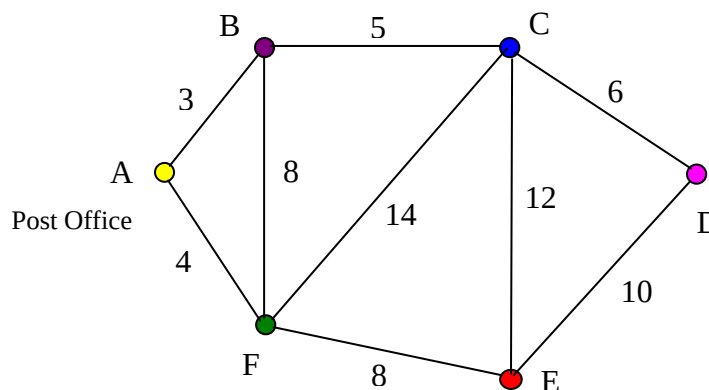
- (a) A bipartite network is Eulerian if it has an even number of edges.
- (b) A bipartite network is Eulerian only if it has an even number of edges.
- (c) A digraph will not be a directed circuit if it contains a node with in-degree larger than out-degree ($d_{in} > d_{out}$); but its underlying network could be a circuit.
- (d) Every circuit is orientable.
- (e) Every orientable network contains a circuit.

4-2 Consider the following graph. Answer the following questions, and explain why or why not.

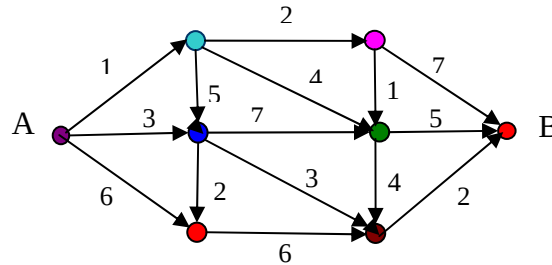
- (a) Is it a bipartite graph?
- (b) Is it orientable?



4-3 Solve the following Chinese postman problem:



4-4 Solve the maximum flow problem on the following graph (show your steps):



4-5 In a typical sensor network, each node is a sensor and there is a node which is the computing centre. Assume that all sensors are fixed in location and each node is equipped with a battery. When one sensor detects a moving target, it will send a message to its immediate neighbor and the neighbor will then pass the message to the next, until the message finally reaches the computing centre. Meanwhile, every activated node will consumes some battery energy. In the design of such a sensor network, two key issues are the main concerns: detection coverage range and battery lifetime.

- What kind of network structure will likely have the longest detection coverage range?
- What kind of network structure will likely have the longest battery lifetime?
- What kind of network structure will likely be optimal in the sense of having both a long detection coverage range and a long battery lifetime?