CSCC73
Algorithm design & analysis

Week 9 Tutorial
Question 1

Following is a flow network and a flow in that network. A label x/y means flow x through edge of capacity y.

1. Is this a maximum flow?
2. Find a minimum cut for this flow network.
Question 2

Input: A flow network $F = (G, s, t, c)$ and a flow $f$ in $F$.
Output: 1 if $f$ is a maximum flow, 0 otherwise.

Give an algorithm that solves this problem in $O(m+n)$
time, where

• $m = \#$ of edges of $G$
• $n = \#$ of nodes of $G$
Question 3

Consider a flow network. Prove or disprove each of the following statements:

1. If all capacities are even, then the value of a maximum flow is even.

2. If all capacities are odd, then the value of a maximum flow is odd.
Question 4

Verify that the traffic on the edges shown below is indeed a flow, i.e., it satisfies the capacity and conservation constraints.

This flow is cyclic: it contains cycles with edges all of which have positive traffic.
1. Identify all the cycles that carry positive traffic in this flow.
2. Show that this flow is maximum.
3. Is there an acyclic maximum flow?
Question 5

Is it possible that the Ford-Fulkerson algorithm produces a cyclic maximum flow?

Either prove that this cannot happen, or show a flow network and a sequence of choices for augmenting paths that results in a cyclic maximum flow.