Homework #7

HW Question 1. Given the original graph on page 2, use the max flow algorithm to compute the max-flow network and min-cut. At each step, show the current flow network and the current residual network. Starting with the original residual network, identify a path to add to the flow network. Then show the updated edges and their weights on the flow graph and the updated residual graph. Show the final max flow graph, the final residual graph, and identify the min-cut(s).

HW Question 2. How many constraints would be required to set up the flow problem from question 1 using a linear program? Explain the type of each constraint and how many of each type. You don't need to specify each one exactly.

HW Question 3. Give an example of a linear program in two variables whose feasible region is infinite, but such that there is an optimum solution of bounded cost. Draw a diagram of the feasible region and explain the objective function for your linear program and why there is an optimum solution.

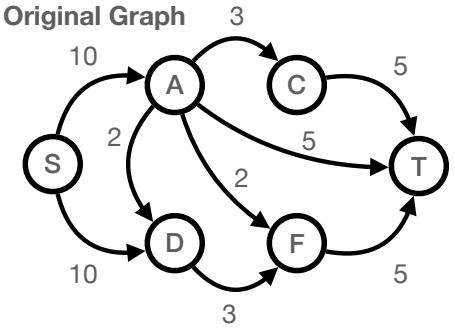
Coding Question 1:

(A) Code up the flow network on pp.2 as a linear program and use the scipy linprog solver to identify the flow on each edge. Demonstrate that it matches your solution from HW Question 1.

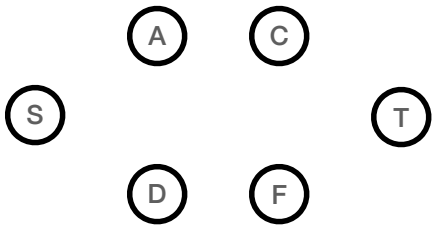
(B) If you could remove edge AD and add its capacity to another edge. Which edge would you change to maximize the flow to T? Make the change to your linear program and demonstrate that it increases the max flow by the weight of the original AD edge.

Coding Question 2: Problem 7.5 from Dasgupta. Code up the constraints and solve it using the scipy linprog solver. Explain the answer and specify the production levels and maximum possible profit given the constraints.

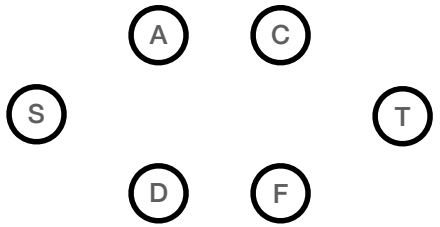
Original Graph



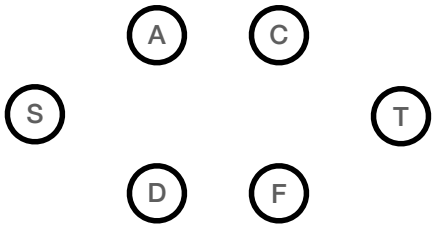
Flow 1



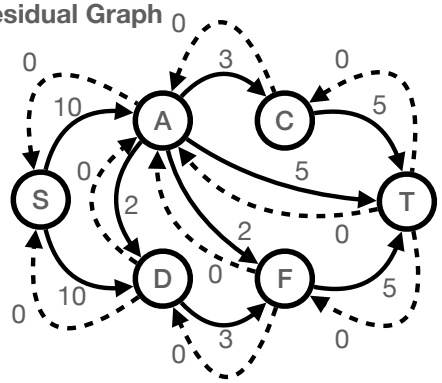
Flow 2



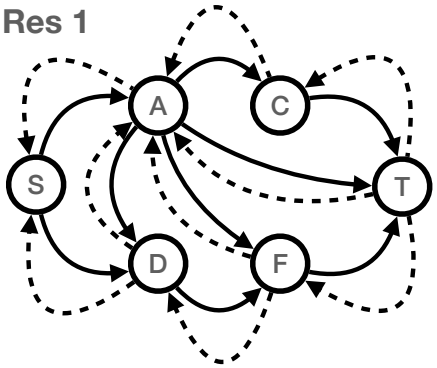
Flow 3



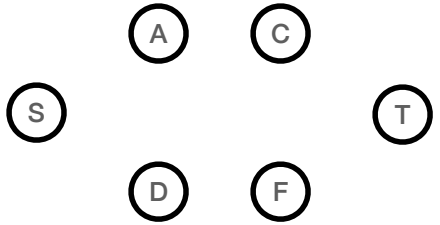
Residual Graph



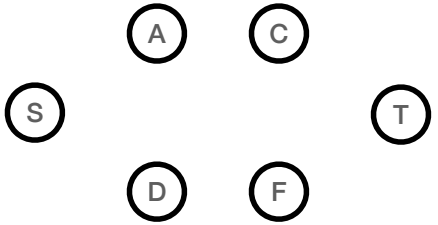
Res 1



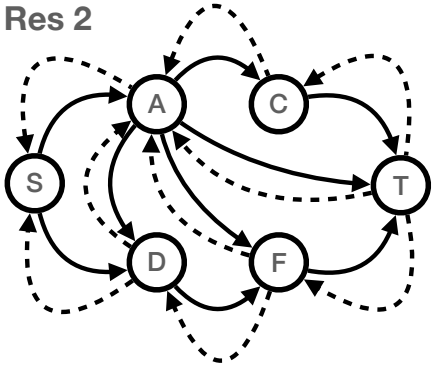
Flow 4



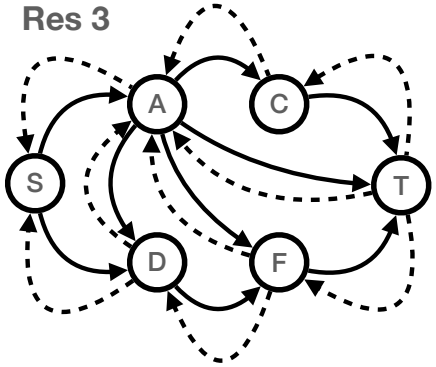
Final Flow Graph



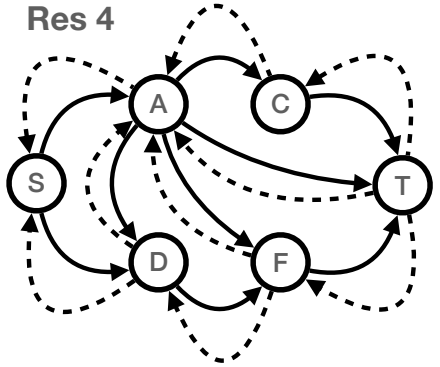
Res 2



Res 3



Res 4



Final Residual Graph