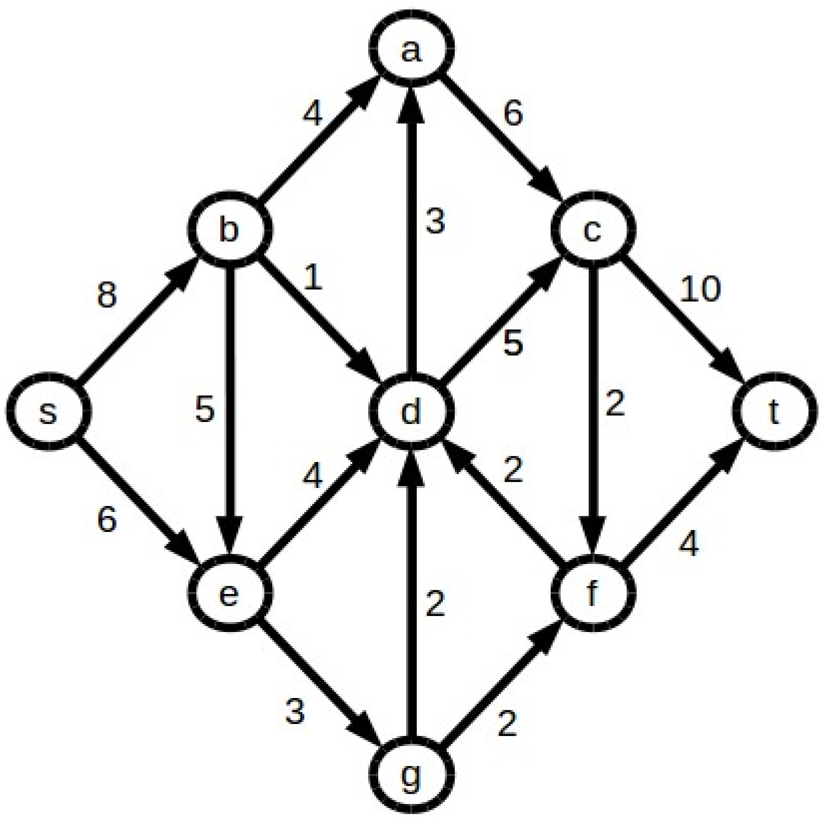
UNIVERSITY OF MINNESOTA
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
4041
ALGORITHMS AND DATA STRUCTURES
FALL 2017

ASSIGNMENT 3:
**Assigned: 12/05/17 Due: 12/10/17 at 11:55pm** (submit via moodle, in a zip if multiple files)

**Problem 1.** (30 points)
Find the maximum flow (from the source "s" to the sink "t") in the following network using the Edmonds-Karp algorithm. At the very least, please show which path you select and the resulting residual network after you incorporate the path's flow. Then identify the minimum capacity cut on this network after you find the maximum flow.

The network shown below has capacities labeled on the edges.




**Problem 2.** (30 points)
Use Strassen's algorthm to find the result of the multiplication shown below. Clearly show all "S" and "P" values. When finding the "P" values, you do **not** need to recursively use Strassen's... instead just compute the 2x2 matrix multiplication directly. (Feel free to use any calculator or online tool to crunch the numbers, but you must still show sufficient work.)

$$\begin{bmatrix} 1 & 5 & 2 & 7 \\ -2 & 1 & 3 & 4 \\ -3 & 2 & 1 & 5 \\ 4 & 2 & -4 & 6 \end{bmatrix} \cdot \begin{bmatrix} -1 & 5 & -2 & 3 \\ 4 & 1 & 8 & 1 \\ 5 & -2 & 6 & 4 \\ 3 & 3 & 3 & 3 \end{bmatrix}$$

**Problem 3.** (40 points)
Use the Fast Fourier Transform to find the resulting polynomial (i.e. C(x) = A(x)*B(x)) in point-value representation (i.e. you do not need to do the last step to convert it back into coefficients). Clearly show all intermediate steps. (Note: you will lose the majority of points if you do this in $O(n^2)$.)
(Note 2: near the end you might want to approximate your numbers with a few decimal places.)

$$A(x) = x^3 - 2 \cdot x^2 + 3 \cdot x - 4$$
$$B(x) = 2 \cdot x^4 + 5 \cdot x - 1$$