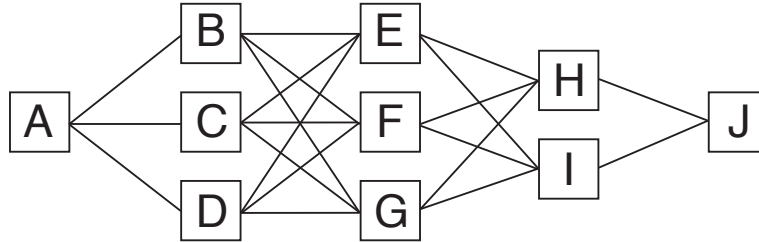# SySc 512 – Quantitative Methods of Systems Science

Homework 5: Discrete optimization.

(1) Compute the shortest chain from A to J in the figure using:
   (a) The greedy algorithm.
   (b) Bellman's principle of optimization.

	B	C	D
A	2	4	3

	E	F	G
B	7	4	6
C	3	2	4
D	4	1	5

	H	I
E	1	4
F	6	3
G	3	3

	J
H	3
I	4

(2) Use the Matlab scripts (`gradientDescent.m`, `grad.m`) on the course website to explore gradient descent method of optimization. For the following objective functions, test different random starting points and report on how much the solution varies. Discuss how and why the solution varies for different values of the termination test parameter (ϵ).
   (a) $f_a(x,y) = 1 - \exp(-\sigma_A * x^2 - \sigma_B * y^2)$, where $\sigma_A = 1$ and $\sigma_B = 5$.
   (b) $f_b(x,y) = \sigma_A * x^2 + \sigma_B * y^2$, where $\sigma_A = 1$ and $\sigma_B = 5$.
   (c) $f_b(x,y) = x^4 + y^4 - A(x^2 + y^2)$, where $A = 0$, or 2.