HOMEWORK SET #1

#1 (10 pts.) You have a 8-liter jug filled with wine and an empty 5-liter and an empty 3-liter jug. The problem is to divide the wine into two 4-liter portions by pouring back and forth between the various jugs, using no other measuring devices. Formulate this as a problem on a network and solve.

#2 (10 pts.) Three mice and three cats on the right bank of the river Styx want to go to the left bank by means of a rowboat that can hold no more than two passengers at a time. If the cats outnumber the mice on either bank, the mice will be killed and eaten. Can all six get safely across?

#3 (10 pts.) Solve the following LP problem:(Optional for the off-campus students)

Max \( Z = -8x_1 - 4x_2 - 3x_3 \)

s.t.

\[-2x_1 + x_2 - x_3 - x_4 \leq -1\]

\[-x_1 - x_2 + x_4 \leq -2\]

\[x_j \geq 0 \ \forall j = 1, 2, 3, 4\]

a) Solve the Primal

b) Solve the Dual graphically and use the complimentary slackness conditions to find the primal solution

#4 (10 pts.) In the labyrinth pictured below, the problem is to get to the pot of gold without being trapped by a minotaur. Draw and describe the equivalent network problem.

#5 (10pts.) The figures below represent the hydrocarbon molecules of ethylene and benzene, C and H denoting carbon and hydrogen atoms respectively. Would you regard these diagrams as graphs? If so, can you suggest necessary conditions that we should impose on a graph in order that it should represent a hydrocarbon?

(a) Ethylene  
(b) Benzene