7.5   Graphs in Puzzles and Games

Please write down all people in your team.

1.   2.

3.   4.

7.5.1   Wolves, Goats, and Cabbages

A traveler has three possessions: a wolf, a goat, and a cabbage. They must transport them across a river.

The catch is that, if left alone, the wolf will eat the goat, or the goat will eat the cabbage. The boat can only hold the traveller and one possession at a time. [a]

For this problem, we are concerned with what valid states are. We can draw a diagram to represent all possible moves between the starting point (everything at the starting location) and the ending point (everything at the ending location) to help us solve it.

Let's use (WC, TG) to mean that the Wolf and Cabbage are left on the departing shore, and the Traveller and the Goat are on the arriving shore. If we write $(WCTG, \emptyset)$, then all four are on the departing shore, and nothing is on the arriving shore.
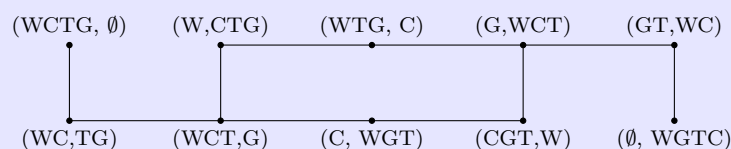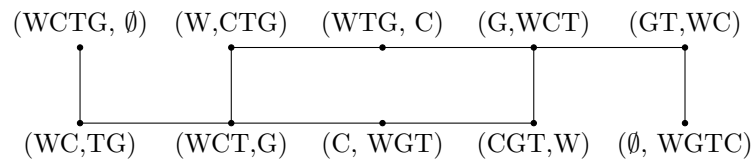

————————————
[a]Discrete Mathematics, Ensley and Crawley

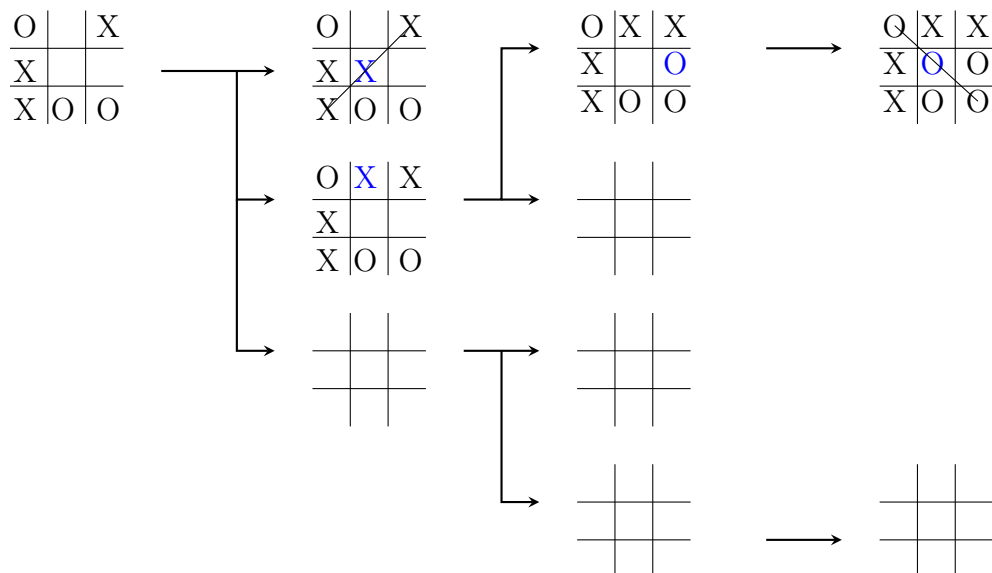## Question 1   _____ / 2

Write a path, starting at $(WCTG, \emptyset)$ and ending at $(\emptyset, WGTC)$, traversing the graph of valid states given.

(WCTG, ∅)   (W,CTG)   (WTG, C)   (G,WCT)   (GT,WC)

(WC,TG)   (WCT,G)   (C, WGT)   (CGT,W)   (∅, WGTC)

Question 2   _____ / 2

Given a tic-tac-toe board with the given starting state, draw a state diagram for all following valid moves until a win. Assume that it is X's turn next. [1]
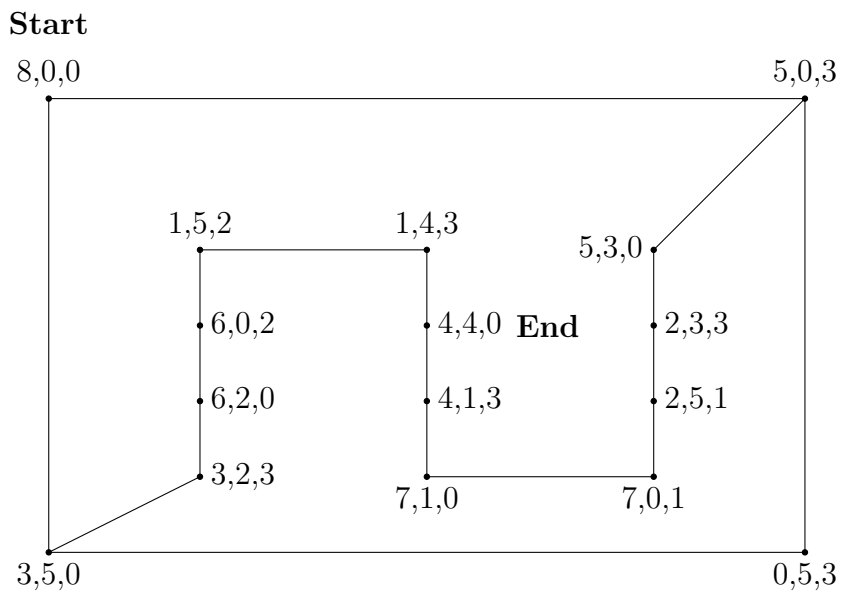

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[1]Diagram from http://neverstopbuilding.com/minimax

Question 3   _____ / 2

Two friends have 2 gallons (8 quarts) of water in a pail. They also have two (empty) jars, one holding 5 quarts and the other 3. Using just these measuring devices, how can they split the water so that 4 quarts are in the larger jar and 4 quarts remain in the pail? [2]

Use the graph below to come up with a walk to the solution.

Start

8,0,0   5,0,3

     1,5,2   1,4,3
                                      5,3,0

        6,0,2   4,4,0 **End**   2,3,3

        6,2,0   4,1,3   2,5,1

        3,2,3
                   7,1,0   7,0,1

3,5,0   0,5,3

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[2] Every node within the square also has edges pointing to two of the four corners of the square, but those have been left off.