

## CS 461 – ARTIFICIAL INTELLIGENCE

### HOMEWORK #4 (5% OR 10 POINTS)

Assigned: Tue 7 Apr 2020

Due: Tue 21 Apr 2020 \*\* 2 pm \*\*

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*You can do this homework in groups of 5 (or less). Your group for this homework should coincide with your term project group. In any case, do not forget to indicate clearly the students who are submitting this homework.*

*You must submit your entire work (including all the original code written) to our TAs. They'll tell you whether there is a need to submit hardcopy, etc.*

*Any programming language can be used as long as you have it available on a portable computer. Needless to say, group members should be prepared to give a homework demo (individually and using that portable computer) when requested to do so by our TAs.*

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Love in the time of cholera<sup>1</sup> may be grueling, but homework in the time of corona need not be so. Thus, this homework will hopefully be both instructive and fun, and also not very demanding. I hope that all of you (including our TAs) are doing well. Take good care of yourselves.

This is an assignment which encourages and in fact requires that you read papers. The papers are freely available as follows<sup>2</sup>:

1. <https://www.jstor.org/stable/30215221>
2. <https://pdfs.semanticscholar.org/f869/5a338d121b033edce15345c754463c6976f7.pdf>

The first (simpler) paper explains and illustrates an approach based on production rules (very similar to our rules from Winston, chapter 7) to solve the following well-known problem<sup>3</sup>: *Given a seven liter jug and a three liter jug and a water supply, can you measure out five liters of water?*

You are first supposed to implement the rules given in this (first) paper and obtain the solutions to the problem via DFS, as also done in the paper (see Fig. 1 in the paper). In other words, you'll write a program which accomplishes what is shown (partially) in Fig. 1. You earn 4 points for your program and

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<sup>1</sup> [https://en.wikipedia.org/wiki/Love\\_in\\_the\\_Time\\_of\\_Cholera](https://en.wikipedia.org/wiki/Love_in_the_Time_of_Cholera)

<sup>2</sup> Don't worry, they are not hard to understand; besides, they are short!

<sup>3</sup> Also see my handwritten notes about this just to refresh your memory:  
[http://www.cs.bilkent.edu.tr/~akman/Water\\_Jugs.pdf](http://www.cs.bilkent.edu.tr/~akman/Water_Jugs.pdf)

1 point each for the two solutions. (Make sure that your program does loop-checking, as illustrated in Fig. 1 with pruned paths.) Notice that one of the solutions will be the shortest solution.

You should then turn to the second (more mathematical) paper and implement the two algorithms formulated there. (They'll be rather small programs.) Then run your programs on Example 3.2 in that paper. You should receive the same answers as computed by your program for the first paper, if everything goes well. You'll earn 1 point each for the two programs and 1 point each for the two solutions.

The solutions (for both cases) should be given in a natural, understandable format. (It doesn't hurt to imitate the papers' notation in displaying them.)

One last thing:

Feel free to activate your accounts on [Piazza](#) if you have not done so. (You are not required to do so!) And do not hesitate to ask questions on the forum. Some of our friends are doing that and I think it is a fruitful learning experience for all involved, including yours truly.

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#### **GENERAL REMARKS (THESE ARE APPLICABLE TO ALL HOMEWORK ASSIGNMENTS)**

- IF YOU ARE REQUESTED TO SUBMIT A HARDCOPY AT ANY TIME IN THIS COURSE, MAKE SURE THAT WHAT YOU SUBMIT IS CLEAN AND FULLY MACHINE-GENERATED. IF THERE IS A HANDWRITTEN ADDITION OR CORRECTION ON A PRINTOUT, YOU'LL DEFINITELY LOSE POINTS.
  - Late submissions will first have 2 points deducted categorically. Then they'll have 2 points deducted for every late day. (A new day begins at 12:00 midnight.)
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