

1. If you leave any part of this question blank, your assignment will not be marked and its weight will be transferred to the final exam.

Each group hands in one (1) only assignment. Print the name and ID number of each group member (at most 4) for this assignment:

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Acknowledge **all** sources, including all references and all people not in your group with whom you discussed any part of any question (for each discussion, list the relevant questions) (continue on the back of this page if there is insufficient space):

Each group member must read, agree to, and sign this statement:

**I am familiar with the Code of Student Behaviour. I understand that there are significant penalties for any infraction of this Code, including failure to acknowledge sources. I have not shared any written or printed version of any of my answers with any other student.**

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2. Try to install fuego on your laptop or home computer. Get the code here <https://sourceforge.net/p/fuego/code/HEAD/tree/>.

here's how to do it on a mac or linux

- (a) install boost and other needed programs (on a mac, use homebrew)
- (b) at the above url, click on the button for https access or svn access, copy the command and execute on your machine.
- (c) cd into directory fuego-code and execute `./setup-build.sh` if successful, this creates file `INSTALL`, which gives instructions;
- (d) execute `./configure`
- (e) execute `make`
- (f) execute `make install`
- (g) that's it. now you can execute `fuegomain/fuego : list_commands` shows you commands.

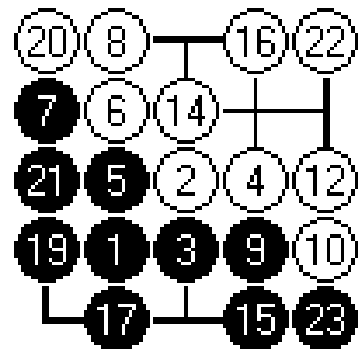
**Spend at most one hour on this.** Were you successful? If yes, how long did it take you? If no, where did you get stuck?

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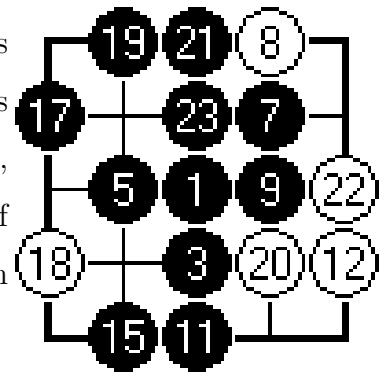
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3. See <http://erikvanderwerf.tengen.nl/5x5/5x5solved.html>.

Here is the final position in a 5x5 game. After move 1 both players played *perfectly*, namely, to maximize (against all possible opponent strategies) their final score. The Tromp-Taylor score of this position is \_\_\_\_\_ wins by \_\_\_\_\_. The stone labelled 11 does not appear because \_\_\_\_\_. On 5x5 if Black plays first at C2 and both players then play perfectly the final score will be \_\_\_\_\_ wins by \_\_\_\_\_.



From <http://erikvanderwerf.tengen.nl/5x5/5x5solved.html>, here is the final position after Black opened in the center. Assume White passes move 24. If Black passes on move 25, the game ends (2 consecutive passes), and the Tromp-Taylor score is Black wins by \_\_\_\_\_ . If Black wants to maximize her final score, then she can keep playing and win by \_\_\_\_\_ .



4. *As the crow flies* means \_\_\_\_\_.

With shortest-path problems on road networks, Euclidean distance is a good heuristic to use with A\* because \_\_\_\_\_.

Following the form shown in the webnotes for the Arad-Bucharest problem, trace the execution of A\* for the problem of finding a path from Oradea to Bucharest. Use the same heuristic function as given in the webnotes (Euclidean distance).

5. In the Oradea-Bucharest problem, suppose for heuristic we estimate each remaining distance to be 0: will  $A^*$  always find a shortest path? \_\_\_\_\_ With this heuristic, what algorithm does  $A^*$  become? \_\_\_\_\_
6. Let A and B each be a solvable 3x3 sliding tile position. Prove or give a counterexample: it is possible to get from A to B by a sequence of sliding tile moves.

Repeat the previous question, with A and B both unsolvable.

7. For a sliding tile position, how does the number of inversions change if we make this move: slide a tile to the empty space to its left? Explain briefly.

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8. For a sliding tile position with 5 columns, how does the number of inversions change if we make this move: slide a tile to the empty space above. Explain briefly.

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9. For a 3x3 sliding tile puzzle, is it always possible to reach a position with tiles 1-3 each in their correct final spot? \_\_\_\_\_

Justify briefly.

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