CS 4810/6810 sample midterm solution (with some rewording of questions)

You have 70 minutes

Please turn off all cellphones, pagers, etc.

You may ask questions about the problems, but not about your answers.

1. NetLogo:

Given the following NetLogo code, write:

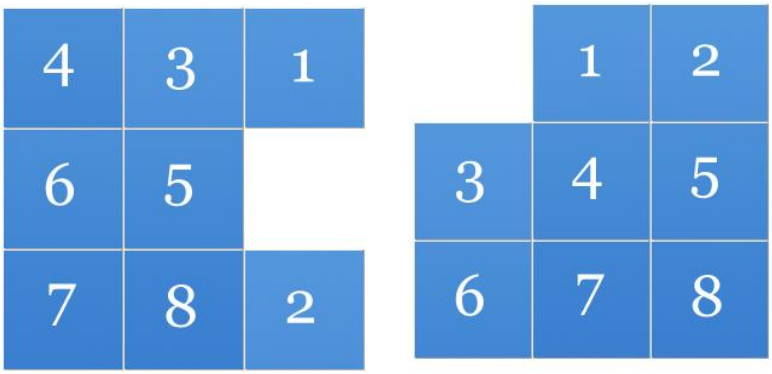
- a NetLogo command *current* for the observer that takes a parameter *tohead*. Moves all boats 1 unit in the heading given.
- A NetLogo reporter *at_edge* for an individual boat and returns true if it is at the boundary of the world

```
breed [boats boat]

to current [tohead]
  ask boats [
    set heading tohead
    forward 1
  ]
end

to-report at_edge
  report xcor = min-pxcor or xcor = max-pxcor or ycor = min-pycor or ycor =
max-pycor
end
```

2. (A*) From the following 8-puzzle position on the left, show the status of the A* algorithm after each of the first 3 nodes is chosen for expansion: include the search tree and the ordering of the candidate nodes to be expanded, and the candidates to expand after the first 3 nodes. Use the Manhattan distance heuristic function of total distance of tiles from their final position. The desired end position is on the right.




```
431   A
65
782
f(n) = h(n) = 11

43    B              431   C              431   D
651                  6 5                  652
782                  782                  78
f(n) = 1+h(n) = 13   f(n) = 1+h(n) = 11   f(n) = 1+h(n) = 11

Choosing D, (ok to choose to have shorter answer)
431   E
652
7 8
f(n) = 2 + h(n) = 11
(can continue with either C or E
```

For 6810 students, do all remaining questions. For 4810 students, you may pick 2 of the last 3 questions, or you can do all 3. If you only pick 2, each question is worth 25 points. If you do all 3, each question is worth 20 points.

3. (Agents) Describe how you might represent the states and possible actions for the following problem.

A news organization wants a program that will scan all public messages posted to a social media website (like Twitter) and will re-publish the messages in some way divided by keyword.

A state includes:
List of unprocessed messages – call this TODO
List of keywords
List of sources to scan for popular keywords
Actions: scan website and add messages to TODO
take next message off TODO and republish to one thread per keyword found in message
scan appropriate sources and update keywords
add, remove or edit sources

4. (Constraint Satisfaction)

Step through 2 iterations of min-conflicts towards a solution of the following system of equations where the variables must have integer values – you don't have to actually complete a solution.

Starting values: w = 0, x = 0, y = 0, z = 10

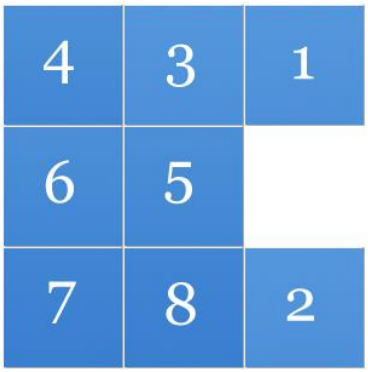
w + x + z = 10
x - y – z = 5
x + 2y + z = 12

Choosing randomly among x, y and z, let's pick y (we don't consider w because there are no violations associated with that variable)
Possible values:
y = -15 (satisfies 2nd equation, but not 3rd equation)
y = 1 (2nd equation still violated)

Choosing y = -15, let's pick x to explore
x = 32 (satisfies 3rd equation, but now 2 violations since both 1st and 2nd equations are wrong)

5. (Iterative deepening)

For the following 8-puzzle, show the order of nodes being explored to a depth of 2



Level 0: initial configuration is not a goal state

Level 1:
Initial config is not a goal state

43
651
782

431
6 5
782

431
652
78
Are not goal states

Level 2:

Consider all configs from levels 1 and 2, then: (assumes we store past states and don't duplicate states along any one path)
4 3
651
782

4 1 431 431
635 65 685
782 782 7 2

431
652
7 8