COMS 4701 - Homework 2 - Written

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Question 1:

Pros:

1. Since we are only caring about the current state instead of the path, the algorithm does not need to store the past states. This saves memory.
2. The algorithm does not need to have the knowledge of the whole state space and going only to the neighbors, so it is faster than search the whole space.
3. For genetic algorithm, it can be widely used to different problems without having deep understanding of them.

Cons:

1. Hill climbing algorithms can be trapped by local min/max. Since the algorithm does not have a knowledge about the global space.
2. Genetic algorithm is slow and take a lot of memory. This is because the algorithm need to store multiple genes for selection and crossover.
3. Parameter tuning is usually needed to get a better result. For example, one need to try different initializing strategy to reach the global min/max.

Question 2:

1. There are 6 queens and each has 6 possible states so it is 6^6 = 46656.

2. Successor can pick one queen among the 6 and each has a possibility of 5, which is 6*5 = 30

3. The pairs that not attacking each others are(counting from left to right, ie Q1 is the queen in first column):
   Q1&Q2, Q1&Q4, Q1&Q5
   Q2&Q3, Q2&Q5, Q2&Q6
   Q3&Q4, Q3&Q5, Q3&Q6
   Fitness function = 9

4. Since the only operation the successor can do is change the position for one queen, mutation should be used to implement this function. The selection does not change the state and cross-over change multiple queen positions.

Question 3:

1. C1 : 1(4/6),2(5/6),3(2/6),4(4/6),5(6/6)
   F1 : 1(4/6), 2(5/6), 4(4/6), 5(6/6)
   C2 : 12(4/6),14(3/6),15(4/6),24(3/6),25(5/6),45(4/6)
   F2 : 12(4/6),14(3/6),15(4/6),24(3/6),25(5/6),45(4/6)
   C3 : 124(3/6),125(4/6),245(3/6),145(3/6)
   F3 : 124(3/6),125(4/6),245(3/6),145(3/6)
   C4 : 1245(3/6)

2. C1 : 1(4/6),2(5/6),3(2/6),4(4/6),5(6/6)
   F1 : 2(5/6), 5(6/6)
   C2 : 25(5/6)
   F2 : 25(5/6)
   2 → 5(sup[5/6],conf[100%])
   2 → 5(sup[5/6],conf[83%])

Question 4:

1. There are total of 16 empty cells, with 4 possible choices so it is 4^16 = 4294967296

2. A, B, C, I, L, E, F, D, G, J $\neq 4$
   A, E, K, G, H, I, J $\neq 2$
   B, F, H, J, K, L, I $\neq 3$

3. Variables with MRV: I, J will be chosen because they can only be 1.

4. A{1,3} B{1,2} C{1,2,3} D{1,2,3}
   E{1,3} F{1,2} G{1,3} H{1,4}
   I{1} J{1} K{1,4} L{1,2}
   Apply arc consistency and binary constraints:
   A{1} B{2} C{3} D{2}
   E{3} F{1} G{3} H{4}
   I{1} J{1} K{4} L{2}