CS540 Midterm Exam
Spring, 2019

1. Consider the following SAT expression:
   (A v B v C) ^ (~A v ~B v ~C) ^(A v D) ^ (B v E) ^ (C v F) ^ (A v F)

   Assume you are using A* search to find a solution, and that your heuristic is the number of subexpressions that are satisfied.

   a) What is the first variable that will have a truth value assigned to it, what will that value be, and why? (If two or more options ae valid, list them all and explain why)

   b) What is the 2nd variable that will have a truth value assigned to it, what will it be, and why? (If two or more options ae valid, list them all and explain why)

2. Now consider using local search to solve the same SAT expression. Assume that the neighborhood function allows you to change the truth value of any one term, and the evaluation function is the number of satisfied subexpressions. Assume, too, that there is no termination predicate.

   a) If the initial state is that all variables are assigned to true, how many steps will it take to find a global solution? Give an example of an optimum solution path.

   b) If the initial state is that all variables are assigned to false, how many steps will it take to find a global solution? Give an example of an optimum solution path.

   c) Give an example of a state that is on a plateau, and explain why it is on a plateau. Would a random plateau walk help in this case?

3. We read a paper on using dynamic local search to solve the maximum clique problem. Answer the following problems about that paper:

   a) What was the search space?

   b) What was the solution set?

   c) What was the neighborhood relation?

   d) What were the memory states?

   e) What was the initialization function?

f) What was the evaluation function?

c) What was the termination predicate?

4. Encode the maximal clique problem as a genetic algorithm. In particular:

   a) How are elements of the population represented?

   b) what cross-over operator do you use? Justify your choice.

   c) what mutation operator do you use? Again, justify your choice.

   d) describe what a hyper-plane represents, given your answer to part 'a'.

5. Assume you want to implement a Kalman filter to track 2D points in an image that implements a constant acceleration model instead of a constant velocity model. (Assume that the observations are still *(x,y)* positions at time *t*.)

   a) How many terms are in the state vector, and what do they represent?

   b) What is the F matrix? (note: I am not asking for a definition. I am asking for a matrix with actual values in it.) Explain why.

   c) What is the H matrix? (note: same as above) Explain why.