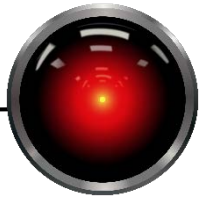


Assignment 4

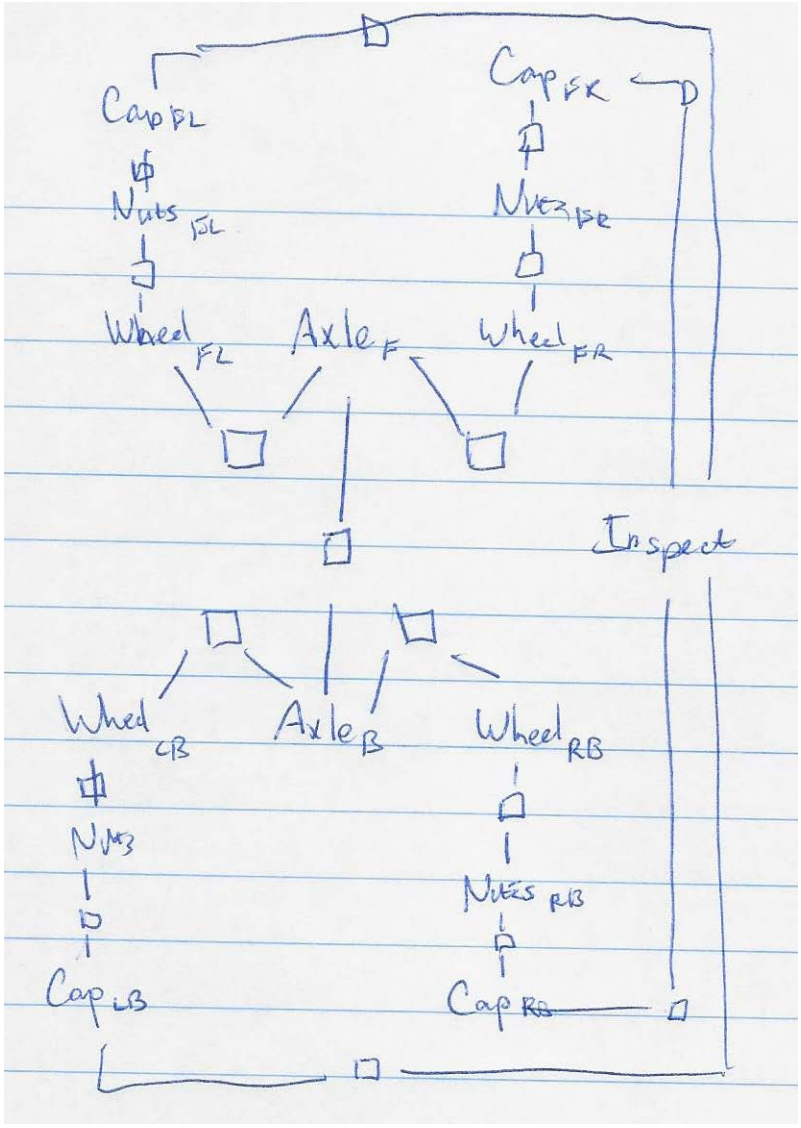
Part I: Questions (20 points each)

1. Write a constraint satisfaction problem specification for a 4 color map problem with colors: pink, green, blue, and red as per the following map:

Variables: CA, NV, UT, AZ, CO, NM, TX
Domains: All variables have domain {pink, green, blue, red}
Constraints:

CA≠NV, CA≠AZ,
NV≠AZ,NV≠UT,
UT≠CO,UT≠NM,UT≠AZ
AZ≠CO,AZ ≠NM,
CO≠NM
NM≠TX

2. Given the vehicle assembly example given in slides 7-9, draw the constraint graph.



Answers may vary slightly. Constraints are boxes between variables. Constraint values are not shown but follow from the problem specification, e.g. the constraint between the front axle and the right front wheel is $Axle_F + 10 \leq Wheel_{RF}$. Note that we have only placed constraints between Inspect and the hubcaps as they are constrained to be the last part of each assembly. We could also have placed constraints between Inspect and each of the other variables and that would have been correct as well.

3. Explain in your own words how conflict-directed backjumping works. As always, be very careful to avoid plagiarizing.

   Sample answer:
   A conflict set is a set of assignments that result in a variable becoming unassignable without violating constraints. When we infer using forward checking, we note the variable assignment that triggered the forward check. This variable and the associated value are assigned to a conflict set of each variable

whose domain is reduced in the forward check. So if variable X was assigned to 3 and this resulted in variable Y's domain being reduced, X=3 would be added to Y's conflict set. When a variable fails due to an empty domain, we examine its conflict set. The last variable in the set is the target of the backjump state.

Suppose Z fails and it has a conflict set {X,W,V}. V would be the backtrack target. We would union V's conflict set with {X,W}, Z's set without the backtrack target. When we continue from V, we know that a failure from V should send us back to the next problem in the conflict set: W.