CS 188 Spring 2019 — Final Review Logic

Q1. Propositional Logic

(Taken from Russell and Norvig 7.15) This question considers representing satisfiability (SAT) problems as CSPs.

(a) Draw the constraint graph corresponding to the SAT problem

$$(\neg X_1 \vee X_2) \wedge (\neg X_2 \vee X_3) \wedge \ldots \wedge (\neg X_{n-1} \vee X_n)$$

for the particular case $n = 5$.

(b) How many solutions are there for this general SAT problem as a function of n?

(c) Suppose we apply `Backtracking-Search` to find *all* solutions to a SAT CSP of the type given in (a). (To find *all* solutions to a CSP, we simply modify the basic algorithm so it continues searching after each solution si found.) Assume that variables are ordered $X_1, \ldots, X_n$ and *false* is ordered before *true*. How much time will the algorithm take to terminate? (Write an $O(\cot)$ expressino as a function of n.)

Q2. First Order Logic

(Taken from Russell and Norvig 8.10) Consider a vocabular with the following symbols:

- $Occuption(p, o)$: Predicate. Person p has occuption o.
- $Customer(p1, p2)$: Predicate. Person $p1$ is a customer of person $p2$.
- $Boss(p1, p2)$: Predicate. Person $P1$ is a boss of person $p2$.
- $Doctor, Surgeon, Lawyer, Actor$: Constants denoting occupations.
- $Emily, Joe$: Constants denoting people.

Use these symbols to write the following assertions in first-roder logic:

a Emily is either a surgeon or a lawyer.

b Joe is an actor, but he also holds another job.

c All surgeons are doctors.

d Joe does not have a lawyer (i.e., is not a customer of any lawyer).

e Emily has a boss who is a lawyer.

f There exists a lawyer all of whose customers are doctors.

g Every surgeon has a lawyer.