**, CSE 620A**

**Spring 2021**

**Homework #2**

**60 points**

*Submit to Canvas a single file with your solutions. For each exercise, you will see the points in parenthesis.*

1. **(20 p)** Consider the following signature:

O = {ann, beth, chris, drake}

F = {mother, father} *(functions w. arity 1)*

P = {friends} *(predicate w. arity 2)*

V = {X}

Specify which of the following are terms, atoms, literals, or none.

1. Beth – none (Beth is not in the signature)
2. mother(ann) – term
3. -father(drake) – none (terms cannot be negated)
4. mother(ann, beth) – none (functions in this signature have arity 1, this function has two arguments, defeating the definition)
5. friends(chris, father(drake)) – atom and literal
6. mother(X) != ann – Depending on implementation, literal or atom and literal. Largely depends on if negation is used under the hood. If negation is not required, literal and atom. If it is, just literal
7. mother(friends(X, chris)) – none (A predicate cannot occur within a function)
8. -mother(chris, beth) – none (terms cannot be negated, arity > 1)
9. -friends(father(chris), drake) – literal
10. -drake – none (Objects cannot be negated)
11. **(40 p)** Consider the set S = { a, d, e, -f, g }. For each of the rules below, state whether they are satisfied by S or not. Justify your answer (i.e., provide an explanation in terms of the definition of satisfiability).
12. a :- b, -c. Yes, satisfied. The rule is vacuously true because the body is not satisfied (b is not an element in S).
13. c :- not b, not -b. No, not satisfied. The body is satisfied, (not b is satisfied because b is not an element of S, therefore nothing can be determined with respect to its validity. The same with not -b), but the head is not satisfied (c is not an element of S)
14. d :- e. Yes, satisfied. The body is satisfied (e is an element of S), and the head is also satisfied (d is an element of S).
15. b | c | f :- a, -f, not h. No, not satisfied. The body is satisfied (a is an element of S, -f is an element of S, nothing is known about h, satisfying not h); however, b, c, and f are all not an element of S, making the head not satisfying.
16. e :- -f, g. Yes, satisfied. The body is satisfied (-f and g are both members of S), and the head is also satisfied (e is an element of S)
17. i :- not b, not c. No, not satisfied. The body is satisfied (neither b nor c are elements of S, so no information is known about them). However, the head is not satisfied (i is not an element of S)
18. a | b | c :- d. Yes, satisfied. The body is satisfied (d is an element of S), and the head is satisfied (a is an element of S, satisfying the entire head).
19. g :- not -g. Yes, satisfied. The body is satisfied (-g is not an element of S, so nothing is known about it), and the head is satisfied (g is an element of S)
20. -e :- d, a. No, not satisfied. The body is satisfied (d and a are both elements of S), but the head is not (-e is not an element of S).
21. h :- a, not g. Yes, satisfied. The body is not satisfied (a is an element of S, but g is element of S, so ‘not g’ is not true). So the rule is vacuously true.