Homework #4

Due: March 9, 2022 **Points:** 100

Questions

1. (*25 points*) Suppose the composite machine *catdog* (see Section 8.4.1) emits the same value from the left and the right. Show that it has received an even number of inputs from the left. (*text*, problem 8.7, modified)

2. (*25 points*) Revisit the example for x := y + z in Section 17.1.1. Assume that x does not exist in state s. Confirm that information flows from y and z to x by computing $H(y_s \mid |x_t)$, $H(y_s)$, $H(z_s \mid x_t)$, and $H(z_s)$ and showing that $H(y_s \mid x_t) < H(y_s)$ and $H(z_s \mid x_t) < H(z_s)$.

3. (*20 points*) Consider the rule of transitive confinement. Suppose a process needs to execute a subprocess in such a way that the child can access exactly two files, one only for reading and one only for writing.

   (a) Could capabilities be used to implement this? If so, how? If not, why not?

   (b) Could access control lists be used to implement this? If so, how? If not, why not?

4. (*30 points*) Section 18.3.2.3 derives a formula for $I(A;X)$. Prove that this formula is a maximum with respect to p when $p = \frac{M^{\frac{1}{m}}}{1+mM^{\frac{1}{m}}}$ (this is different than what is in the text).