Problem

1. Automated reasoning tools have found good use in the area of planning and scheduling, especially in support of mission-critical operations. For example, NASA uses automated planning and scheduling to operate spacecraft, manage robotic rovers, and run the Deep Space Network. The `2SAT` algorithm is an example of an automated-reasoning algorithm because it automates the basic logical inferences that humans sometimes make when making decisions. For example, six employees, Amy, Bao, Carlos, Daniel, Elias, and Francis are part of the workforce for a large-scale project. The project supervisor must know which of them will attend work on Saturday to help the project stay on schedule. The following are the constraints that she is faced with.

   - If Francis does not attend, then Carlos will also not attend since they both had planned to spend the day together.
   - Either Amy or Carlos will attend, but not both.
   - If Francis attends then Daniel will not attend because Daniel's job has only a small amount of work left, and Francis will be able to cover for him.
   - Elias and Francis will either both attend or both not attend because their project positions are highly dependent on each other.
   - If Daniel attends, then Bao will not attend because in that case she will look after their children.
   - Either Bao or Elias must attend but not both, because their skill sets are almost identical and there is only need for one of them.
   - Either Daniel or Carlos (or both) will attend.
   - If Bao attends then Amy will not attend.

   Directions. Write all answers on a collective sheet(s) of paper.

   a. Using the variables $A, B, \ldots, F$, take turns translating each of the above eight statements to a Boolean formula. For example, A stands for "Amy will attend work on Saturday". Next to each formula, write the implication formulas that are implied by the formula, and initialize your contribution. Hint 1: use $\leftrightarrow$ and $\oplus$ for equivalence and exclusive-or. Hint 2: the above statements imply 22 different implication formulas. (10 pts)

   b. Use the implications from the previous part to construct the implication graph associated with the logic problem. The student who provided the implications from Problem 1 should be the one who draws the edges for those implications. (5 pts)

   c. Perform the `Improved 2SAT` algorithm by computing the necessary reachability sets. Use alphabetical order and positive literal before negative literal when choosing the reachability set to compute next. (15 pts)