You are given seven different programs with names T, U, V, W, X, Y, Z. Each program attempts to solve the same task. Programs T, V, X are written in Java, while programs U, W, Y, Z are written in Python (not Java). Let P represent the set of all programs for solving the task (our "universe" or "domain"), J represent the set of all *Java* programs, and C represent the set of all *correct* programs. (Assume that these are the only seven programs that exist for solving the task.)

1. Suppose that programs T, U, V, X, Z are correct and programs W, Y are incorrect (not correct). For each statement below: (i) say whether the statement is true or false, and list the programs that you considered to justify your answer, and (ii) express the statement using the logical notation presented in class (use sets, predicates, $\forall$ and/or $\exists$).

    (a) All Python programs are correct.

        i.

            False: test program W (or Y) to show that the statement is false. They are counter-examples to the statement's claim. They disprove the claim.

        ii.

            $\forall\, x \in \overline{J}, C(x).$

    (b) Some correct program is written in Java.

        i.

            True: test program T (or V, or X) to show that the statement is true. They provide an example that proves the claim.

        ii.

            $\exists\, x \in C, J(x).$

    (c) Every Java program is correct.

        i.

            True: test programs T, V, and X to verify.

        ii.

            $\forall\, x \in J, C(x).$

    (d) Only programs written in Python are incorrect.

        i.

            True: test programs T, V, and X to verify.

        ii.

            $\forall\, x \in \overline{C}, x \in \overline{J}$
            or $\forall\, x \in P, \neg C(x) \Rightarrow \neg J(x).$
            (or realize the connection to (c) and reuse that statement)

2. As before, let P represent the set of all programs (our "universe" or "domain"), J represent the set of all *Java* programs, and C represent the set of all *correct* programs.

For each statement in the previous question, draw one Venn diagram representing a situation when the statement is true, and another Venn diagram representing a situation when the statement is false.

You should re-use the facts that programs T, V, X are written in Java and programs U, W, Y, Z are written in Python (not Java). But in order to be able to draw Venn diagrams for both situations, you will need to modify the facts about the correctness of the programs.

For each statement, we draw one diagram illustrating a situation where the statement is true (on the left), followed by a second diagram illustrating a situation where the statement is false (on the right). Note that in each diagram, regions that do not explicitly contain an element are empty. Also note that there are many possible solutions!

(a)

(b)

(c)

(d)