

Worth: 2%

Due: By 6pm on Wednesday 21 January

As in Exercise 1, suppose that you are given seven different programs A, C, E, G, I, K, M , each meant to carry out the same task, where programs C, G, K, M are written in Python and programs A, E, I are written in Java, and let P represent the set of all programs (our “universe”), J represent the set of all Java programs, and T represent the set of all correct programs.

Recall that in class, we saw how set notation like “ $x \in T$ ” could be expressed in predicate notation as “ $T(x)$ ”, and how this could be used to write different sentences symbolically. Make sure that you understand this correspondence well before answering the following questions.

1. For each English sentence below, give the “standard” symbolic representation of that sentence, as discussed in class (where all quantifiers are over objects in the universe P), then give a second, *different* symbolic representation of the same sentence (where you are allowed to quantify over different domains or to change the order of predicates, when appropriate, but **without** introducing any new predicate or set).
 - (a) Some incorrect program is written in Java.
 - (b) No Java program is correct.
 - (c) Only programs written in Python produce incorrect output.
 - (d) The program is correct and is written in Python.
 - (e) If some Java program is correct, then all Java programs are correct.
2. Give a *natural* English sentence that captures the meaning of each symbolic sentence below.
 - (a) $\exists x \in P, \neg J(x) \wedge T(x)$
 - (b) $\forall x \in P, \neg J(x) \wedge T(x)$
 - (c) $\neg \forall x \in P, T(x) \Rightarrow J(x)$
 - (d) $\forall x \in P, \neg J(x) \Leftrightarrow T(x)$
 - (e) $(\forall x \in P, J(x) \Rightarrow T(x)) \vee (\forall x \in P, J(x) \Rightarrow \neg T(x))$