Recall the “restaurant menu” example from Exercise 1, and let \( M \) represent the set of all menu items, \( V \) represent the subset of all vegetarian items, \( P \) represent the subset of all popular items, and \( L \) represent the subset of all items that cost less than $10.

Recall that in class, we saw how set notation like “\( x \in V \)” can be expressed in predicate notation as “\( V(x) \)”, and how this can be used to write different sentences symbolically. Make sure that you understand this correspondence 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 the universe \( M \) and predicate notation is used everywhere else), 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 and the connectives, when appropriate, but without introducing any new predicate or set).

   (a) Some popular items are not vegetarian.
   (b) Popular items cost less than $10.
   (c) No item that costs less than $10 is popular.
   (d) Some item that costs less than $10 is neither vegetarian nor popular.
   (e) If some popular item costs less than $10, then every popular item costs less than $10.

2. Give a natural English sentence that expresses the meaning of each symbolic sentence below.

   (a) \( \neg \exists x \in M, V(x) \land P(x) \)
   (b) \( \exists x \in M, P(x) \Rightarrow V(x) \)
   (c) \( \neg \forall x \in M, V(x) \Rightarrow L(x) \)
   (d) \( \forall x \in M, \neg P(x) \Rightarrow \neg L(x) \)
   (e) \( (\forall x \in M, L(x) \Rightarrow P(x)) \land (\forall x \in M, \neg V(x) \Rightarrow P(x)) \)