

In the diagram below each shape has three attributes:

- Color: Red, Gray, or Black
- Shape: Diamond, Circle, or Square
- Fill: Empty, Cross Hatched, or Solid

Additionally you can describe shapes in relation to each other using terms like *above*, *below*, *to the right of*, *to the left of*, *in the same column*, or *in the same row*, or by a property it does not have. Let

- R be the set of all the red shapes,
- B be the set of all the black shapes,
- G be the set of all the gray shapes,
- C be the set of all the circles,
- S be the set of all the squares,
- D be the set of all the diamonds,
- E be the set of all the empty shapes,
- F be the set of all the filled shapes, and
- H be the set of all the cross hatched shapes.

Finally, we read the symbol \forall as “for all,” \exists as “there exists,” and \in as “in,” so that

$$\forall d \in D : d \in R$$

would be read “for d in Diamonds, d is in Red” or in better English

“All the diamonds are red.”

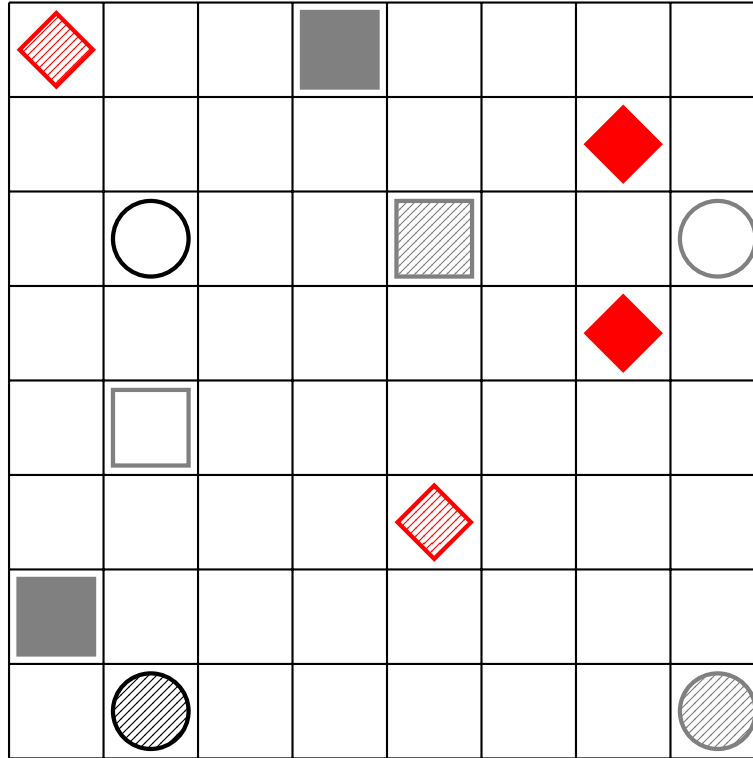
And,

$$\exists s \in S : s \in E$$

would be read “there exists s in Squares such that s is in Empty,” or

“At least one of the squares is empty.”

Now try and make statements that fit each category described below the diagram. First make your statements in English, then try to translate them into symbolic language.



- There exists a circle such that $(\exists c \in C)$:
- For all the red shapes $(\forall r \in R)$:
- For all filled shapes $(\forall f \in F)$:
- There exists a square such that for all circles $(\exists s \in S, \forall c \in C)$:
- For all solid figures there exists a cross hatched figure: $(\forall f \in F, \exists h \in H)$: