# Homework 1

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### 1.1.1

(a) $\emptyset \subseteq \emptyset$ is true because both objects are sets (so the comparator makes sense) and these sets are in fact equal.

(c) $\emptyset \in \{\emptyset\}$ is true because the empty set is an element in the set containing only the empty set.

(e) True, $\{a, b\}$ is an element in the set.

(g) True, because both a and b themselves are in the power set on the right hand side.

### 1.1.2

(a) $\{3\}$.

(c) $(\{1, 2\}) \cup (\{7, 9\}) = \{1, 2, 7, 9\}$.

(e) $\{\emptyset\}$

### 1.2.2

$R \circ R = \{(a, a|b|c|d), (b, a|b|c)\}$ where '|' denotes 'or'. $R^{-1} = \{(b, a), (c, a), (d, c), (a, a), (a, b)\} = \{(b, a), (c, a), (d, c), (a, a|b)\}$ None of $R, R \circ R, R^{-1}$ are functions because they all map at least one input to different outputs.

### 1.3.2

(i) R is not symmetric, S is symmetric.

(ii) Neither R nor S is reflexive.

(iii) Neither R nor S are transitive.