# Assignment 1: Sets

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**1** **Let A be the set $\{\alpha, \{1, \alpha\}, \{3\}, \{\{1, 3\}\}, 3\}$. Which of the following statements are true and which are false?**

**1.a** $\alpha \in A$.

true

**1.b** $\{\alpha\} \notin A$.

true

**1.c** $\{1, \alpha\} \subseteq A$.

false

**1.d** $\{3, \{3\}\} \subseteq A$.

true

**1.e** $\{1, 3\} \in A$.

false

**1.f** $\{\{1, 3\}\} \subseteq A$.

false

**1.g** $\{\{1, \alpha\}\} \subseteq A$.

true

**1.h** $\{1, \alpha\} \notin A$.

false

**1.i** $\emptyset \subseteq A$.

true

**2 Let B,C,D,E be the following sets:**

$$B = \{x | x \text{ a real number}, x^2 < 4\},$$
$$C = \{x | x \text{ a real number}, 0 <= x < 2\},$$
$$D = \{x | x \in \mathbb{Z}, x^2 < 1\},$$
$$E = \{1\}.$$

**2.a Which pair of these sets has the property that neither is contained in the other?**

Sets D and E

**2.b You are given that X is one of the sets B,C,D,E, but you do not know which one. You are also given that $E \subseteq X$ and $X \subseteq B$. What can you deduce about X?**

X is either B or E

**3 Which of the following arguments are valid? For the valid ones, write down the argument symbolically.**

**3.a I eat chocolate if I am depressed. I am not depressed. Therefore I am not eating chocolate.**

Not valid

**3.b I eat chocolate only if I am depressed. I am not depressed. Therefore I am not eating chocolate.**

Valid. If C is eating chocolate and D is being depressed, then $P \Leftrightarrow D$, so $\bar{P} \Leftrightarrow \bar{D}$.

**3.c If a movie is not worth seeing, then it was not made in England. A movie is worth seeing only if critic Ivor Smallbrain reviews it. The movie *Cat on a Hot Tin Proof* was not reviewed by Ivor Smallbrain. Therefore *Cat on a Hot Tin Proof* was not made in England.**

Valid. If W is worth seeing, E is made in England, and I is reviewed by Ivor Smallbrain, then $\bar{W} \Rightarrow \bar{E}$ and $W \Leftrightarrow I$. Therefore $\bar{I} \Leftrightarrow \bar{W}$ and then $\bar{I} \Rightarrow \bar{E}$.