CS1860

Additional exercises on Sets (voluntary, non-assessed)

Please attempt to solve these exercises. Feel free to come and see me if you have doubts on your solutions or cannot solve any particular exercise. You can also submit to me written solutions that I will comment on.

1 – Suppose that $A = \{2, 4, 6\}$, $B = \{2, 6\}$, $C = \{4, 6\}$, and $D = \{4, 6, 8\}$. Determine which of these sets are subsets of which other of these sets.

2 – For each of the following sets, determine whether 2 is an element of that set.

a) $\{x \in \mathbf{R} \mid x \text{ is an integer greater than } 1\}$
b) $\{x \in \mathbf{R} \mid x \text{ is the square of an integer}\}$
c) $\{2,\{2\}\}$
d) $\{\{2\},\{\{2\}\}\}$
e) $\{\{2\},\{2,\{2\}\}\}$
f) $\{\{\{2\}\}\}$

3 – For each of the sets in Exercise 2, determine whether $\{2\}$ is an element of that set.

4 – Determine whether these statements are true or false.

a) $\varnothing \in \{\varnothing\}$
b) $\varnothing \in \{\varnothing, \{\varnothing\}\}$
c) $\{\varnothing\} \in \{\varnothing\}$
d) $\{\varnothing\} \in \{\{\varnothing\}\}$
e) $\{\varnothing\} \subseteq \{\varnothing, \{\varnothing\}\}$
f) $\{\{\varnothing\}\} \subseteq \{\varnothing, \{\varnothing\}\}$
g) $\{\{\varnothing\}\} \subseteq \{\{\varnothing\}, \{\varnothing\}\}$

5 – Determine whether each of these statements is true or false.

a) $x \in \{x\}$
b) $\{x\} \subseteq \{x\}$
c) $\{x\} \in \{x\}$
d) $\{x\} \in \{\{x\}\}$
e) $\varnothing \subseteq \{x\}$
f) $\varnothing \in \{x\}$

6 – What is the cardinality of each of these sets?

a) $\{a\}$
b) $\{\{a\}\}$
c) $\{a, \{a\}\}$
d) $\{a, \{a\}, \{a, \{a\}\}\}$

7 – What is the cardinality of each of these sets?

a) $\varnothing$

b) $\{\varnothing\}$

c) $\{\varnothing, \{\varnothing\}\}$

d) $\{\varnothing, \{\varnothing\}, \{\varnothing, \{\varnothing\}\}\}$

8 – Let $A = \{1, 2, 3, 4, 5\}$ and $B = \{0, 3, 6\}$. Find

a) $A \cup B$

b) $A \cap B$

c) $A \setminus B$

d) $B \setminus A$

9 – Let $A = \{a, b, c, d, e\}$ and $B = \{a, b, c, d, e, f, g, h\}$. Find

a) $A \cup B$

b) $A \cap B$

c) $A \setminus B$

d) $B \setminus A$

10 – Consider the set $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$. Express each of following subsets of U as a bit string:

a) $\{3, 4, 5\}$

b) $\{1, 3, 6, 10\}$

c) $\{2, 3, 4, 7, 8, 9\}$

11 – Using the set U as above, find the subset specified by each of the following bit strings:

a) 1111001111

b) 0101111000

c) 1000000001