CSE 355: Intro to Theoretical Computer Science
Recitation #1 Solution

1. [5 pts] Write a short informal English description of the following sets.

Example: $S = \{1, 3, 5, 7, \ldots\}$
Description: Set of all positive odd integers.

a) $A = \{\ldots, -4, -2, 0, 2, 4, \ldots\}$

Set of all even integers (or numbers).

b) $A = \{n \mid n = 2m \text{ for some } m \text{ in } N\}$

Set of all positive even integers.

c) $A = \{n \mid n = 2m \text{ for some } m \text{ in } N \text{ and } n = 3k \text{ for some } k \text{ in } N\}$

Set of all positive even integers that are multiples of 6.

d) $A = \{w \mid w \text{ is a string of 0s and 1s and } w \text{ equals the reverse of } w \text{ itself}\}$

Set of all strings defined on {0, 1} that are palindromes.

e) $A = \{n \mid n \text{ is an integer and } n = n + 1\}$

The empty set.

2. [5 pts] Write formal description of the following sets.

Example: The set containing the numbers 1, 10 and 100
Formal description: {1, 10, 100}

a) The set containing all integers that are greater than 5.

$S = \{n \mid n > 5 \text{ for some } n \in \mathbb{Z}\}$ or $S = \{n \in \mathbb{Z} \mid n > 5\}$

b) The set containing all-natural numbers that are less than 5.

$S = \{n \mid n < 5 \text{ for some } n \in \mathbb{N}\}$ or $S = \{n \in \mathbb{N} \mid n < 5\}$

c) The set containing the string *aba*

$S = \{aba\}$

d) The set containing the empty string

$S = \{\varepsilon\}$

e) The set containing nothing at all

$\emptyset$

3. [5 pts] Let A be the set $\{x, y, z\}$ and B be the set $\{x, y\}$, answer the following question:

a) Is A a subset of B?

No. Since for A to be a subset of B, every member of A must also be a member of B, z is not.

b) What is $A \cup B$?

$\{x, y, z\}$

c) What is $A \cap B$?

$\{x, y\}$

d) What is $A \times B$?

$\{ (x,x), (x,y), (y,x), (y,y), (z,x), (z,y) \}$

e) What is the power set of B?

$\{\emptyset , \{x\}, \{y\}, \{x, y\} \}$

4. [5 pts] Let X be the set $\{1, 2, 3, 4, 5\}$ and Y be the set $\{6, 7, 8, 9, 10\}$. The unary function $\boldsymbol{f}: X \rightarrow Y$ and the binary function $\boldsymbol{g}: X \times Y \rightarrow Y$ are described below:

n	***f(n)***
1	6
2	7
3	6
4	7
5	6

g	6	7	8	9	10
1	10	10	10	10	10
2	7	8	9	10	6
3	7	7	8	8	9
4	9	8	7	6	10
5	6	6	6	6	6

a) What is the value of f (2)?

f (2) = 7

b) What is the range and domain of $\boldsymbol{f}$?

domain of f is X, range is set {6, 7}. (if student answered domain is X and range if Y, also treated it as correct)

c) What is the value of $\boldsymbol{g}(2, 10)$?

$g(2, 10) = 6$

d) What are the range and domain of $\boldsymbol{g}$?

domain of g is $X \times Y$, range is Y

e) What is the value of $\boldsymbol{g}(4, \boldsymbol{f}(4))$?

$g(4, f(4)) = 8$