Language Exercises

Exercise 1. You are given x, y, and S such that $2 \leq x, y, \leq 36$ and $S \in$ `[0-9A-Z]+` is a valid positive 32-bit integer written in base x. Output the value of S in base y using as few lines of code as possible.

Sample input	Sample output
`10 16 255`	`ff`
`2 8 1101111101`	`1575`
`16 36 c0dface`	`3cerim`

Exercise 2. You are given an integer x such that $0 \leq x < 10^9$. Print the same integer such that the number is left-padded with zeros to make a 9 digit number. Write the fewest lines of code to accomplish this.

Sample input	Sample output
`417370`	`000417370`

Exercise 3. You are given a decimal number x such that $0 \leq x < 10^9$. Print the same decimal number to exactly three decimal points, rounding if necessary. Write the fewest lines of code to accomplish this.

Sample input	Sample output
`4086.910607`	`4086.911`

Runtime Exercises

Question: For the following problems, how many operations will your program run in the worst case scenario? About how long will the program run? (Do not write the program.)

Exercise 4. Given two sets of integers A and B such that $1 \leq |A|, |B| \leq 10^6$, find the size of $A \cap B$.

Exercise 5. Given a set S of n *randomly scattered* points (x, y) such that $n \leq \mathbf{10^3}$ and $-100 \leq x, y \leq 100$, find the greatest Euclidean distance between any two points in S.

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Data Structure Exercises

Question: What data structures will help you solve the following problems? (Do not write the program.)

Exercise 7. You are given a string of parenthesis made from the characters `{}()[]`. Write a program that outputs *balanced* when the parenthesis are balanced and *unbalanced* when they are not.

Sample input	Sample output
`()`	`balanced`
`(([[([{(()}])]]))`	`unbalanced`
`((((()))(()))(()((()))))`	`balanced`

Exercise 8. Given an integer v and a list of integers S such that $1 \leq |S| \leq 10^6$, find two integers $a, b \in S$ such that $v = a + b$.

Exercise 9. Given an *unsorted* list of integers S such that $1 \leq |S| \leq 10^6$, find the length of the longest increasing contiguous sub-array in S.