

Computer Science and Programming Lab Class 4

Task 1. *Loop – Basic (5 minutes)*

Please write a Python program which adds up all integers in the following list [29,1,50,67,92,30,4,5,93,24] and print the sum of all numbers.

Task 2. *Loop – Basic (10 minutes)*

Read a positive integer from the console. Please add up all its single digits and print the sum. For instance, the result of 28573 is $2 + 8 + 5 + 7 + 3 = 25$.

Hint: To achieve that, please convert the integer to a string first, using the *str* function. Afterwards, iterate all characters in the string, and sum up the value of the character. Each character can be converted to an integer using the *int* function.

Task 3. *Loop – Goldbach conjecture (15 minutes)*

Goldbach's conjecture is one of the oldest and best-known unsolved problems in number theory and all of mathematics. It states: **Every even integer greater than 2 can be expressed as the sum of two primes.**

Please verify Goldbach conjecture for integers smaller than 1000. For any even number n in that interval which obeys the conjecture, please print the two prime numbers summing up to n .

Hint: Find all prime numbers under 1000 at first and store them in a list. Afterwards, iterate all numbers from 1 to 999, and try to express them as a sum of any two elements of the prime number list. You can generate all pairs of prime numbers by using a nested loop. However, note that a function without nested loops would be more efficient.

Task 4. Function – Basic (10 minutes)

Please implement the function `max_of_3()` which reads three integers and returns the max value of the three integers. And then call the function to find the maximum of the three integers 3,5, and 10.

Task 5. Dictionary – Basic (5 minutes)

Build a dictionary in Python to store basic information of Alice. Alice's **name** is **Alice**. Alice has an **age** of **16**. Alice's **hobby** is **reading**. The **books** she likes to read are '**Alice's Adventures in Wonderland**', '**The Little Prince**' and '**Harry Potter**'. Name the dictionary with '**Alice**', and find the second book she likes to read.

Task 6. Dictionary – Basic (10 minutes)

Build a dictionary in Python which stores for each number in the interval [1,1000], whether it is a prime number. If the number (=key) is a prime number, then the value of the dictionary element should be 'yes'. Otherwise, the value should be 'no'

Task 7. Set – Basic (10 minutes)

There are many sport clubs at Beihang university, for instance, soccer club, climbing club and tennis club. Students participating these clubs are listed below.

Club name	Student list
Soccer club	['Henry','Mike','Jerry','Hans','John']
Climbing club	['Henry','George','Hans','John']
Tennis club	['Mike','Jerry','Hans','Peter','Tiger']

Table 1: Student list

Use the **set** data structure in Python to represent the student list of each club (so you have three variables, each of them being a set), and find all the students who attend soccer club and climbing club but not in the tennis club, by using set operations union, intersection, and difference.

Task 8. *Function – Recursion* (15 minutes)

Please implement a function called `fibonacci()` which reads in an integer **n** and returns the **nth** number in Fibonacci sequence.

Hint: The Fibonacci sequence is characterized by the fact that every number after the first two is the sum of the two preceding ones. That is $F_n = F_{n-1} + F_{n-2}$. We define that $F(0) = 0$ and $F(1) = 1$. Please solve this problem using recursion, by breaking down a larger problem into smaller subproblems.

Task 9. *Function – Recursion* (10 minutes)

Please implement a the recursive solution for the Tower of Hanoi. Just try to reconstruct your solution by thinking about the algorithmic process: You break down the problem of moving N disks into two smaller problems of moving N-1 disks. The base case is moving one disk only.