

Programming and Data Structures with Python: Problem Set 1

1. The *hexadecimal* system represents numbers in the base 16. The fifteen digits in this system are '0', '1', ..., '9', 'A', 'B', ..., 'F', where 'A' stands for the value 10, 'B' for 11, ..., 'F' stands for the value 15. Write a Python function `hexa` which computes the number whose hexadecimal representation is the given string (the letters in the given string are guaranteed to be one of '0', ..., '9', 'A', ..., 'F').

```
hexa "9" = 9
hexa "11" = 17
hexa "1A" = 26
hexa "90" = 144
hexa "111" = 273
```

2. By adapting the binary search function described in class, write a function `bleft` which takes a value v and a sorted list l and returns the largest i such that $l[i] < v$. If there is no such i the function returns -1 . Your function should only make logarithmic number of comparisons (like the binary search function).

```
bleft(3, [1, 3, 3, 3, 3, 4, 4, 8]) = 0
bleft(3, [4, 5, 5, 8]) = -1
bleft(3, [3, 5, 5, 8]) = -1
```

3. Write a function `quickCount` which takes a value v and a sorted list l and returns the number of occurrences of v in l . [Hint: How do you use the previous problem to propose a fast solution to this problem?]

```
quickCount(3, [1, 3, 3, 3, 3, 4, 4, 8]) = 4
quickCount(2, [1, 3, 3, 3, 3, 4, 4, 8]) = 0
```

4. In this problem the aim is to check if a given list of list of integers represents a possible solution to a sudoku puzzle.

- (a) Write a python function `validrow` that takes as input a list of integers and verifies that it is some permutation of $\{1, 2, \dots, 9\}$.
- (b) Write a python function `transpose` that takes as input a matrix given as a list of list of integers computes the transpose of the matrix.
- (c) Write a python function `blocksTorows` that takes a list with 3 elements each of which is a list with 9 elements and does the following: Let the elements of the first list be $a_1 \dots a_9$, that of the second list $b_1 \dots b_9$ and the third list be $c_1 \dots c_9$. It returns a list with 3 elements. The first element is $[a_1, a_2, a_3, b_1, b_2, b_3, c_1, c_2, c_3]$, the second is $[a_4, a_5, a_6, b_4, b_5, b_6, c_4, c_5, c_6]$ and the last element consists of the remaining elements.
- (d) Write a function `validsolution` which takes a matrix of integers with 9 elements each of which is a list of 9 integers and verifies that it satisfies the requirements of the solution to a Sudoku puzzle.