

ES112 Lab and Practice Problems

September 15, 2015

1. Write down a program that takes as input a number and prints one the following:
 - If the number is divisible by 3 it should print “Divisible by 3”.
 - If divisible by 5 it should print “Divisible by 5”.
 - If divisible by both 3 and 5, it should print “Divisible by both 3 and 5” (not any of the above messages).
2. Write down a program that reads three numbers a , b and c and outputs the two roots of the equation $ax^2 + bx + c = 0$. Recall that in order to raise a^b in python you have to do `a**b`. Check first whether `(-1)**(0.5)` works. If not, then you have to think of another way to handle the complex roots case.
3. Write a program that takes n as input from user and prints the result of sum of all numbers that are less than equal to n and are not divisible by 5.
4. Write down a program that takes as input a string s and prints it out again, with every alternate letter starting from index value 1 being converted to upper case (remember that python indices start from 0, not 1). For instance, if the input string is “This is a string”, the output should be “THiS Is a sTrInG”. Note that the whitespace does not change. Also, any existing upper case characters remain upper case.
5. Write down a program called `issorted.py` that takes a list as an input and returns `True` if the list is sorted in ascending order and `False` otherwise. For instance `[1,2,2]` should return `True` whereas `['b', 'a']` should return `False`.
6. Write down a program that first read n . It then reads n numbers x_1, x_2, \dots, x_n , and then calculates both the mean $\bar{x} = \frac{\sum_i x_i}{n}$ and the standard deviation $\left(\frac{\sum_i (x_i - \bar{x})^2}{n} \right)^{1/2}$.
7. Write down a program that given a number n , returns the value of $n! = 1 \cdot 2 \cdot 3 \dots (n-1) \cdot n$.

8. “abecedarian” means that the letters in the string appear alphabetically. Write a program called `is_abecedarian.py` that returns `True` if the letters in a string appear in alphabetical order (repeated letters are ok) and `False` otherwise. You should check that the input string only contain letters a-z or A-Z. Capital and small letters should be considered same.
9. Write down a program that helps a user verify the following theorem : $11^n - 4^n$ is divisible by 7 for every n . The program should take a number n as input from the user, and then either say yes or no depending on whether the value $11^n - 4^n$ is divisible by 7. For bonus, convince the user by showing the remainder and the quotient when divided by 7.
10. Write down a program that takes as input two strings x and y and then finds out when x and y are anagrams of each other. I.e. the set of letters in each should be the same. For instance, $x = \text{“Tom Cruise”}$ and $y = \text{“So Im cuter”}$ or $\text{“Tom Marvolo Riddle”}$ and $\text{“I am Lord Voldemort”}$.
11. Write down a program that does the following: it takes as input an integer d as the degree of a polynomial, and then takes $d+1$ inputs a_0, a_1, \dots, a_d as the coefficients of the polynomial $a_0 + a_1x + \dots + a_dx^d$. The program should then return the derivative of this polynomial in the form $b_0 + b_1x + \dots$ for the computed values of the coefficients b_i .
12. Modify the above problem where the polynomial in addition to all the coefficients being supplied, the user can also supply a value for x and the program returns the evaluation of the polynomial at the supplied value.
13. Write a program that takes an input two strings a and b and returns yes or no depending on whether a is a substring of b . For example, “this is” is a substring of the string “this is a substring”. Do not use the “ in” keyword to compare strings.
14. Write a program that inputs a number n and prints whether it is prime or not.
15. Write down a function `mylog(x)` to find out the value of $\ln(1+x)$. Use the series

$$\ln(1+x) = x - \frac{x^2}{2} + \frac{x^3}{4} - \dots + (-1)^{n+1} \frac{x^n}{n!} + \dots$$
 The function should take as parameter x and a number n , and compute the series for n terms.
16. The function should take as parameter x and an accuracy δ , and compute the series to the accuracy δ .