

Midterm Preparation

Loops

1. Two functions that prints out the best approximation of π and e as a fraction of integers of at most 2 digits. (Hint: You need to loop over all integers between 1 (included) and 100 (excluded) twice. For each pair of integers a and b , compare the absolute value of $|\frac{a}{b} - \pi|$ with the previously seen best absolute difference. If this absolute difference is better than the previously seen best value, then update the best-a-seen-so-far, the best-b-seen-so-far, and the best seen absolute difference. Then print out the best-a-seen-so-far, the best-b-seen-so-far, and the best seen absolute difference when you have finished the loops.

2. A function of n that calculates $\sqrt{12} \sum_{k=0}^n \frac{(-\frac{1}{3})^k}{2k+1}$. Compare this value with π for $n \in \{5, 10, 20, 30\}$.

3. A function of k that calculates the product of the first k odd numbers, i.e. $1, 3, 5, \dots, 2k - 1$. In Mathematics, this is known as $(2k - 1)!!$

Lists

4. A function of a single argument, a list, that returns True or False, depending on whether there are more odd than even numbers in the list.
5. A function that takes as sole argument a list of numbers and returns the variance, namely the sum of squared differences of the list elements from their mean.
6. A function that implements the same functionality as the Python function max, namely to return the maximum element among the elements in a list. (Hint: you need to walk through the list, remembering and potentially updating the maximum element seen so far.)
7. A function of a list of numbers that returns the difference between the maximum and the minimum of the elements in the list. Can you do this without using either max or min?

Strings

8. A function of a string that returns the ratio of vowels over consonants in the string. Punctuation marks etc. are ignored.
9. A function of a string that replaces all letters 's' with 'z' and all letters 'z' with 's'.
10. A function of a string that returns the vowel that is most frequent in the string. Ties are resolved by alphabetic precedence.