Problem 1. *(Sine Function)* Implement the function \( \sin() \) in \( \text{sin.py} \) that calculates the sine of the argument \( x \) in radians, using the formula:

\[
\sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \cdots.
\]

Hint: In order to avoid the inaccuracies caused by computing with huge numbers, follow the approach described on page 97 of the IPP text for computing the function \( e^x \).

\$ python3 sin.py 60
0.8660254037844385
0.8660254037844386

Problem 2. *(Euclidean Distance)* Implement the function \( \text{distance()} \) in \( \text{distance.py} \) that returns the Euclidean distance between the vectors \( x \) and \( y \) represented as one-dimensional lists of floats. The Euclidean distance is calculated as the square root of the sums of the squares of the differences between the corresponding entries. You may assume that \( x \) and \( y \) have the same length.

\$ python3 distance.py 5
-9 1 10 -1 1
-5 9 6 7 4
13.0

Problem 3. *(Palindrome)* Implement the function \( \text{is_palindrome()} \) in \( \text{palindrome.py} \) that returns \( \text{True} \) if the argument \( s \) is a palindrome (ie, reads the same forwards and backwards), and \( \text{False} \) otherwise. You may assume that \( s \) is all lower case and that it doesn’t have any whitespace characters.

\$ python3 palindrome.py bolton
False
\$ python3 palindrome.py amanaplanacanalpanama
True

Problem 4. *(Reverse)* Implement the function \( \text{reverse()} \) in \( \text{reverse.py} \) that reverses the one-dimensional list \( a \) in place, ie, without creating a new list.

\$ python3 reverse.py
to be or not to be that is the question
<ctrl-d>
question the is that be to not or be to

Problem 5. *(Transpose)* Implement the function \( \text{transpose()} \) in \( \text{transpose.py} \) that creates and returns a new matrix that is the transpose of the matrix represented by the argument \( a \). Note that \( a \) need not have the same number rows and columns. Recall that the transpose of an \( m \)-by-\( n \) matrix \( A \) is an \( n \)-by-\( m \) matrix \( B \) such that \( B_{ij} = A_{ji} \), where \( 1 \leq i \leq n \) and \( 1 \leq j \leq m \).

\$ python3 transpose.py
2 3
1 2 3
4 5 6
1.0 4.0
2.0 5.0
3.0 6.0

Files to Submit

1. \( \text{sin.py} \)
2. \( \text{distance.py} \)
3. \( \text{palindrome.py} \)
Before you submit:

- Make sure your programs meet the input and output specifications by running the following command on the terminal:

```bash
$ python3 run_tests.py -v [<problems>]
```

where the optional argument `<problems>` lists the problems (Problem1, Problem2, etc.) you want to test, separated by spaces; all the problems are tested if no argument is given.

- Make sure your programs meet the style requirements by running the following command on the terminal:

```bash
$ pycodestyle <program>
```

where `<program>` is the .py file whose style you want to check.