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In [2]: #question 5b

import math as mt
#import the library used to construct table
from prettytable import PrettyTable

#the same code from question 3 equation 1
def e_exp_x(order,x):
    sum = 0
    for n in range (order+1):
        #  $((-1)**n)*(x**n)/mt.factorial(n)$  is the general formula for  $n_{th}$  term
        sum +=  $((-1)**n)*(x**n)/mt.factorial(n)$ 
    return sum

myTable = PrettyTable(['order','result','error'])

#set the value of x and get the true value of the expression
x = 0.1
true_val = mt.e**(-x)

#try and tabulate result with increment value of order starting from zero order
for order in range(10):
    result = e_exp_x(order=order,x=x)
    error = abs(true_val-result)
    myTable.add_row([order,result,error])

print("value of x: ",x)
print("true value: ",true_val)
print(myTable)

#conclusion: with x set to 0.1, expansion up to one order gives error within  $10^{-3}$ 
#conclusion: with x set to 0.1, expansion up to 3 order gives error within  $10^{-6}$ 

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value of x: 0.1
true value: 0.9048374180359595
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order	result	error
0	1.0	0.09516258196404048
1	0.9	0.004837418035959495
2	0.905	0.00016258196404050906
3	0.9048333333333334	4.084702626139247e-06
4	0.9048375000000001	8.196404055471618e-08
5	0.9048374166666667	1.3692927902653196e-09
6	0.9048374180555556	1.9596102518448788e-11
7	0.9048374180357144	2.4513724383723456e-13
8	0.9048374180359624	2.886579864025407e-15
9	0.9048374180359596	1.1102230246251565e-16

In [ ]: