1. Exponential series

In this assignment we use Taylor series expansion for calculating the value of exponent in KEIL

$$e^x = \sum_{i=0}^{\infty} \frac{x^i}{(i)!} = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \cdots$$

Different values of $\mathbf{e^x}$ are being calculated using KEIL , C program and Absolute value for different value of x.

Table: Value of exponential function for different value of **x**

S.No.	x	e^x (ARM)	e^x (C Program)	e^x (Absolute value)	No. of iterations
1.	1	2.71828	2.718	2.71828	20
2.	2	7.38906	7.388713	7.3891	20
3.	3	20.0855	20.066393	20.0855	20
4.	4	54.5979	54.598148	54.5982	20
5.	5	148.403	148.4131	148.4132	20
6.	6	403.428	403.428	403.4288	20
7.	7	1096.62	1096.6331	1096.6332	20
8.	8	2980.68	2980.958	2980.958	20
9.	9	8099.52	8103.0839	8103.0839	20
10.	10	2.20E+04	22026.464844	22026.4658	20
11.	12	1.63E+05	162754.796875	162754.7914	30
12.	14	1.20E+06	1202604.25	1202604.284	30
13.	16	8.88E+06	8886111	8886110.521	30
14.	18	6.53E+07	65659968	65659969.14	30
15.	20	4.75E+08	485165184	485165195.4	30
16.	25	#INF	72004902912	72004899337	30

We can see in the above table that as value of x increases number of iterations should have to increase in order to get less error in the output.

Also for large value of **X** KEIL simulator output shows #INF

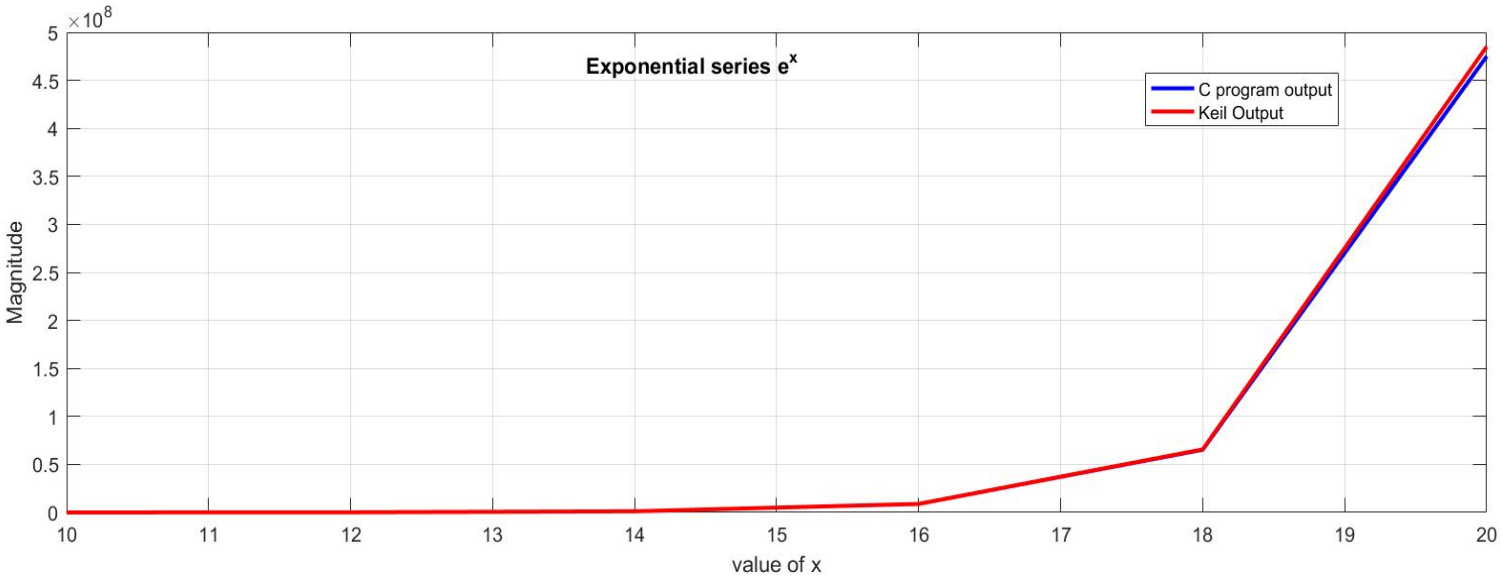

Fig : Output of exponential function

2. Tan x series

For calculating **tan x** series we first calculate **sin x** term and **cos x** term using taylor series expansion.

$$\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots$$

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots$$

Then we find value of tan x = (sin x / cos x)

S.No.	Angle(rads)	Angle(degree)	Tan x (KEIL)	Tan x (C program)
	0.174532	10	0.174533	0.176326
	0.349064	20	0.363968	0.363968
	0.523596	30	0.577347	0.577347
	0.698128	40	0.839093	0.839093
	0.872660	50	1.19174	1.191742
	1.047192	60	1.73202	1.732029
	1.221724	70	2.74742	2.747422
	1.396256	80	5.67084	5.671036
	1.570788	90	120341	120094.2
	1.745320	100	-5.67159	-5.67159
	1.919852	110	-2.74756	-2.74756
	2.094384	120	-1.7321	-1.7321

	2.268916	130	-1.19178	-1.19178
	2.443448	140	-0.83912	-0.83912
	2.617980	150	-0.57737	-0.57737
	2.792512	160	-0.36399	-0.36399
	2.967044	170	-0.17634	-0.17634
	3.141576	180	-1.67E-05	-1.70E-05
	3.316108	190	0.176308	0.176309
	3.490640	200	0.363949	0.363949
	3.665172	210	0.577324	0.577324
	3.839704	220	0.839064	0.839065
	4.014236	230	1.1917	1.191702
	4.188768	240	1.73196	1.731962
	4.363300	250	2.74727	2.74728
	4.537832	260	5.67048	5.670484
	4.712364	270	39977.3	40031.41
	4.886896	280	-5.67213	-5.67214
	5.061428	290	-2.74772	-2.74771
	5.235960	300	-1.73219	-1.73216
	5.410492	310	-1.19187	-1.19182
	5.585024	320	-0.83924	-0.83915
	5.759556	330	-0.57756	-0.57739
	5.934088	340	-0.36431	-0.36401
	6.108620	350	-0.17693	-0.17636
	6.283152	360	-0.00108	-3.30E-05

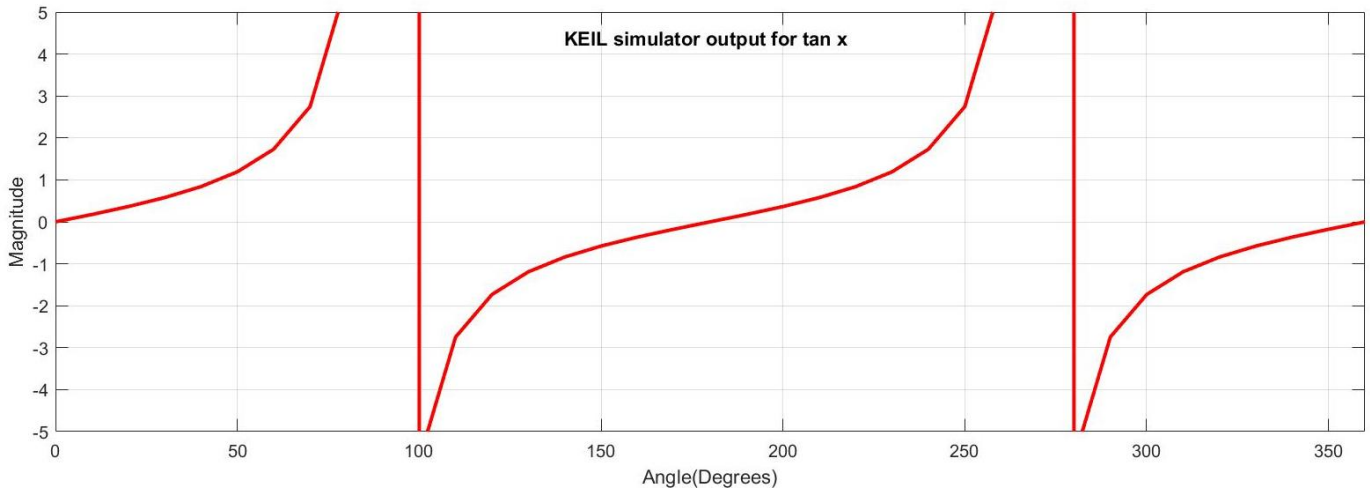

Fig :Graph obtained from KEIL simulator

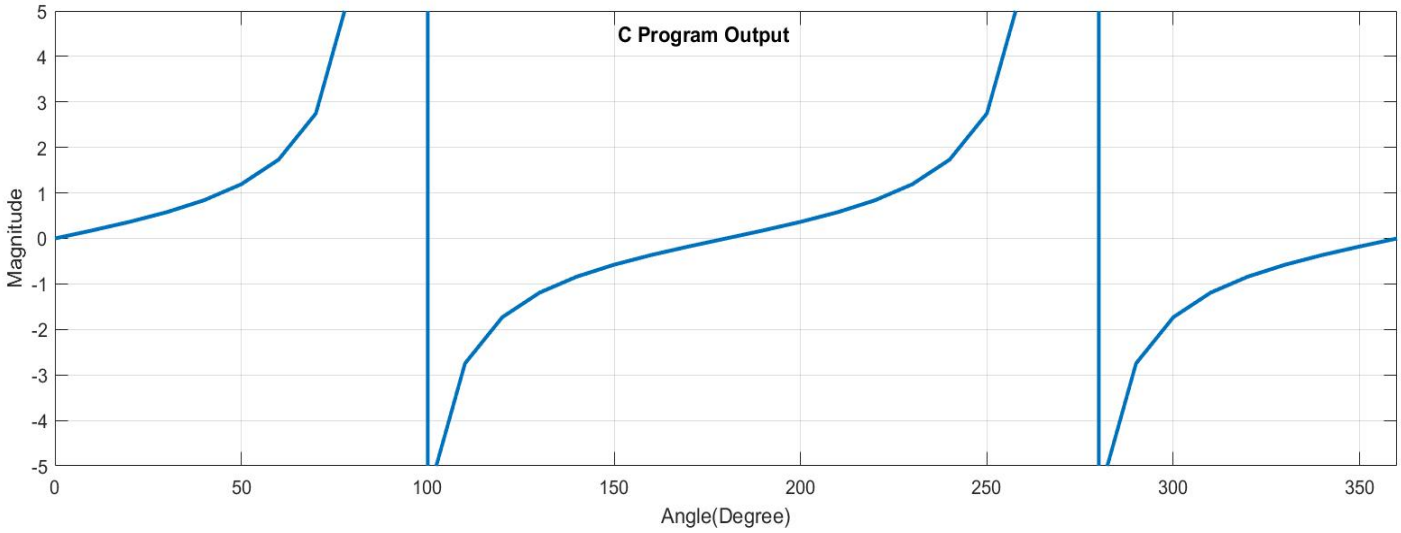

Fig : Graph obtained from C program

As we can see from the graph the output values obtained from KEIL simulator and C program is nearly same.