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Experiment No.	1

AIM:	To implement the various functions e.g. linear, non-linear, quadratic, exponential etc.
Program 1	
PROBLEM STATEMENT :	For this experiment, you have to implement at least 10 functions from the given list. The input (i.e. n) to all the above functions varies from 0 to 100 with increment of 10. Then add the function n! in the list and execute the same for n from 0 to 20 with increment of 2.
ALGORITHM/ THEORY:	**Theory:** A function is a relation between a set of inputs and a set of permissible outputs with the property that each input is related to exactly one output. Let A & B be any two non-empty sets; mapping from A to B will be a function only when every element in set A has one end, only one image in set B.
PROGRAM:	

```c
#include <stdio.h>
#include <math.h>
// 11th func is n factorial for 0 to 20 (0,2,4,6,8,10)

void tableDouble(int start, int end, int incr, double (*f)())
{
   FILE *fp = fopen("output.csv", "a+");
   fprintf(fp, "n, f(n)\n");
   for (int i = start; i <= end; i += incr)
   {
       printf("\t%d\t| %f\n", i, f(i));
       fprintf(fp, "%d, %f\n", i, f(i));
   }
   fclose(fp);
   printf("\n");
}
void tableInt(int start, int end, int incr, int (*f)())
```

```
{
   FILE *fp = fopen("output.csv", "a+");
   fprintf(fp, "n, f(n)\n");
   for (int i = start; i <= end; i += incr)
   {
       printf("\t%d\t| %d\n", i, f(i));
       fprintf(fp, "%d, %d\n", i, f(i));
   }
   fclose(fp);
   printf("\n");
}
void tablelong(int start, int end, int incr, unsigned long long
(*f)())
{
   FILE *fp = fopen("output.csv", "a+");
   fprintf(fp, "n, f(n)\n");
   for (int i = start; i <= end; i += incr)
   {
       printf("\t%d\t| %lld\n", i, f(i));
       fprintf(fp, "%d, %lld\n", i, f(i));
   }
   fclose(fp);
   printf("\n");
}

int linear(int x)
{
   return x + 5;
}
double fun1(int x) { return pow(1.5, x); }
double ln(int x) { return log(x); }
double twon(int x) { return pow(2, x); }
double lnlnn(int x) { return log(log(x)); }
double rtln(int x) { return sqrt(log10(x)); }
double en(int x) { return exp(x); }
double logsqn(int x) { return pow(log2(x), 2); }

unsigned long long factorial(unsigned long f)
{
   if (f)
       return (f * factorial(f - 1));
```

```
   return 1;
}

double nloglogn(int x) { return pow(x, log2(log2(x))); }
double sqrt2logn(int x) { return pow(sqrt(2), log2(x)); }

int (*fInt)(int);
double (*fDouble)(int);
unsigned long long (*fLong)(unsigned long f);
int main()
{
   printf("\tLinear(n+5)\n");
   fInt = linear;
   tableInt(0, 100, 10, fInt);
   printf("\t(3/2)^n\n");
   fDouble = fun1;
   tableDouble(0, 100, 10, fDouble);
   printf("\tln(n)\n");
   fDouble = ln;
   tableDouble(0, 100, 10, fDouble);
   printf("\t2^n\n");
   fDouble = twon;
   tableDouble(0, 100, 10, fDouble);
   printf("\tln ln n\n");
   fDouble = lnlnn;
   tableDouble(0, 100, 10, fDouble);
   printf("\tsqroot(log(n))\n");
   fDouble = rtln;
   tableDouble(0, 100, 10, fDouble);
   printf("\te^n\n");
   fDouble = en;
   tableDouble(0, 100, 10, fDouble);
   printf("\t(log n)^2\n");
   fDouble = logsqn;
   tableDouble(0, 100, 10, fDouble);
   printf("\tn^(log(log(n)))\n");
   fDouble = nloglogn;
   tableDouble(0, 100, 10, nloglogn);
   printf("\tsqrt(2)^logn\n");
   fDouble = sqrt2logn;
   tableDouble(0, 100, 10, fDouble);
```

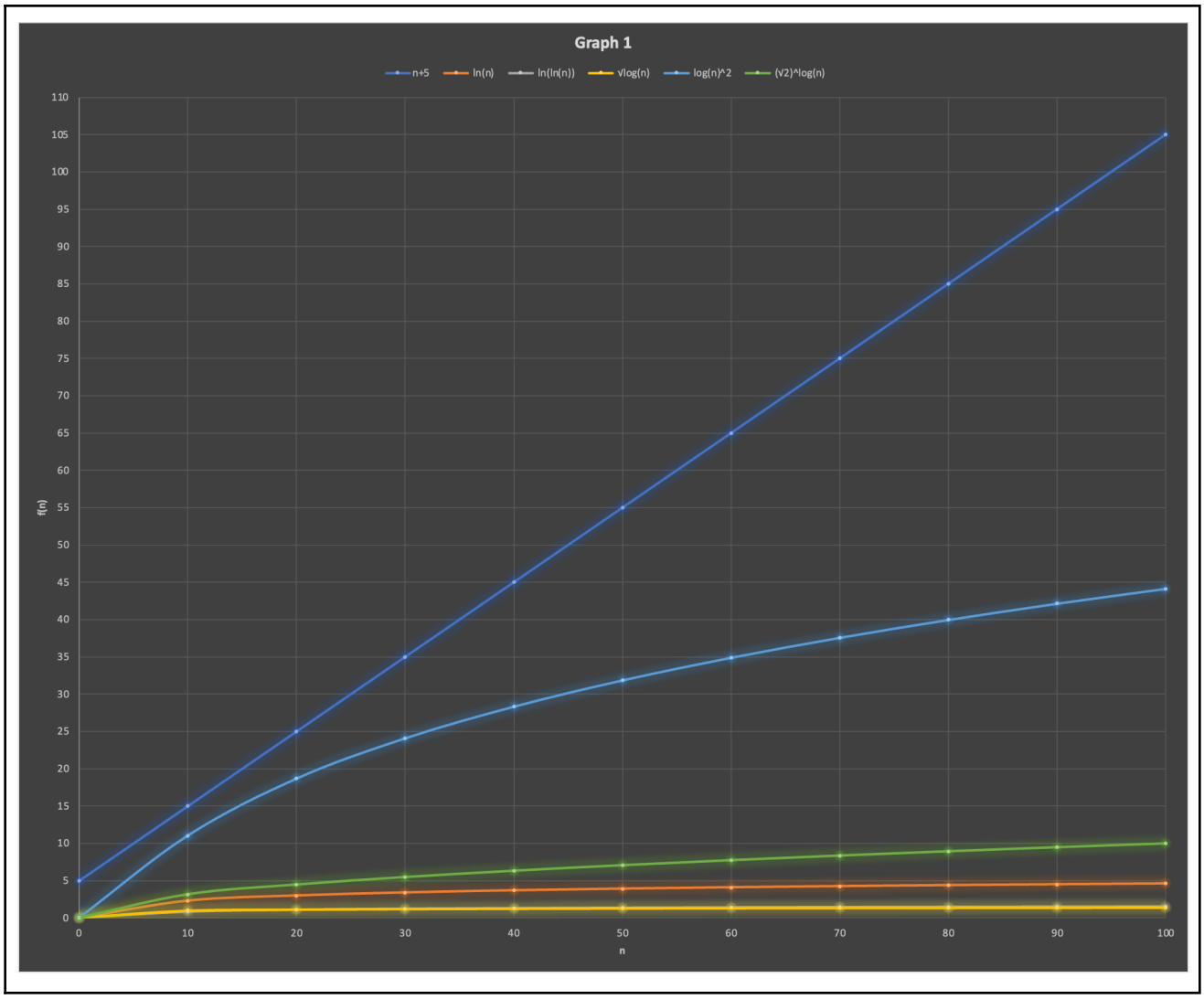
```
    printf("\tFactorial\n");
    fLong = factorial;
    tablelong(0, 20, 2, fLong);
}
```

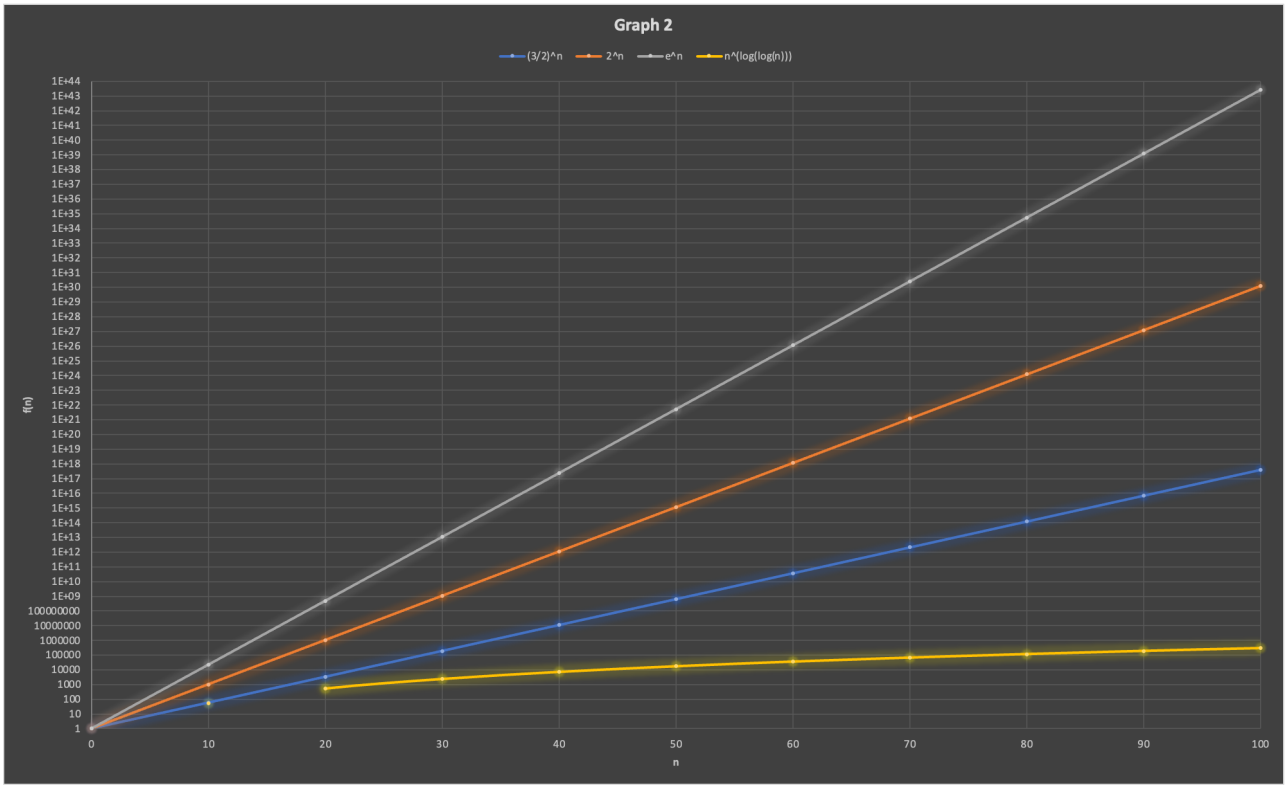
RESULT:

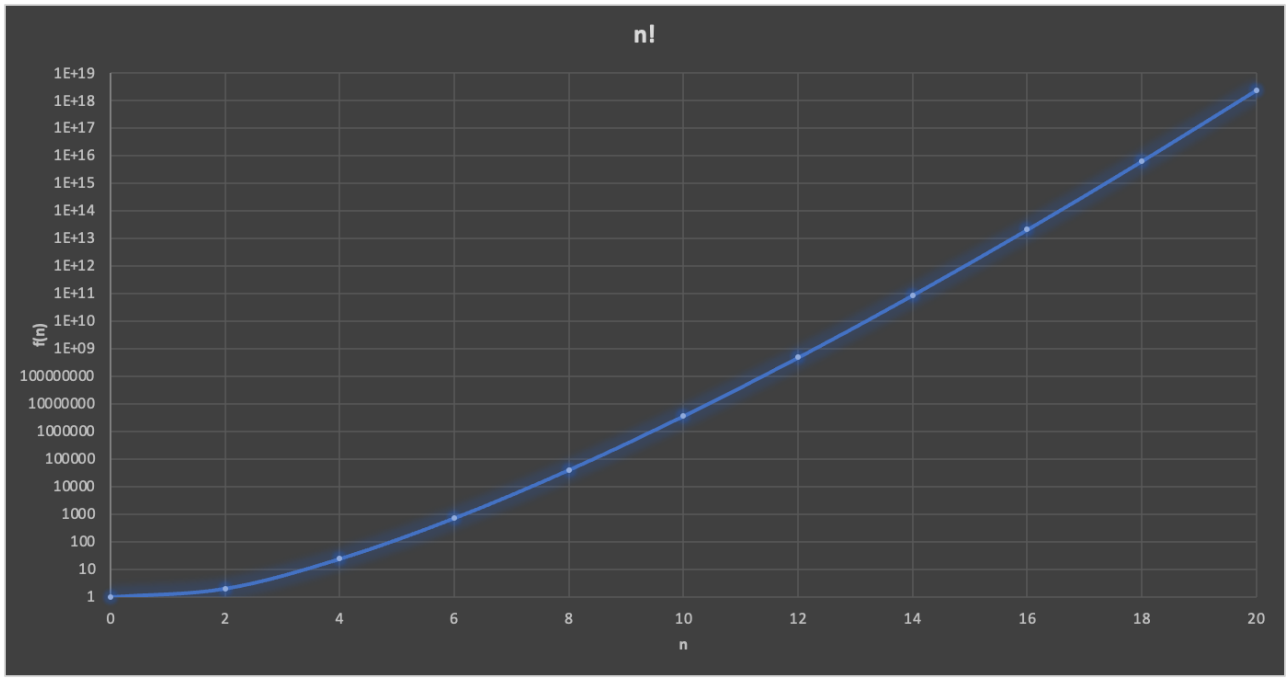
```
 *  Executing task: /usr/bin/clang /Users/stephen03/Dev/repos
/stepDAA/exp1a/e1a.c -o ../excs/e1a && ../excs/e1a

        Linear(n+5)
        0       | 5
        10      | 15
        20      | 25
        30      | 35
        40      | 45
        50      | 55
        60      | 65
        70      | 75
        80      | 85
        90      | 95
        100     | 105

        (3/2)^n
        0       | 1.000000
        10      | 57.665039
        20      | 3325.256730
        30      | 191751.059233
        40      | 11057332.320940
        50      | 637621500.214050
        60      | 36768468716.933022
        70      | 2120255184830.251953
        80      | 122264598055704.640625
        90      | 7050392822843069.000000
        100     | 406561177535215232.000000

        ln(n)
        0       | -inf
        10      | 2.302585
        20      | 2.995732
        30      | 3.401197
        40      | 3.688879
        50      | 3.912023
        60      | 4.094345
        70      | 4.248495
        80      | 4.382027
        90      | 4.499810
        100     | 4.605170

        2^n
        0       | 1.000000
        10      | 1024.000000
        20      | 1048576.000000
        30      | 1073741824.000000
        40      | 1099511627776.000000
        50      | 1125899906842624.000000
        60      | 1152921504606846976.000000
        70      | 1180591620717411303424.000000
        80      | 1208925819614629174706176.000000
        90      | 1237940039285380274899124224.000000
        100     | 1267650600228229401496703205376.000000
```

```
ln ln n
0       | nan
10      | 0.834032
20      | 1.097189
30      | 1.224128
40      | 1.305323
50      | 1.364055
60      | 1.409607
70      | 1.446565
80      | 1.477511
90      | 1.504035
100     | 1.527180

sqroot(log(n))
0       | nan
10      | 1.000000
20      | 1.140627
30      | 1.215369
40      | 1.265725
50      | 1.303445
60      | 1.333473
70      | 1.358344
80      | 1.379525
90      | 1.397942
100     | 1.414214

e^n
0       | 1.000000
10      | 22026.465795
20      | 485165195.409790
30      | 10686474581524.462891
40      | 235385266837020000.000000
50      | 5184705528587072045056.000000
60      | 114200738981568423454048256.000000
70      | 2515438670919166879789330989056.000000
80      | 55406223843935098344518031635382272.000000
90      | 1220403294317840834182894301529193316352.000000
100     | 26881171418161356094253400435962903554686976.000000

(log n)^2
0       | inf
10      | 11.035206
20      | 18.679062
30      | 24.077575
40      | 28.322919
50      | 31.853113
60      | 34.891357
70      | 37.568110
80      | 39.966775
90      | 42.144157
100     | 44.140825
```

```
n^(log(log(n)))
0       | nan
10      | 53.953652
20      | 558.923805
30      | 2453.077703
40      | 7312.856023
50      | 17449.641770
60      | 36002.511074
70      | 67028.075382
80      | 115588.141769
90      | 187835.707195
100     | 291099.655375

sqrt(2)^logn
0       | 0.000000
10      | 3.162278
20      | 4.472136
30      | 5.477226
40      | 6.324555
50      | 7.071068
60      | 7.745967
70      | 8.366600
80      | 8.944272
90      | 9.486833
100     | 10.000000

Factorial
0       | 1
2       | 2
4       | 24
6       | 720
8       | 40320
10      | 3628800
12      | 479001600
14      | 87178291200
16      | 20922789888000
18      | 6402373705728000
20      | 2432902008176640000

* Terminal will be reused by tasks, press any key to close it.
```


Graph 1
n+5
ln(n)
ln(ln(n))
√log(n)
log(n)^2
(√2)^log(n)
f(n)
n
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
0
10
20
30
40
50
60
70
80
90
100





CONCLUSION:	Successfully implemented various functions in C and observed their outputs for a set of numbers both in tabular as well as graphical format. Depending on the nature of the function used, the graph can be better understood. For example, in the case of n!, we see a curve similar to that of e^n.