DAA EXPERIMENT NO. 1-A

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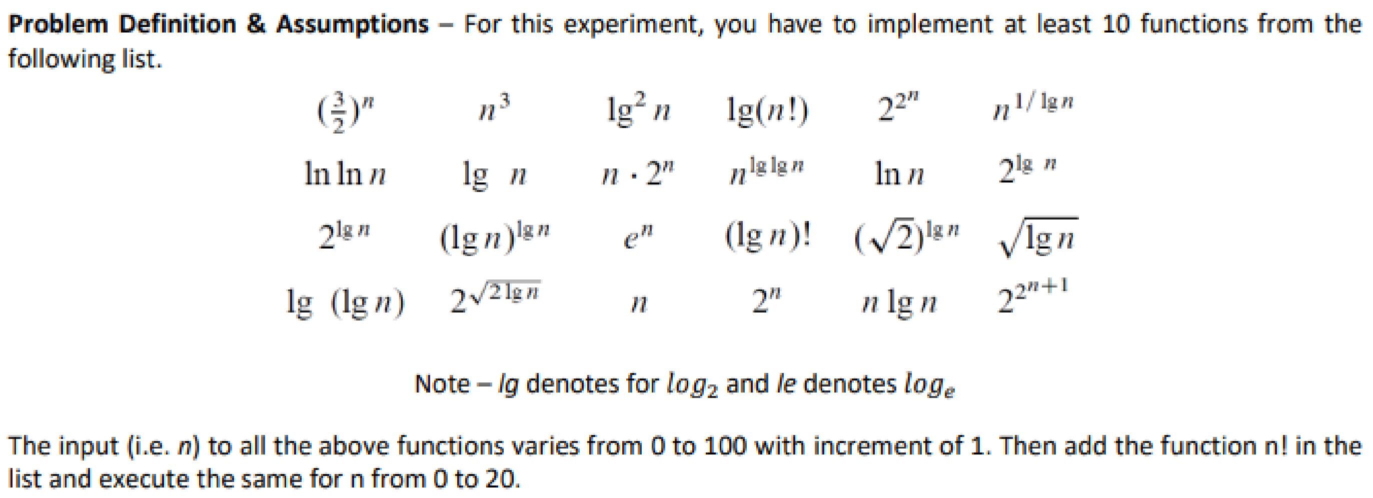
AIM: To implement the various functions e.g. linear, non-linear, quadratic, exponential etc.



Problem Definition & Assumptions – For this experiment, you have to implement at least 10 functions from the following list.

$(\frac{3}{2})^n$	n^3	$\lg^2 n$	$\lg(n!)$	2^{2^n}	$n^{1/\lg n}$
$\ln \ln n$	$\lg \ n$	$n \cdot 2^n$	$n^{\lg \lg n}$	$\ln n$	$2^{\lg \ n}$
$2^{\lg n}$	$(\lg n)^{\lg n}$	e^n	$(\lg n)!$	$(\sqrt{2})^{\lg n}$	$\sqrt{\lg n}$
$\lg \ (\lg n)$	$2^{\sqrt{2 \lg n}}$	n	2^n	$n \lg n$	$2^{2^{n+1}}$

Note – *lg* denotes for log_2 and *le* denotes log_e

The input (i.e. *n*) to all the above functions varies from 0 to 100 with increment of 1. Then add the function n! in the list and execute the same for n from 0 to 20.

ALGORITHM:

STEP 1: Include the required libraries: stdio.h, stdlib.h, math.h

STEP 2: Define the following functions:

- int f1_n(int n) - returns n
- int f2_n_cube(int n) - returns n^3
- double f3_3_by_2_pow_n(int n) - returns 1.5^n
- double f4_ln_n(int n) - returns log(n)
- double f5_ln_ln_n(int n) - returns log(log(n))
- double f6_log2_n(int n) - returns log2(n)
- double f7_log2_log2_n(int n) - returns log2(log2(n))
- double f8_n_log2_n(int n) - returns n * log2(n)
- long f9_2_pow_n(int n) - returns 2^n
- double f10_2_pow_log_n(int n) - returns 2^log2(n)
- long f11_n_fact(long n) - returns n! (factorial of n)

STEP 3: In the main function, Print the header line of the output table, which shows the names of the functions.

STEP 4: Use a for loop to iterate over the values of n from 0 to 100.

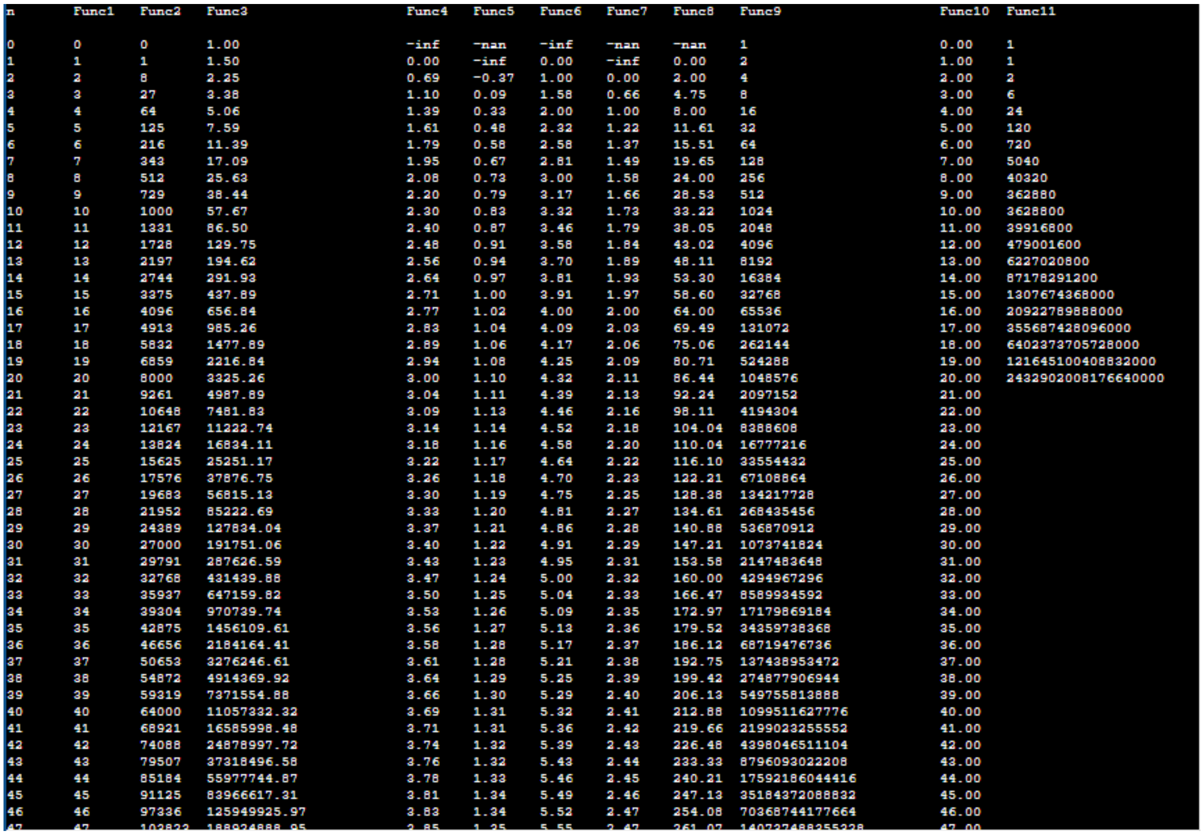
STEP 5: Within the for loop, print the value of n, followed by the values returned by each function, one function per tab-separated column.
STEP 6: For the function f11_n_fact, only print its value where n between 0 to 20.
STEP 7: End the line

CODE:

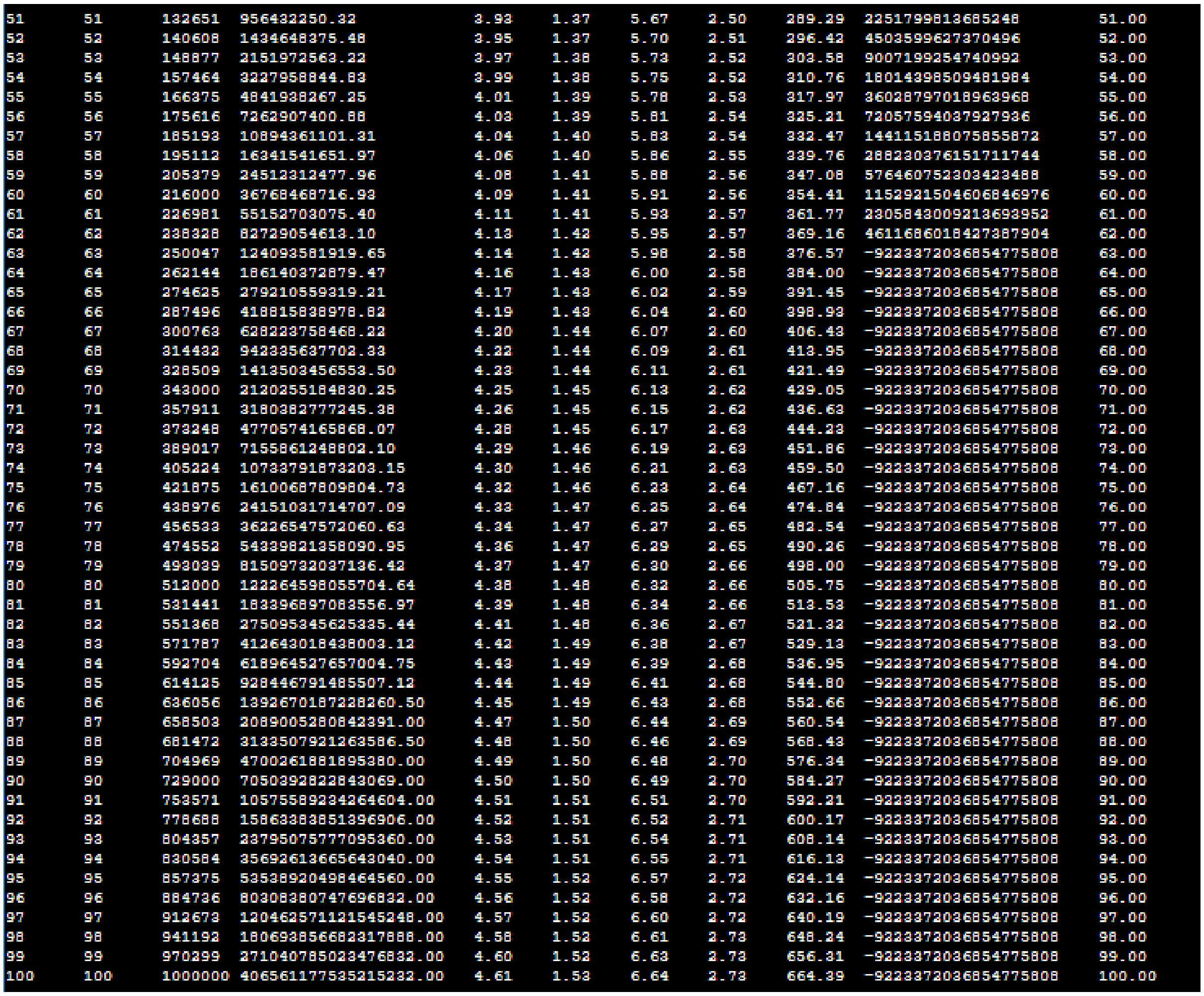
```
#include <stdio.h>
 #include <stdlib.h>
 #include <math.h>

 int f1_n(int n){
   return n;
 }
 int f2_n_cube(int n){
   return n*n*n;
 }
 double f3_3_by_2_pow_n(int n){
   return pow(1.5, n);
 }
 double f4_ln_n(int n){
   return log(n);
 }
 double f5_ln_ln_n(int n){
   return log(log(n));
 }
 double f6_log2_n(int n){
   return log2(n);
 }
 double f7_log2_log2_n(int n){
   return log2(log2(n));
 }
 double f8_n_log2_n(int n){
   return n * log2(n);
 }
 long f9_2_pow_n(int n){
   return pow(2, n);
 }
 double f10_2_pow_log_n(int n){
   return pow(2, log2(n));
 }
 long f11_n_fact(long n){
   return ((n == 1 || n == 0) ? 1 : n * f11_n_fact(n - 1));
 }

 int main(){
   printf("n\tFunc1\tFunc2\t%-20s\tFunc4\tFunc5\tFunc6\tFunc7\tFunc8\t%-
21s\tFunc10\tFunc11\n\n","Func3","Func9");
   for(int i=0; i <= 100; i++) {
       printf("%d\t", i);
       printf("%d\t", f1_n(i));
       printf("%d\t", f2_n_cube(i));
       printf("%-18.2f\t", f3_3_by_2_pow_n(i));
```

```
      printf("%.2f\t", f4_ln_n(i));
      printf("%.2f\t", f5_ln_ln_n(i));
      printf("%.2f\t", f6_log2_n(i));
      printf("%.2f\t", f7_log2_log2_n(i));
      printf("%.2f\t", f8_n_log2_n(i));
      printf("%-21ld\t", f9_2_pow_n(i));
      printf("%.2f\t", f10_2_pow_log_n(i));
      if(i<=20)
       printf("%ld", f11_n_fact(i));
      printf("\n");
  }
  return 0;
}
```

OUTPUT:

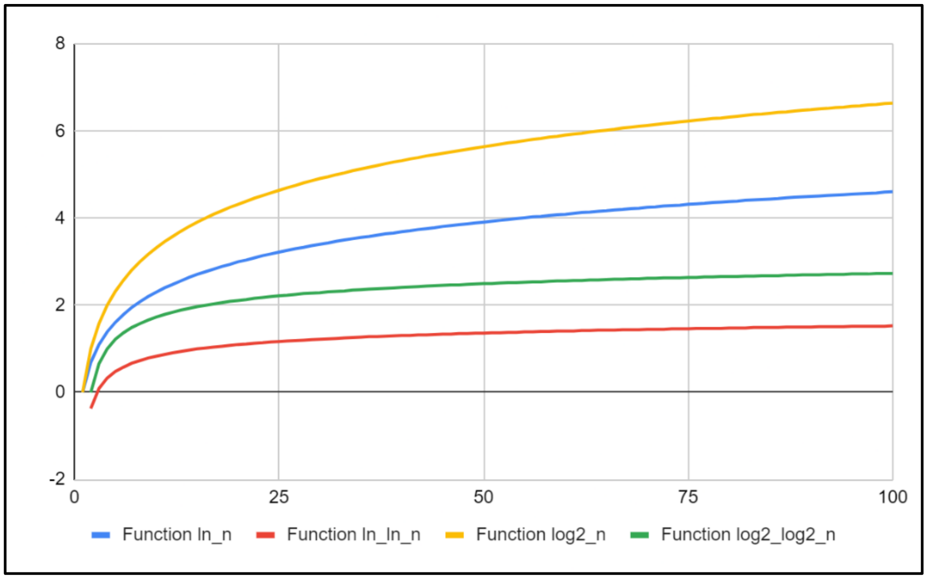


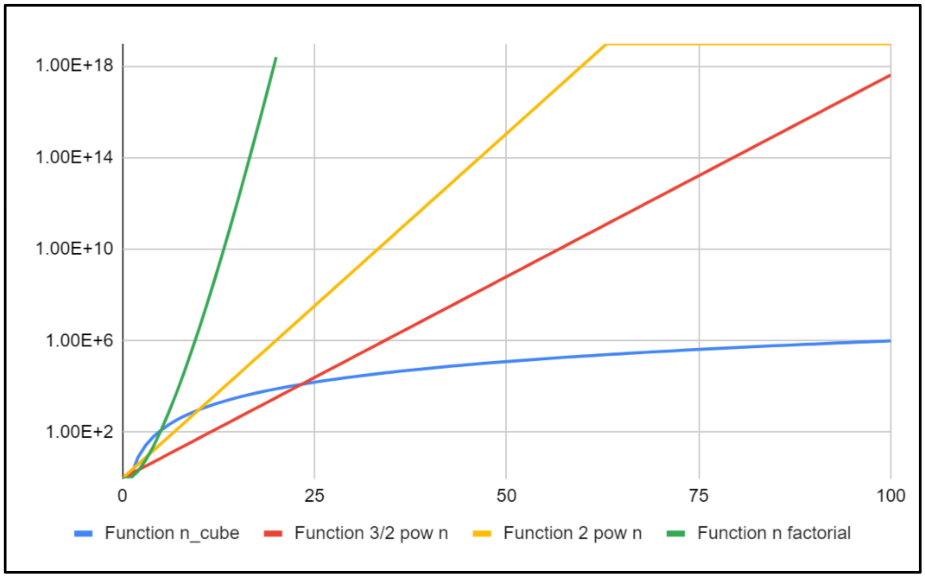
```
n       Func1   Func2   Func3                   Func4   Func5   Func6   Func7   Func8   Func9                   Func10  Func11

0       0       0       1.00                    -inf    -nan    -inf    -nan    -nan    1                       0.00    1
1       1       1       1.50                    0.00    -inf    0.00    -inf    0.00    2                       1.00    1
2       2       8       2.25                    0.69    -0.37   1.00    0.00    2.00    4                       2.00    2
3       3       27      3.38                    1.10    0.09    1.58    0.66    4.75    8                       3.00    6
4       4       64      5.06                    1.39    0.33    2.00    1.00    8.00    16                      4.00    24
5       5       125     7.59                    1.61    0.48    2.32    1.22    11.61   32                      5.00    120
6       6       216     11.39                   1.79    0.58    2.58    1.37    15.51   64                      6.00    720
7       7       343     17.09                   1.95    0.67    2.81    1.49    19.65   128                     7.00    5040
8       8       512     25.63                   2.08    0.73    3.00    1.58    24.00   256                     8.00    40320
9       9       729     38.44                   2.20    0.79    3.17    1.66    28.53   512                     9.00    362880
10      10      1000    57.67                   2.30    0.83    3.32    1.73    33.22   1024                    10.00   3628800
11      11      1331    86.50                   2.40    0.87    3.46    1.79    38.05   2048                    11.00   39916800
12      12      1728    129.75                  2.48    0.91    3.58    1.84    43.02   4096                    12.00   479001600
13      13      2197    194.62                  2.56    0.94    3.70    1.89    48.11   8192                    13.00   6227020800
14      14      2744    291.93                  2.64    0.97    3.81    1.93    53.30   16384                   14.00   87178291200
15      15      3375    437.89                  2.71    1.00    3.91    1.97    58.60   32768                   15.00   1307674368000
16      16      4096    656.84                  2.77    1.02    4.00    2.00    64.00   65536                   16.00   20922789888000
17      17      4913    985.26                  2.83    1.04    4.09    2.03    69.49   131072                  17.00   355687428096000
18      18      5832    1477.89                 2.89    1.06    4.17    2.06    75.06   262144                  18.00   6402373705728000
19      19      6859    2216.84                 2.94    1.08    4.25    2.09    80.71   524288                  19.00   121645100408832000
20      20      8000    3325.26                 3.00    1.10    4.32    2.11    86.44   1048576                 20.00   2432902008176640000
21      21      9261    4987.89                 3.04    1.11    4.39    2.13    92.24   2097152                 21.00
22      22      10648   7481.83                 3.09    1.13    4.46    2.16    98.11   4194304                 22.00
23      23      12167   11222.74                3.14    1.14    4.52    2.18    104.04  8388608                 23.00
24      24      13824   16834.11                3.18    1.16    4.58    2.20    110.04  16777216                24.00
25      25      15625   25251.17                3.22    1.17    4.64    2.22    116.10  33554432                25.00
26      26      17576   37876.75                3.26    1.18    4.70    2.23    122.21  67108864                26.00
27      27      19683   56815.13                3.30    1.19    4.75    2.25    128.38  134217728               27.00
28      28      21952   85222.69                3.33    1.20    4.81    2.27    134.61  268435456               28.00
29      29      24389   127834.04               3.37    1.21    4.86    2.28    140.88  536870912               29.00
30      30      27000   191751.06               3.40    1.22    4.91    2.29    147.21  1073741824              30.00
31      31      29791   287626.59               3.43    1.23    4.95    2.31    153.58  2147483648              31.00
32      32      32768   431439.88               3.47    1.24    5.00    2.32    160.00  4294967296              32.00
33      33      35937   647159.82               3.50    1.25    5.04    2.33    166.47  8589934592              33.00
34      34      39304   970739.74               3.53    1.26    5.09    2.35    172.97  17179869184             34.00
35      35      42875   1456109.61              3.56    1.27    5.13    2.36    179.52  34359738368             35.00
36      36      46656   2184164.41              3.58    1.28    5.17    2.37    186.12  68719476736             36.00
37      37      50653   3276246.61              3.61    1.28    5.21    2.38    192.75  137438953472            37.00
38      38      54872   4914369.92              3.64    1.29    5.25    2.39    199.42  274877906944            38.00
39      39      59319   7371554.88              3.66    1.30    5.29    2.40    206.13  549755813888            39.00
40      40      64000   11057332.32             3.69    1.31    5.32    2.41    212.88  1099511627776           40.00
41      41      68921   16585998.48             3.71    1.31    5.36    2.42    219.66  2199023255552           41.00
42      42      74088   24878997.72             3.74    1.32    5.39    2.43    226.48  4398046511104           42.00
43      43      79507   37318496.58             3.76    1.32    5.43    2.44    233.33  8796093022208           43.00
44      44      85184   55977744.87             3.78    1.33    5.46    2.45    240.21  17592186044416          44.00
45      45      91125   83966617.31             3.81    1.34    5.49    2.46    247.13  35184372088832          45.00
46      46      97336   125949925.97            3.83    1.34    5.52    2.47    254.08  70368744177664          46.00
47      47      103823  188924888.95            3.85    1.35    5.55    2.47    261.07  140737488355328         47.00
```

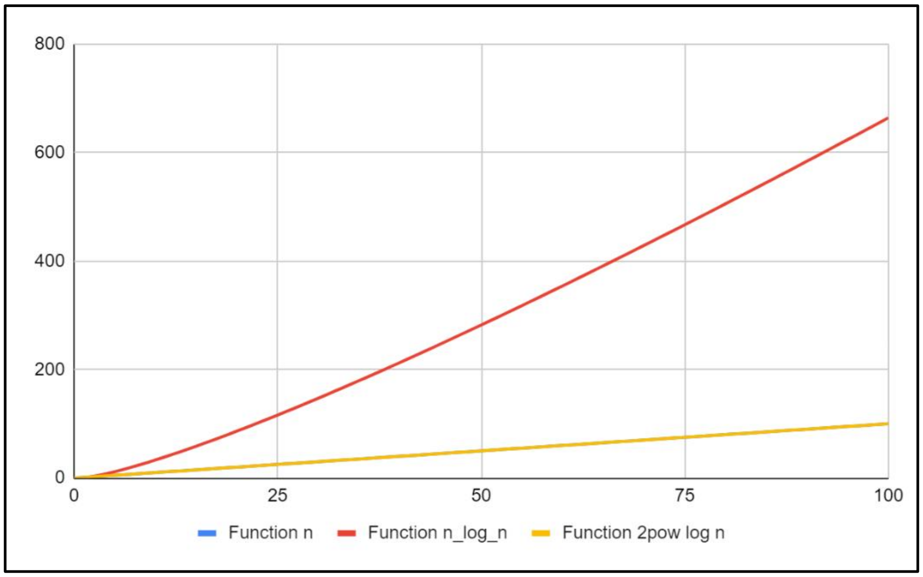


```
51      51      132651  956432250.32            3.93    1.37    5.67    2.50    289.29  2251799813685248        51.00
52      52      140608  1434648375.48           3.95    1.37    5.70    2.51    296.42  4503599627370496        52.00
53      53      148877  2151972563.22           3.97    1.38    5.73    2.52    303.58  9007199254740992        53.00
54      54      157464  3227958844.83           3.99    1.38    5.75    2.52    310.76  18014398509481984       54.00
55      55      166375  4841938267.25           4.01    1.39    5.78    2.53    317.97  36028797018963968       55.00
56      56      175616  7262907400.88           4.03    1.39    5.81    2.54    325.21  72057594037927936       56.00
57      57      185193  10894361101.31          4.04    1.40    5.83    2.54    332.47  144115188075855872      57.00
58      58      195112  16341541651.97          4.06    1.40    5.86    2.55    339.76  288230376151711744      58.00
59      59      205379  24512312477.96          4.08    1.41    5.88    2.56    347.08  576460752303423488      59.00
60      60      216000  36768468716.93          4.09    1.41    5.91    2.56    354.41  1152921504606846976     60.00
61      61      226981  55152703075.40          4.11    1.41    5.93    2.57    361.77  2305843009213693952     61.00
62      62      238328  82729054613.10          4.13    1.42    5.95    2.57    369.16  4611686018427387904     62.00
63      63      250047  124093581919.65         4.14    1.42    5.98    2.58    376.57  -9223372036854775808    63.00
64      64      262144  186140372879.47         4.16    1.43    6.00    2.58    384.00  -9223372036854775808    64.00
65      65      274625  279210559319.21         4.17    1.43    6.02    2.59    391.45  -9223372036854775808    65.00
66      66      287496  418815838978.82         4.19    1.43    6.04    2.60    398.93  -9223372036854775808    66.00
67      67      300763  628223758468.22         4.20    1.44    6.07    2.60    406.43  -9223372036854775808    67.00
68      68      314432  942335637702.33         4.22    1.44    6.09    2.61    413.95  -9223372036854775808    68.00
69      69      328509  1413503456553.50        4.23    1.44    6.11    2.61    421.49  -9223372036854775808    69.00
70      70      343000  2120255184830.25        4.25    1.45    6.13    2.62    429.05  -9223372036854775808    70.00
71      71      357911  3180382777245.38        4.26    1.45    6.15    2.62    436.63  -9223372036854775808    71.00
72      72      373248  4770574165868.07        4.28    1.45    6.17    2.63    444.23  -9223372036854775808    72.00
73      73      389017  7155861248802.10        4.29    1.46    6.19    2.63    451.86  -9223372036854775808    73.00
74      74      405224  10733791873203.15       4.30    1.46    6.21    2.63    459.50  -9223372036854775808    74.00
75      75      421875  16100687809804.73       4.32    1.46    6.23    2.64    467.16  -9223372036854775808    75.00
76      76      438976  24151031714707.09       4.33    1.47    6.25    2.64    474.84  -9223372036854775808    76.00
77      77      456533  36226547572060.63       4.34    1.47    6.27    2.65    482.54  -9223372036854775808    77.00
78      78      474552  54339821358090.95       4.36    1.47    6.29    2.65    490.26  -9223372036854775808    78.00
79      79      493039  81509732037136.42       4.37    1.47    6.30    2.66    498.00  -9223372036854775808    79.00
80      80      512000  122264598055704.64      4.38    1.48    6.32    2.66    505.75  -9223372036854775808    80.00
81      81      531441  183396897083556.97      4.39    1.48    6.34    2.66    513.53  -9223372036854775808    81.00
82      82      551368  275095345625335.44      4.41    1.48    6.36    2.67    521.32  -9223372036854775808    82.00
83      83      571787  412643018438003.12      4.42    1.49    6.38    2.67    529.13  -9223372036854775808    83.00
84      84      592704  618964527657004.75      4.43    1.49    6.39    2.68    536.95  -9223372036854775808    84.00
85      85      614125  928446791485507.12      4.44    1.49    6.41    2.68    544.80  -9223372036854775808    85.00
86      86      636056  1392670187228260.50     4.45    1.49    6.43    2.68    552.66  -9223372036854775808    86.00
87      87      658503  2089005280842391.00     4.47    1.50    6.44    2.69    560.54  -9223372036854775808    87.00
88      88      681472  3133507921263586.50     4.48    1.50    6.46    2.69    568.43  -9223372036854775808    88.00
89      89      704969  4700261881895380.00     4.49    1.50    6.48    2.70    576.34  -9223372036854775808    89.00
90      90      729000  7050392822843069.00     4.50    1.50    6.49    2.70    584.27  -9223372036854775808    90.00
91      91      753571  10575589234264604.00    4.51    1.51    6.51    2.70    592.21  -9223372036854775808    91.00
92      92      778688  15863383851396906.00    4.52    1.51    6.52    2.71    600.17  -9223372036854775808    92.00
93      93      804357  23795075777095360.00    4.53    1.51    6.54    2.71    608.14  -9223372036854775808    93.00
94      94      830584  35692613665643040.00    4.54    1.51    6.55    2.71    616.13  -9223372036854775808    94.00
95      95      857375  53538920498464560.00    4.55    1.52    6.57    2.72    624.14  -9223372036854775808    95.00
96      96      884736  80308380747696832.00    4.56    1.52    6.58    2.72    632.16  -9223372036854775808    96.00
97      97      912673  120462571121545248.00   4.57    1.52    6.60    2.72    640.19  -9223372036854775808    97.00
98      98      941192  180693856682317888.00   4.58    1.52    6.61    2.73    648.24  -9223372036854775808    98.00
99      99      970299  271040785023476832.00   4.60    1.52    6.63    2.73    656.31  -9223372036854775808    99.00
100     100     1000000 406561177535215232.00   4.61    1.53    6.64    2.73    664.39  -9223372036854775808    100.00
```

RESULT:


8
6
4
2
0
-2
0
25
50
75
100
Function ln_n
Function ln_ln_n
Function log2_n
Function log2_log2_n


1.00E+18
1.00E+14
1.00E+10
1.00E+6
1.00E+2
0
25
50
75
100
Function n_cube
Function 3/2 pow n
Function 2 pow n
Function n factorial


800
600
400
200
0
0
25
50
75
100
Function n
Function n_log_n
Function 2pow log n

RESULT ANALYSIS:

The return values of above 11 (linear, non-linear, quadratic, exponential) functions are plotted on three separate line graphs due to extreme variation in range of return values.

In the above 3 graphs, horizontal x-axis represents the value of n from 0 to 100 and the vertical y-axis represents the return value of functions.

Some of the function plotted on graph grow linearly and some grow exponentially.

CONCLUSION:

Various linear, non-linear, quadratic, exponential functions were implemented across values of 0 to 100.