|  |  |
| --- | --- |
| **NAME:** | Shubham Solanki |
| **UID:** | 2022301015 |
| **SUBJECT** | Design and Analysis of Algorithms |
| **EXPERIMENT NO :** | 1 (A) |
| **AIM:** | To implement the various functions e.g. linear, non-linear, quadratic, exponential etc. |
| **ALGORITHM:** | **Function n:**  i. Initialize a variable n.  ii. Take the value of n from 0-100 and print all of them.  **Function n^3:**  i. Initialize variables n and result.  ii. result = n\*n\*n  iii. Apply a for loop for values of n from 0-100 and print all  the values for result.  **Function 3n/2:**  i. Initialize variables n and result.  ii. result = 3n/2  iii. Apply a for loop for values of n from 0-100 and print all  the values for result.  **Function logn:**  i. Initialize variables n and result.  ii. result = log10(n)  iii. Apply a for loop for values of n from 0-100 and print all  the values for result.  **Function ln n:**  i. Initialize variables n and result.  ii. result = ln(n)  iii. Apply a for loop for values of n from 0-100 and print all  the values for result.  **Function 2^n:**  i. Initialize variables n and result.  ii. result = pow(2,n)  iii. Apply a for loop for values of n from 0-100 and print all  the values for result.  **Function e^n:**  i. Initialize variables n and result.  ii. result = pow(e,n)  iii. Apply a for loop for values of n from 0-100 and print all  the values for result.  **Function 2^log n:**  i. Initialize variables n and result.  ii. result = pow(2,log10(n))  iii. Apply a for loop for values of n from 0-100 and print all  the values for result.  **Function n\*2^n:**  i. Initialize variables n and result.  v. result = n\*pow(2,n)  vi. Apply a for loop for values of n from 0-100 and print all  the values for result.  **Function sqrt(log n):**  i. Initialize variables n and result.  ii. result = sqrt(log10(n))  iii. Apply a for loop for values of n from 0-100 and print all  the values for result. |
| **PROGRAM:** | #include <stdio.h>  #include <math.h>  int cube(int n) {      return n\*n\*n;  }  float fraction(int n) {    int b = 3 \* n;    float result = (float)(b) / (float)(2);    return result;  }  float logfc(int a) {    float c = log10(a);    return c;  }  float lnfc(int a) {    float c = log(a);    return c;  }  float power(int a) {    float b = pow(2, a);    return b;  }  float expo(int a) {    float b = exp(a);    return b;  }  float logPower(int a) {    float b = pow(2, log10(a));    return b;  }  float func5(int a) {    float b = a \* (pow(2, a));    return b;  }  float rootlog(int a) {    float b = sqrt(log10(a));    return b;  }  float powerRootLog(int a) {    float b = pow(sqrt(2), log10(a));    return b;  }  float factorial(int a) {    if (a <= 1) {      return 1;    }    return a \* factorial(a - 1);  }  int main() {    int a;    float b;    for (int i = 1; i <= 100; i++) {      printf("%d", i);      a = cube(i);      printf(" %d", a);      b = fraction(i);      printf(" %.2f", b);      b = logfc(i);      printf(" %.2f", b);      b = lnfc(i);      printf(" %.2f", b);      b = power(i);      printf(" %.1f", b);      b = expo(i);      printf(" %.2f", b);      b = logPower(i);      printf(" %.2f", b);      b = func5(i);      printf(" %.1f", b);      b = rootlog(i);      printf(" %.2f", b);      b =powerRootLog(i);      printf(" %.2f", b);      if (i <= 20) {        b = factorial(i);        printf(" %f", b);      }      printf("\n");    }    return 0;  } |
| **Observations**  **Values of functions**   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **n** | **n^3** | **3n/2** | **log n** | **ln n** | **2^n** | **e^n** | **2^lon n** | **n\*2^n** | **sqrt(log n)** | **sqrt(2)^log n** | | 1 | 1 | 1.5 | 0 | 0 | 2 | 2.72 | 1 | 2 | 0 | 1 | | 2 | 8 | 3 | 0.3 | 0.69 | 4 | 7.39 | 1.23 | 8 | 0.55 | 1.11 | | 3 | 27 | 4.5 | 0.48 | 1.1 | 8 | 20.09 | 1.39 | 24 | 0.69 | 1.18 | | 4 | 64 | 6 | 0.6 | 1.39 | 16 | 54.6 | 1.52 | 64 | 0.78 | 1.23 | | 5 | 125 | 7.5 | 0.7 | 1.61 | 32 | 148.41 | 1.62 | 160 | 0.84 | 1.27 | | 6 | 216 | 9 | 0.78 | 1.79 | 64 | 403.43 | 1.71 | 384 | 0.88 | 1.31 | | 7 | 343 | 10.5 | 0.85 | 1.95 | 128 | 1096.63 | 1.8 | 896 | 0.92 | 1.34 | | 8 | 512 | 12 | 0.9 | 2.08 | 256 | 2980.96 | 1.87 | 2048 | 0.95 | 1.37 | | 9 | 729 | 13.5 | 0.95 | 2.2 | 512 | 8103.08 | 1.94 | 4608 | 0.98 | 1.39 | | 10 | 1000 | 15 | 1 | 2.3 | 1024 | 22026.46 | 2 | 10240 | 1 | 1.41 | | 11 | 1331 | 16.5 | 1.04 | 2.4 | 2048 | 59874.14 | 2.06 | 22528 | 1.02 | 1.43 | | 12 | 1728 | 18 | 1.08 | 2.48 | 4096 | 162754.8 | 2.11 | 49152 | 1.04 | 1.45 | | 13 | 2197 | 19.5 | 1.11 | 2.56 | 8192 | 442413.4 | 2.16 | 106496 | 1.06 | 1.47 | | 14 | 2744 | 21 | 1.15 | 2.64 | 16384 | 1202604 | 2.21 | 229376 | 1.07 | 1.49 | | 15 | 3375 | 22.5 | 1.18 | 2.71 | 32768 | 3269017 | 2.26 | 491520 | 1.08 | 1.5 | | 16 | 4096 | 24 | 1.2 | 2.77 | 65536 | 8886111 | 2.3 | 1048576 | 1.1 | 1.52 | | 17 | 4913 | 25.5 | 1.23 | 2.83 | 131072 | 24154952 | 2.35 | 2228224 | 1.11 | 1.53 | | 18 | 5832 | 27 | 1.26 | 2.89 | 262144 | 65659968 | 2.39 | 4718592 | 1.12 | 1.55 | | 19 | 6859 | 28.5 | 1.28 | 2.94 | 524288 | 1.78E+08 | 2.43 | 9961472 | 1.13 | 1.56 | | 20 | 8000 | 30 | 1.3 | 3 | 1048576 | 4.85E+08 | 2.46 | 20971520 | 1.14 | 1.57 | | 21 | 9261 | 31.5 | 1.32 | 3.04 | 2097152 | 1.32E+09 | 2.5 | 44040192 | 1.15 | 1.58 | | 22 | 10648 | 33 | 1.34 | 3.09 | 4194304 | 3.58E+09 | 2.54 | 92274688 | 1.16 | 1.59 | | 23 | 12167 | 34.5 | 1.36 | 3.14 | 8388608 | 9.74E+09 | 2.57 | 1.93E+08 | 1.17 | 1.6 | | 24 | 13824 | 36 | 1.38 | 3.18 | 16777216 | 2.65E+10 | 2.6 | 4.03E+08 | 1.17 | 1.61 | | 25 | 15625 | 37.5 | 1.4 | 3.22 | 33554432 | 7.2E+10 | 2.64 | 8.39E+08 | 1.18 | 1.62 | | 26 | 17576 | 39 | 1.41 | 3.26 | 67108864 | 1.96E+11 | 2.67 | 1.74E+09 | 1.19 | 1.63 | | 27 | 19683 | 40.5 | 1.43 | 3.3 | 1.34E+08 | 5.32E+11 | 2.7 | 3.62E+09 | 1.2 | 1.64 | | 28 | 21952 | 42 | 1.45 | 3.33 | 2.68E+08 | 1.45E+12 | 2.73 | 7.52E+09 | 1.2 | 1.65 | | 29 | 24389 | 43.5 | 1.46 | 3.37 | 5.37E+08 | 3.93E+12 | 2.76 | 1.56E+10 | 1.21 | 1.66 | | 30 | 27000 | 45 | 1.48 | 3.4 | 1.07E+09 | 1.07E+13 | 2.78 | 3.22E+10 | 1.22 | 1.67 | | 31 | 29791 | 46.5 | 1.49 | 3.43 | 2.15E+09 | 2.9E+13 | 2.81 | 6.66E+10 | 1.22 | 1.68 | | 32 | 32768 | 48 | 1.51 | 3.47 | 4.29E+09 | 7.9E+13 | 2.84 | 1.37E+11 | 1.23 | 1.68 | | 33 | 35937 | 49.5 | 1.52 | 3.5 | 8.59E+09 | 2.15E+14 | 2.86 | 2.83E+11 | 1.23 | 1.69 | | 34 | 39304 | 51 | 1.53 | 3.53 | 1.72E+10 | 5.83E+14 | 2.89 | 5.84E+11 | 1.24 | 1.7 | | 35 | 42875 | 52.5 | 1.54 | 3.56 | 3.44E+10 | 1.59E+15 | 2.92 | 1.2E+12 | 1.24 | 1.71 | | 36 | 46656 | 54 | 1.56 | 3.58 | 6.87E+10 | 4.31E+15 | 2.94 | 2.47E+12 | 1.25 | 1.71 | | 37 | 50653 | 55.5 | 1.57 | 3.61 | 1.37E+11 | 1.17E+16 | 2.97 | 5.09E+12 | 1.25 | 1.72 | | 38 | 54872 | 57 | 1.58 | 3.64 | 2.75E+11 | 3.19E+16 | 2.99 | 1.04E+13 | 1.26 | 1.73 | | 39 | 59319 | 58.5 | 1.59 | 3.66 | 5.5E+11 | 8.66E+16 | 3.01 | 2.14E+13 | 1.26 | 1.74 | | 40 | 64000 | 60 | 1.6 | 3.69 | 1.1E+12 | 2.35E+17 | 3.04 | 4.4E+13 | 1.27 | 1.74 | | 41 | 68921 | 61.5 | 1.61 | 3.71 | 2.2E+12 | 6.4E+17 | 3.06 | 9.02E+13 | 1.27 | 1.75 | | 42 | 74088 | 63 | 1.62 | 3.74 | 4.4E+12 | 1.74E+18 | 3.08 | 1.85E+14 | 1.27 | 1.76 | | 43 | 79507 | 64.5 | 1.63 | 3.76 | 8.8E+12 | 4.73E+18 | 3.1 | 3.78E+14 | 1.28 | 1.76 | | 44 | 85184 | 66 | 1.64 | 3.78 | 1.76E+13 | 1.29E+19 | 3.12 | 7.74E+14 | 1.28 | 1.77 | | 45 | 91125 | 67.5 | 1.65 | 3.81 | 3.52E+13 | 3.49E+19 | 3.15 | 1.58E+15 | 1.29 | 1.77 | | 46 | 97336 | 69 | 1.66 | 3.83 | 7.04E+13 | 9.5E+19 | 3.17 | 3.24E+15 | 1.29 | 1.78 | | 47 | 103823 | 70.5 | 1.67 | 3.85 | 1.41E+14 | 2.58E+20 | 3.19 | 6.61E+15 | 1.29 | 1.79 | | 48 | 110592 | 72 | 1.68 | 3.87 | 2.81E+14 | 7.02E+20 | 3.21 | 1.35E+16 | 1.3 | 1.79 | | 49 | 117649 | 73.5 | 1.69 | 3.89 | 5.63E+14 | 1.91E+21 | 3.23 | 2.76E+16 | 1.3 | 1.8 | | 50 | 125000 | 75 | 1.7 | 3.91 | 1.13E+15 | 5.18E+21 | 3.25 | 5.63E+16 | 1.3 | 1.8 | | 51 | 132651 | 76.5 | 1.71 | 3.93 | 2.25E+15 | 1.41E+22 | 3.27 | 1.15E+17 | 1.31 | 1.81 | | 52 | 140608 | 78 | 1.72 | 3.95 | 4.5E+15 | 3.83E+22 | 3.29 | 2.34E+17 | 1.31 | 1.81 | | 53 | 148877 | 79.5 | 1.72 | 3.97 | 9.01E+15 | 1.04E+23 | 3.3 | 4.77E+17 | 1.31 | 1.82 | | 54 | 157464 | 81 | 1.73 | 3.99 | 1.8E+16 | 2.83E+23 | 3.32 | 9.73E+17 | 1.32 | 1.82 | | 55 | 166375 | 82.5 | 1.74 | 4.01 | 3.6E+16 | 7.69E+23 | 3.34 | 1.98E+18 | 1.32 | 1.83 | | 56 | 175616 | 84 | 1.75 | 4.03 | 7.21E+16 | 2.09E+24 | 3.36 | 4.04E+18 | 1.32 | 1.83 | | 57 | 185193 | 85.5 | 1.76 | 4.04 | 1.44E+17 | 5.69E+24 | 3.38 | 8.21E+18 | 1.33 | 1.84 | | 58 | 195112 | 87 | 1.76 | 4.06 | 2.88E+17 | 1.55E+25 | 3.4 | 1.67E+19 | 1.33 | 1.84 | | 59 | 205379 | 88.5 | 1.77 | 4.08 | 5.76E+17 | 4.2E+25 | 3.41 | 3.4E+19 | 1.33 | 1.85 | | 60 | 216000 | 90 | 1.78 | 4.09 | 1.15E+18 | 1.14E+26 | 3.43 | 6.92E+19 | 1.33 | 1.85 | | 61 | 226981 | 91.5 | 1.79 | 4.11 | 2.31E+18 | 3.1E+26 | 3.45 | 1.41E+20 | 1.34 | 1.86 | | 62 | 238328 | 93 | 1.79 | 4.13 | 4.61E+18 | 8.44E+26 | 3.46 | 2.86E+20 | 1.34 | 1.86 | | 63 | 250047 | 94.5 | 1.8 | 4.14 | 9.22E+18 | 2.29E+27 | 3.48 | 5.81E+20 | 1.34 | 1.87 | | 64 | 262144 | 96 | 1.81 | 4.16 | 1.84E+19 | 6.24E+27 | 3.5 | 1.18E+21 | 1.34 | 1.87 | | 65 | 274625 | 97.5 | 1.81 | 4.17 | 3.69E+19 | 1.69E+28 | 3.51 | 2.4E+21 | 1.35 | 1.87 | | 66 | 287496 | 99 | 1.82 | 4.19 | 7.38E+19 | 4.61E+28 | 3.53 | 4.87E+21 | 1.35 | 1.88 | | 67 | 300763 | 100.5 | 1.83 | 4.2 | 1.48E+20 | 1.25E+29 | 3.55 | 9.89E+21 | 1.35 | 1.88 | | 68 | 314432 | 102 | 1.83 | 4.22 | 2.95E+20 | 3.4E+29 | 3.56 | 2.01E+22 | 1.35 | 1.89 | | 69 | 328509 | 103.5 | 1.84 | 4.23 | 5.9E+20 | 9.25E+29 | 3.58 | 4.07E+22 | 1.36 | 1.89 | | 70 | 343000 | 105 | 1.85 | 4.25 | 1.18E+21 | 2.52E+30 | 3.59 | 8.26E+22 | 1.36 | 1.9 | | 71 | 357911 | 106.5 | 1.85 | 4.26 | 2.36E+21 | 6.84E+30 | 3.61 | 1.68E+23 | 1.36 | 1.9 | | 72 | 373248 | 108 | 1.86 | 4.28 | 4.72E+21 | 1.86E+31 | 3.62 | 3.4E+23 | 1.36 | 1.9 | | 73 | 389017 | 109.5 | 1.86 | 4.29 | 9.44E+21 | 5.05E+31 | 3.64 | 6.89E+23 | 1.37 | 1.91 | | 74 | 405224 | 111 | 1.87 | 4.3 | 1.89E+22 | 1.37E+32 | 3.65 | 1.4E+24 | 1.37 | 1.91 | | 75 | 421875 | 112.5 | 1.88 | 4.32 | 3.78E+22 | 3.73E+32 | 3.67 | 2.83E+24 | 1.37 | 1.92 | | 76 | 438976 | 114 | 1.88 | 4.33 | 7.56E+22 | 1.01E+33 | 3.68 | 5.74E+24 | 1.37 | 1.92 | | 77 | 456533 | 115.5 | 1.89 | 4.34 | 1.51E+23 | 2.76E+33 | 3.7 | 1.16E+25 | 1.37 | 1.92 | | 78 | 474552 | 117 | 1.89 | 4.36 | 3.02E+23 | 7.5E+33 | 3.71 | 2.36E+25 | 1.38 | 1.93 | | 79 | 493039 | 118.5 | 1.9 | 4.37 | 6.04E+23 | 2.04E+34 | 3.73 | 4.78E+25 | 1.38 | 1.93 | | 80 | 512000 | 120 | 1.9 | 4.38 | 1.21E+24 | 5.54E+34 | 3.74 | 9.67E+25 | 1.38 | 1.93 | | 81 | 531441 | 121.5 | 1.91 | 4.39 | 2.42E+24 | 1.51E+35 | 3.75 | 1.96E+26 | 1.38 | 1.94 | | 82 | 551368 | 123 | 1.91 | 4.41 | 4.84E+24 | 4.09E+35 | 3.77 | 3.97E+26 | 1.38 | 1.94 | | 83 | 571787 | 124.5 | 1.92 | 4.42 | 9.67E+24 | 1.11E+36 | 3.78 | 8.03E+26 | 1.39 | 1.94 | | 84 | 592704 | 126 | 1.92 | 4.43 | 1.93E+25 | 3.03E+36 | 3.8 | 1.62E+27 | 1.39 | 1.95 | | 85 | 614125 | 127.5 | 1.93 | 4.44 | 3.87E+25 | 8.22E+36 | 3.81 | 3.29E+27 | 1.39 | 1.95 | | 86 | 636056 | 129 | 1.93 | 4.45 | 7.74E+25 | 2.24E+37 | 3.82 | 6.65E+27 | 1.39 | 1.96 | | 87 | 658503 | 130.5 | 1.94 | 4.47 | 1.55E+26 | 6.08E+37 | 3.84 | 1.35E+28 | 1.39 | 1.96 | | 88 | 681472 | 132 | 1.94 | 4.48 | 3.09E+26 | 1.65E+38 | 3.85 | 2.72E+28 | 1.39 | 1.96 | | 89 | 704969 | 133.5 | 1.95 | 4.49 | 6.19E+26 | 1.#J | 3.86 | 5.51E+28 | 1.4 | 1.97 | | 90 | 729000 | 135 | 1.95 | 4.5 | 1.24E+27 | 1.#J | 3.88 | 1.11E+29 | 1.4 | 1.97 | | 91 | 753571 | 136.5 | 1.96 | 4.51 | 2.48E+27 | 1.#J | 3.89 | 2.25E+29 | 1.4 | 1.97 | | 92 | 778688 | 138 | 1.96 | 4.52 | 4.95E+27 | 1.#J | 3.9 | 4.56E+29 | 1.4 | 1.98 | | 93 | 804357 | 139.5 | 1.97 | 4.53 | 9.9E+27 | 1.#J | 3.91 | 9.21E+29 | 1.4 | 1.98 | | 94 | 830584 | 141 | 1.97 | 4.54 | 1.98E+28 | 1.#J | 3.93 | 1.86E+30 | 1.4 | 1.98 | | 95 | 857375 | 142.5 | 1.98 | 4.55 | 3.96E+28 | 1.#J | 3.94 | 3.76E+30 | 1.41 | 1.98 | | 96 | 884736 | 144 | 1.98 | 4.56 | 7.92E+28 | 1.#J | 3.95 | 7.61E+30 | 1.41 | 1.99 | | 97 | 912673 | 145.5 | 1.99 | 4.57 | 1.58E+29 | 1.#J | 3.96 | 1.54E+31 | 1.41 | 1.99 | | 98 | 941192 | 147 | 1.99 | 4.58 | 3.17E+29 | 1.#J | 3.98 | 3.11E+31 | 1.41 | 1.99 | | 99 | 970299 | 148.5 | 2 | 4.6 | 6.34E+29 | 1.#J | 3.99 | 6.27E+31 | 1.41 | 2 | | 100 | 1000000 | 150 | 2 | 4.61 | 1.27E+30 | 1.#J | 4 | 1.27E+32 | 1.41 | 2 |   **Factorial Values**  1-1  2-2  3-6  4-24  5-120  6-720  7-5040  8-40320  9-362880  10-3628800  11-39916800  12-479001600  13-6227020800  14-87178289152  15-1307674411008  16-20922790576128  17-355687414628352  18-6402373530419200  19-121645104594157570  20-2432902023163674600  **Graphs**  **Observation for n graph**   * The graph of the equation f(n)=n has a slope of 1, and its y-intercept is 0. * It goes through the origin (0, 0), and for each unit increase in n, there is an equal increment in f(n).   **Observation**   * As the value of n moves from a negative to a positive one, the graph of f(n)=n3 is a smooth, continuous curve that rapidly increases. * The point is traversed by the graph (0, 0)   **Observation**  The graph of f(n)=3n/2 is a straight line with a slope of 3/2 and y-intercept of 0. It passes through the origin (0,0) .  **Observation**   * The graph of the equation f(n)=log10(n), where log10 is the base-10 logarithm, is a smooth, continuous curve that begins at negative infinity and moves closer to zero as n moves closer to 1. * The value of f(n) increases along with n, though more slowly. * The graph goes through the point (1, 0), and f(n) rises by one unit for each factor of ten increase in n.   **Observation**   * The graph of the equation f(n)=log(n), where log is the natural logarithm (base e), is a smooth, continuous curve that begins at negative infinity and moves closer to zero as n moves closer to 1. * The value of f(n) increases along with n, though more slowly. * The graph goes through the point (1, 0), and f(n) rises by one unit for each unit increase in n caused by an increase in the factor e.   **Observation**     * The graph of the equation f(n)=2n is a smooth, continuous curve that rises quickly from 1 as n moves from negative to positive numbers. * The point is traversed by the graph (0, 1)   **Observation**   * The graph of the equation f(n)=e^n, where e is a mathematical constant roughly equal to 2.71828, is a smooth, continuous curve that rises quickly as n moves from negative to positive values. * The point is traversed by the graph (0, 1)   **Observation**   * When n climbs from 1 to positive values, the graph of f(n)=2(log10 n) is a smooth, continuous curve that starts at 1 and quickly rises.   **Observation**   * The graph of f(n)=n\*2^n is a smooth and continuous curve that rapidly increases as n increases from negative to positive values. The graph passes through the point (0, 0)   **Observation**   * The graph of the equation f(n)=sqrt(log10 n), where sqrt stands for the square root function and log10 for base-10 logarithm, is a smooth, continuous curve that rises from zero as n moves from one to positive numbers.   **Observation**   * The graph of the equation f(n)=sqrt(2)(log10 n) is a smooth, continuous curve that rises quickly as n rises from zero to positive values.   **Observation**   * The graph of the equation f(n)=n!, where n! denotes the factorial of n (the sum of all positive integers up to n), is a smooth, continuous curve that rises quickly as n climbs from zero to positive values. * The point (0, 1) is on the graph, and as n increases towards positive infinity, f(n) increases towards positive infinity as well. | |
| **Conclusion**  Through this experiment, I gained a comprehensive understanding of utilizing logarithmic and exponential functions in C programming language and the implementation of recursive functions, enhancing my programming skills and knowledge. | |