Universidad de Guanajuato

División de Ingenierías Campus Irapuato Salamanca

|

Introducción

En la primera práctica de programación en ingeniería se realizó un proyecto donde se hizo uso de conocimientos adquiridos en el primer parcial de la materia tales como funciones, recursividad, declaración y manejo de distintos tipos de variables, ciclos, etc. a través del cálculo de funciones matemáticas en un programa. El usuario podrá elegir el número de iteraciones a realizar y en varios casos el valor a calcular por la función.

Al final se compararán ambos resultados y estos a su vez se compararán con los obtenidos por calculadora.

Objetivos

Determinar los valores de series de constantes y de funciones especiales para n términos mediante ciclos for, while o do-while. El valor debe de ser calculado para cualquier valor de n. Es necesario realizar las validaciones correspondientes.

Procedimiento

Diagrama de flujo

Resultados y análisis

Tablas comparativas

1. **Ln (2) = 0.6931471806**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **N** | **x** | **Fn(x)** | **Fn(x)- Fn-1(x)** | **En** |
| 1 | 2 | 1 |  | -0.306853 |
| 2 | 2 | 0.5 | -0.5 | 0.1931472 |
| 4 | 2 | 0.583333 | 0.083333 | 0.1098142 |
| 8 | 2 | 0.634524 | 0.051191 | 0.0586232 |
| 16 | 2 | 0.662872 | 0.028348 | 0.0302752 |
| 32 | 2 | 0.677766 | 0.014894 | 0.0153812 |
| 64 | 2 | 0.685395 | 0.007629 | 0.0077522 |
| 128 | 2 | 0.689256 | 0.003861 | 0.0038912 |

1. **= 0.7853981634**

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| --- | --- | --- | --- | --- |
| **N** | **x** | **Fn(x)** | **Fn(x)- Fn-1(x)** | **En** |
| 1 | π/4 | 1 |  | 0.2146018 |
| 2 | π/4 | 0.666667 | -0.333333 | 0.1187312 |
| 4 | π/4 | 0.72381 | 0.057143 | 0.0615882 |
| 8 | π/4 | 0.754268 | 0.030458 | 0.0311302 |
| 16 | π/4 | 0.769788 | 0.01552 | 0.0156102 |
| 32 | π/4 | 0.777588 | 0.0078 | 0.0078102 |
| 64 | π/4 | 0.781492 | 0.003904 | 0.0039062 |
| 128 | π/4 | 0.783445 | 0.001953 | 0.0019532 |

1. **= 1.644934067**

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| --- | --- | --- | --- | --- |
| **N** | **x** | **Fn(x)** | **Fn(x)- Fn-1(x)** | **En** |
| 1 | π^2/6 | 1 |  | 0.6449341 |
| 2 | π^2/6 | 1.25 | 0.25 | 0.3949341 |
| 4 | π^2/6 | 1.423611 | 0.173611 | 0.2213231 |
| 8 | π^2/6 | 1.527422 | 0.103811 | 0.1175121 |
| 16 | π^2/6 | 1.584347 | 0.056925 | 0.0605871 |
| 32 | π^2/6 | 1.614167 | 0.02982 | 0.0307671 |
| 64 | π^2/6 | 1.629431 | 0.015264 | 0.0155031 |
| 128 | π^2/6 | 1.637152 | 0.007721 | 0.0077821 |

1. **= 1.23370055**

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| **N** | **x** | **Fn(x)** | **Fn(x)- Fn-1(x)** | **En** |
| 1 | π^2/8 | 1 |  | 0.2337006 |
| 2 | π^2/8 | 1.111111 | 0.111111 | 0.1225896 |
| 4 | π^2/8 | 1.171519 | 0.060408 | 0.0621816 |
| 8 | π^2/8 | 1.202491 | 0.030972 | 0.0312096 |
| 16 | π^2/8 | 1.218081 | 0.01559 | 0.0156196 |
| 32 | π^2/8 | 1.225889 | 0.007808 | 0.0078116 |
| 64 | π^2/8 | 1.229794 | 0.003905 | 0.0039065 |
| 128 | π^2/8 | 1.231748 | 0.001954 | 0.0019525 |

1. **= 0.5**

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| **N** | **x** | **Fn(x)** | **Fn(x)- Fn-1(x)** | **En** |
| 1 | 1/2 | 0.333333 |  | 0.166667 |
| 2 | 1/2 | 0.4 | 0.066667 | 0.1 |
| 4 | 1/2 | 0.444444 | 0.044444 | 0.055556 |
| 8 | 1/2 | 0.470588 | 0.026144 | 0.029412 |
| 16 | 1/2 | 0.484848 | 0.01426 | 0.015152 |
| 32 | 1/2 | 0.492308 | 0.00746 | 0.007692 |
| 64 | 1/2 | 0.496124 | 0.003816 | 0.003876 |
| 128 | 1/2 | 0.498054 | 0.00193 | 0.001946 |

1. **= 0.75**

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| **N** | **x** | **Fn(x)** | **Fn(x)- Fn-1(x)** | **En** |
| 1 | 3/4 | 0.333333 |  | 0.416667 |
| 2 | 3/4 | 0.458333 | 0.125 | 0.291667 |
| 4 | 3/4 | 0.566667 | 0.108334 | 0.183333 |
| 8 | 3/4 | 0.644444 | 0.077777 | 0.105556 |
| 16 | 3/4 | 0.69281 | 0.048366 | 0.05719 |
| 32 | 3/4 | 0.720143 | 0.027333 | 0.029857 |
| 64 | 3/4 | 0.734732 | 0.014589 | 0.015268 |
| 128 | 3/4 | 0.742278 | 0.007546 | 0.007722 |

**= 7.389056099**

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| --- | --- | --- | --- | --- |
| **N** | **x** | **Fn(x)** | **Fn(x)- Fn-1(x)** | **En** |
| 1 |  | 1 |  | 6.3890561 |
| 2 |  | 3 | 2 | 4.3890561 |
| 4 |  | 7 | 4 | 0.3890561 |
| 8 |  | 7.389047 | 0.389047 | 9.099E-06 |
| 16 |  | 7.3509946 | -0.0380524 | 0.0380615 |
| 32 |  | inf | #¡VALOR! | #¡VALOR! |
| 64 |  | inf | #¡VALOR! | #¡VALOR! |
| 128 |  | inf | #¡VALOR! | #¡VALOR! |

**= 54.59815003**

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| --- | --- | --- | --- | --- |
| **N** | **x** | **Fn(x)** | **Fn(x)- Fn-1(x)** | **En** |
| 1 | 4 | 1 |  | 53.59815 |
| 2 | 4 | 5 | 4 | 49.59815 |
| 4 | 4 | 34.333332 | 29.333332 | 20.264818 |
| 8 | 4 | 54.548176 | 20.214844 | 0.049974 |
| 16 | 4 | -2203575.5 | -2203630.048 | 2203630.1 |
| 32 | 4 | inf | #¡VALOR! | #¡VALOR! |
| 64 | 4 | inf | #¡VALOR! | #¡VALOR! |
| 128 | 4 | inf | #¡VALOR! | #¡VALOR! |

**= 2.117000017**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **N** | **x** | **Fn(x)** | **Fn(x)- Fn-1(x)** | **En** |
| 1 | 0.75 | 1 |  | 1.117 |
| 2 | 0.75 | 1.75 | 0.75 | 0.367 |
| 4 | 0.75 | 2.114746 | 0.364746 | 0.002254 |
| 8 | 0.75 | 2.117 | 0.002254 | 1.7E-08 |
| 16 | 0.75 | 2.117 | 0 | 1.7E-08 |
| 32 | 0.75 | inf | #¡VALOR! | #¡VALOR! |
| 64 | 0.75 | inf | #¡VALOR! | #¡VALOR! |
| 128 | 0.75 | inf | #¡VALOR! | #¡VALOR! |

1. **ln (1 + x)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **N** | **x** | **Fn(x)** | **Fn(x)- Fn-1(x)** | **En** |
| 1 | 0.50 | 0.5 |  | -0.094535 |
| 2 | 0.50 | 0.416667 | -0.083333 | -0.011202 |
| 4 | 0.50 | 0.405804 | -0.010863 | -0.000339 |
| 8 | 0.50 | 0.405466 | -0.000338 | -8.92E-07 |
| 16 | 0.50 | 0.405465 | -1E-06 | 1.081E-07 |
| 32 | 0.50 | 0.405465 | 0 | 1.081E-07 |
| 64 | 0.50 | 0.405465 | 0 | 1.081E-07 |
| 128 | 0.50 | 0.405465 | 0 | 1.081E-07 |

**ln (1 + 0.5) = 0.4054651081**

**ln (1 + 0.456) = 0.3756929498**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **N** | **x** | **Fn(x)** | **Fn(x)- Fn-1(x)** | **En** |
| 1 | **0.456** | 0.456 |  | -0.080307 |
| 2 | **0.456** | 0.383638 | -0.072362 | -0.007945 |
| 4 | **0.456** | 0.375859 | -0.007779 | -0.000166 |
| 8 | **0.456** | 0.375693 | -0.000166 | -5.02E-08 |
| 16 | **0.456** | 0.375693 | 0 | -5.02E-08 |
| 32 | **0.456** | 0.375693 | 0 | -5.02E-08 |
| 64 | **0.456** | 0.375693 | 0 | -5.02E-08 |
| 128 | **0.456** | 0.375693 | 0 | -5.02E-08 |

**ln (1 + 0.99) = 0.6881346387**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **N** | **x** | **Fn(x)** | **Fn(x)- Fn-1(x)** | **En** |
| 1 | **0.99** | 0.99 |  | -0.301865 |
| 2 | **0.99** | 0.823383 | -0.166617 | -0.135248 |
| 4 | **0.99** | 0.749671 | -0.073712 | -0.061536 |
| 8 | **0.99** | 0.715706 | -0.033965 | -0.027571 |
| 16 | **0.99** | 0.699696 | -0.01601 | -0.011561 |
| 32 | **0.99** | 0.692294 | -0.007402 | -0.004159 |
| 64 | **0.99** | 0.689224 | -0.00307 | -0.001089 |
| 128 | **0.99** | 0.688285 | -0.000939 | -0.00015 |

**= 0.5493061443**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **N** | **x** | **Fn(x)** | **Fn(x)- Fn-1(x)** | **En** |
| 1 | **0.5** | 0 |  | 0.5493061 |
| 2 | **0.5** | 0.5 | 0.5 | 0.0493061 |
| 4 | **0.5** | 0.549033 | 0.049033 | 0.0002731 |
| 8 | **0.5** | 0.549306 | 0.000273 | 1.443E-07 |
| 16 | **0.5** | 0.549306 | 0 | 1.443E-07 |
| 32 | **0.5** | 0.549306 | 0 | 1.443E-07 |
| 64 | **0.5** | 0.549306 | 0 | 1.443E-07 |
| 128 | **0.5** | 0.549306 | 0 | 1.443E-07 |

**= 0**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **N** | **x** | **Fn(x)** | **Fn(x)- Fn-1(x)** | **En** |
| 1 | **0** | 0 |  | 0 |
| 2 | **0** | 0 | 0 | 0 |
| 4 | **0** | 0 | 0 | 0 |
| 8 | **0** | 0 | 0 | 0 |
| 16 | **0** | 0 | 0 | 0 |
| 32 | **0** | 0 | 0 | 0 |
| 64 | **0** | 0 | 0 | 0 |
| 128 | **0** | 0 | 0 | 0 |

**= 1.47221949**

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| --- | --- | --- | --- | --- |
| **N** | **x** | **Fn(x)** | **Fn(x)- Fn-1(x)** | **En** |
| 1 | **0.9** | 0 |  | 1.4722195 |
| 2 | **0.9** | 0.9 | 0.9 | 0.5722195 |
| 4 | **0.9** | 1.329426 | 0.429426 | 0.1427935 |
| 8 | **0.9** | 1.45641 | 0.126984 | 0.0158095 |
| 16 | **0.9** | 1.471892 | 0.015482 | 0.0003275 |
| 32 | **0.9** | 1.472219 | 0.000327 | 4.9E-07 |
| 64 | **0.9** | 1.472219 | 0 | 4.9E-07 |
| 128 | **0.9** | 1.472219 | 0 | 4.9E-07 |

10) ln(x)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| N | x | Fn(x) | Fn(x)- Fn-1(x) | En |  | -0.69314718 |
| 1 | 0.5 | -0.666667 |  | -0.02648018 |  |  |
| 2 | 0.5 | -0.693004 | -0.026337 | -0.00014318 |  |  |
| 4 | 0.5 | -0.693147 | -0.000143 | -1.8E-07 |  |  |
| 8 | 0.5 | -0.693147 | 0 | -1.8E-07 |  |  |
| 16 | 0.5 | -0.693147 | 0 | -1.8E-07 |  |  |
| 32 | 0.5 | -0.693147 | 0 | -1.8E-07 |  |  |
| 64 | 0.5 | -0.693147 | 0 | -1.8E-07 |  |  |
| 128 | 0.5 | -0.693147 | 0 | -1.8E-07 |  |  |
| N | x | Fn(x) | Fn(x)- Fn-1(x) | En |  | 1.609437912 |
| 1 | 5 | 1.333333 |  | 0.276104912 |  |  |
| 2 | 5 | 1.583539 | -0.250206 | 0.025898912 |  |  |
| 4 | 5 | 1.608934 | -0.025395 | 0.000503912 |  |  |
| 8 | 5 | 1.609438 | -0.000504 | -8.8E-08 |  |  |
| 16 | 5 | 1.609438 | 0 | -8.8E-08 |  |  |
| 32 | 5 | 1.609438 | 0 | -8.8E-08 |  |  |
| 64 | 5 | 1.609438 | 0 | -8.8E-08 |  |  |
| 128 | 5 | 1.609438 | 0 | -8.8E-08 |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| N | x | Fn(x) | Fn(x)- Fn-1(x) | En |  | 0 |
| 1 | 1 | 0 |  | 0 |  |  |
| 2 | 1 | 0 | 0 | 0 |  |  |
| 4 | 1 | 0 | 0 | 0 |  |  |
| 8 | 1 | 0 | 0 | 0 |  |  |
| 16 | 1 | 0 | 0 | 0 |  |  |
| 32 | 1 | 0 | 0 | 0 |  |  |
| 64 | 1 | 0 | 0 | 0 |  |  |
| 128 | 1 | 0 | 0 | 0 |  |  |

11 ln(x)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| N | x | Fn(x) | Fn(x)- Fn-1(x) | En |  | 0 |
| 1 | 1 | 0 |  | 0 |  |  |
| 2 | 1 | 0 | 0 | 0 |  |  |
| 4 | 1 | 0 | 0 | 0 |  |  |
| 8 | 1 | 0 | 0 | 0 |  |  |
| 16 | 1 | 0 | 0 | 0 |  |  |
| 32 | 1 | 0 | 0 | 0 |  |  |
| 64 | 1 | 0 | 0 | 0 |  |  |
| 128 | 1 | 0 | 0 | 0 |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| N | x | Fn(x) | Fn(x)- Fn-1(x) | En |  | 1.609437912 |
| 1 | 5 | 0.8 |  | 0.809437912 |  |  |
| 2 | 5 | 1.12 | -0.32 | 0.489437912 |  |  |
| 4 | 5 | 1.393067 | -0.273067 | 0.216370912 |  |  |
| 8 | 5 | 1.553224 | -0.160157 | 0.056213912 |  |  |
| 16 | 5 | 1.603886 | -0.050662 | 0.005551912 |  |  |
| 32 | 5 | 1.609351 | -0.005465 | 8.6912E-05 |  |  |
| 64 | 5 | 1.609438 | -8.7E-05 | -8.8E-08 |  |  |
| 128 | 5 | 1.609438 | 0 | -8.8E-08 |  |  |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| N | x | Fn(x) | Fn(x)- Fn-1(x) | En |  | -0.69314718 |
| 1 | 0.5 | -1 |  | 0.30685282 |  |  |
| 2 | 0.5 | -0.5 | 0.5 | -0.19314718 |  |  |
| 4 | 0.5 | -0.583333 | -0.083333 | -0.10981418 |  |  |
| 8 | 0.5 | -0.634524 | -0.051191 | -0.05862318 |  |  |
| 16 | 0.5 | -0.662872 | -0.028348 | -0.03027518 |  |  |
| 32 | 0.5 | -0.677766 | -0.014894 | -0.01538118 |  |  |
| 64 | 0.5 | -0.685396 | -0.00763 | -0.00775118 |  |  |
| 128 | 0.5 | -0.689256 | -0.00386 | -0.00389118 |  |  |

Conclusiones

Bibliografías