

UNIVERSIDAD GALILEO

Postgrado en Análisis y Predicción de Datos

Curso: Algoritmos en la Ciencia de Datos Horario: lunes: 18:00 – 21:00

Tutor: PhD. Alberth Alvarado



Laboratorio No. 2

Galileo
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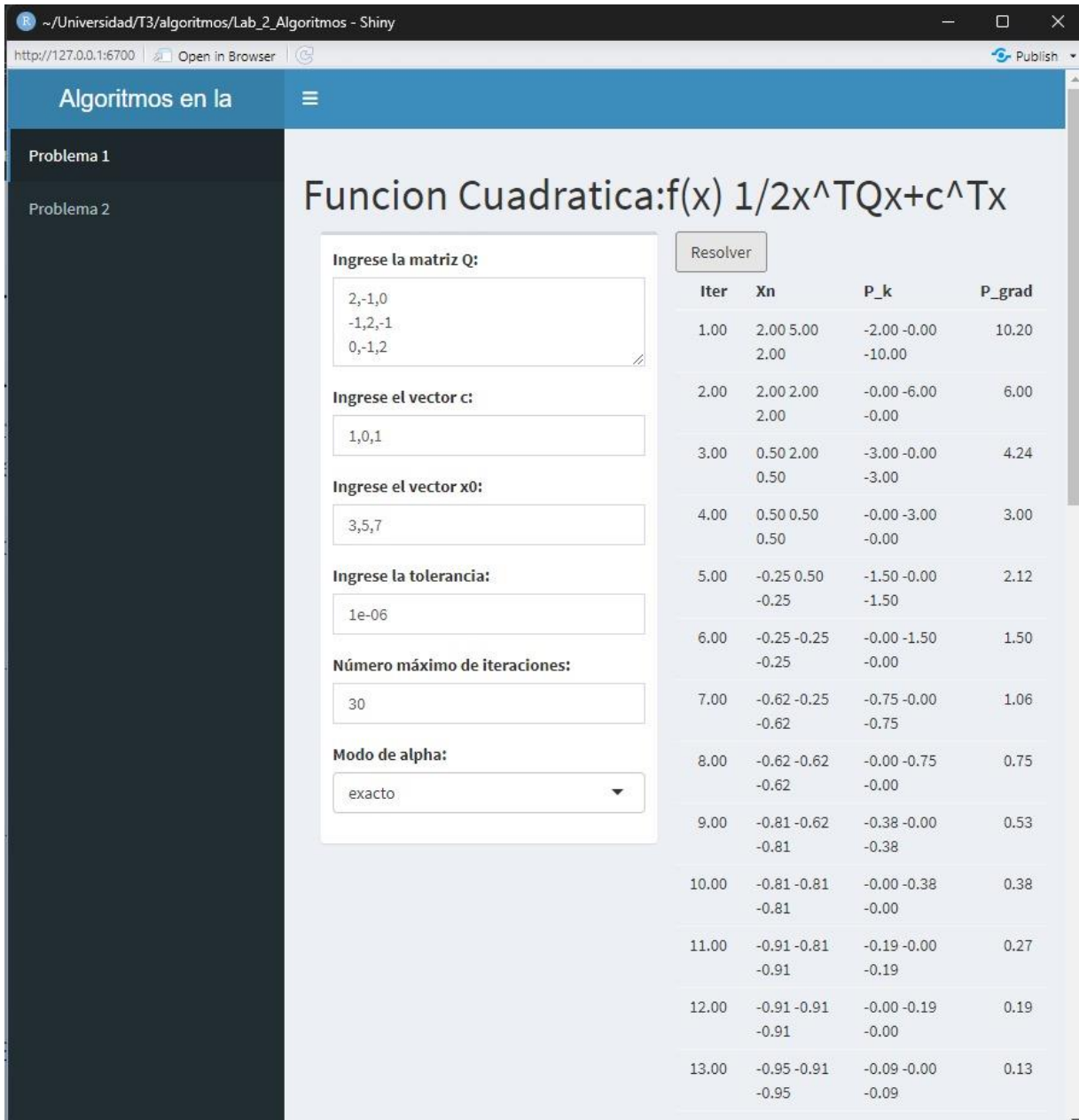
Edgar Geovany Ocaña Orozco – 24010004
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Guatemala, 01 de septiembre de 2024

2. SECCIÓN DOCUMENTAL DE EXPERIMENTACIÓN

1.) Función Cuadrática

Step size exacto:



Algoritmos en la

Problema 1

Problema 2

Funcion Cuadratica: $f(x) = \frac{1}{2}x^T Q x + c^T x$

Ingrese la matriz Q:

2,-1,0
-1,2,-1
0,-1,2

Ingrese el vector c:

1,0,1

Ingrese el vector x0:

3,5,7

Ingrese la tolerancia:

1e-06

Número máximo de iteraciones:

30

Modo de alpha:

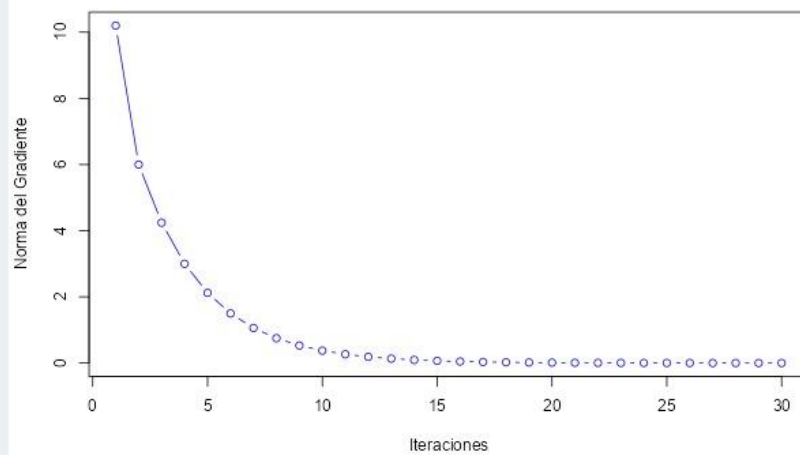
exacto

Resolver

Iter	Xn	P_k	P_grad
1.00	2.00 5.00 2.00	-2.00 -0.00 -10.00	10.20
2.00	2.00 2.00 2.00	-0.00 -6.00 -0.00	6.00
3.00	0.50 2.00 0.50	-3.00 -0.00 -3.00	4.24
4.00	0.50 0.50 0.50	-0.00 -3.00 -0.00	3.00
5.00	-0.25 0.50 -0.25	-1.50 -0.00 -1.50	2.12
6.00	-0.25 -0.25 -0.25	-0.00 -1.50 -0.00	1.50
7.00	-0.62 -0.25 -0.62	-0.75 -0.00 -0.75	1.06
8.00	-0.62 -0.62 -0.62	-0.00 -0.75 -0.00	0.75
9.00	-0.81 -0.62 -0.81	-0.38 -0.00 -0.38	0.53
10.00	-0.81 -0.81 -0.81	-0.00 -0.38 -0.00	0.38
11.00	-0.91 -0.81 -0.91	-0.19 -0.00 -0.19	0.27
12.00	-0.91 -0.91 -0.91	-0.00 -0.19 -0.00	0.19
13.00	-0.95 -0.91 -0.95	-0.09 -0.00 -0.09	0.13

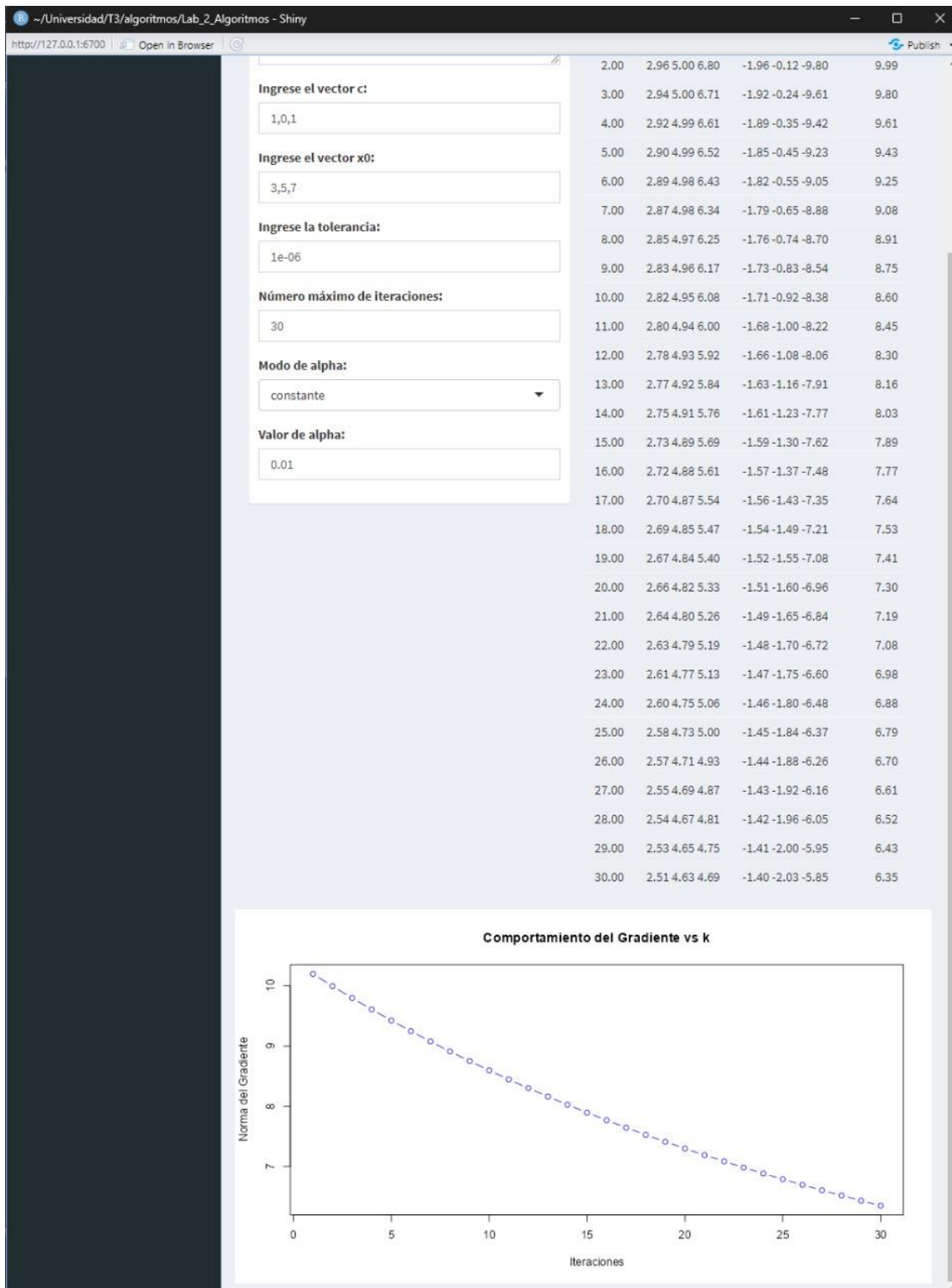
22.00	-1.00 -1.00	-0.00 -0.01	0.01
	-1.00	-0.00	
23.00	-1.00 -1.00	-0.00 -0.00	0.00
	-1.00	-0.00	
24.00	-1.00 -1.00	-0.00 -0.00	0.00
	-1.00	-0.00	
25.00	-1.00 -1.00	-0.00 -0.00	0.00
	-1.00	-0.00	
26.00	-1.00 -1.00	-0.00 -0.00	0.00
	-1.00	-0.00	
27.00	-1.00 -1.00	-0.00 -0.00	0.00
	-1.00	-0.00	
28.00	-1.00 -1.00	-0.00 -0.00	0.00
	-1.00	-0.00	
29.00	-1.00 -1.00	-0.00 -0.00	0.00
	-1.00	-0.00	
30.00	-1.00 -1.00	-0.00 -0.00	0.00
	-1.00	-0.00	

Comportamiento del Gradiente vs k

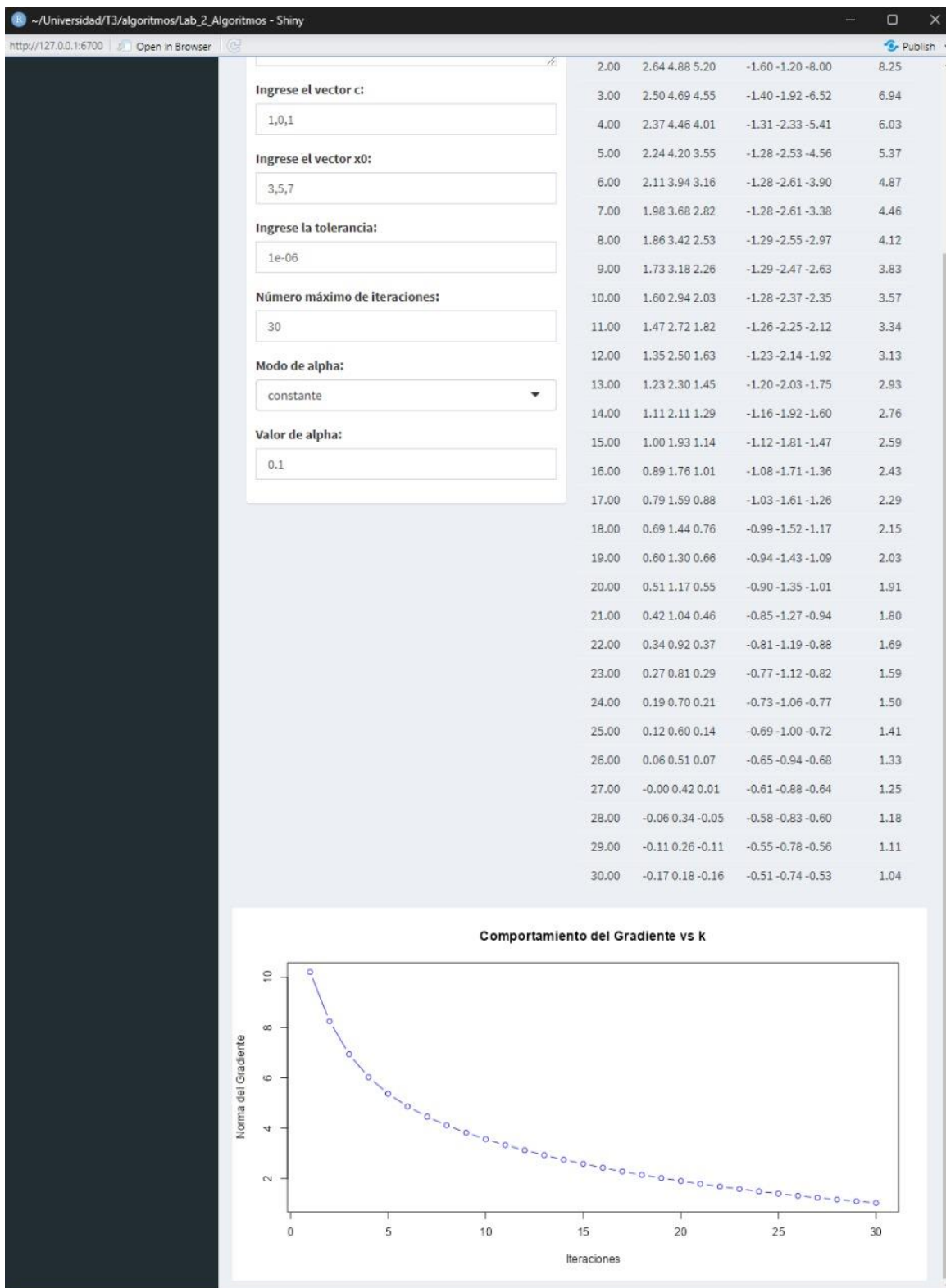


Step size constante:

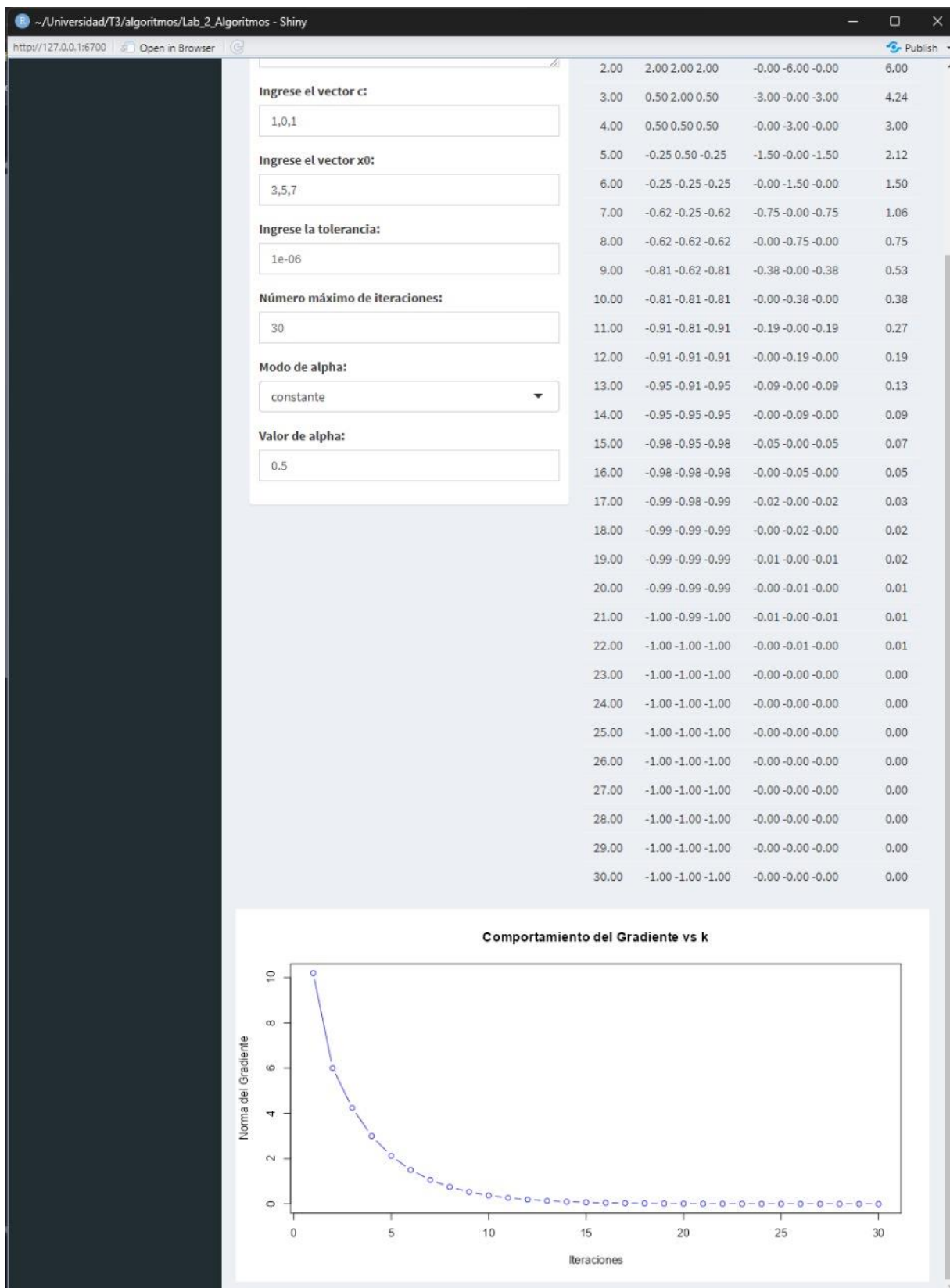
0.001

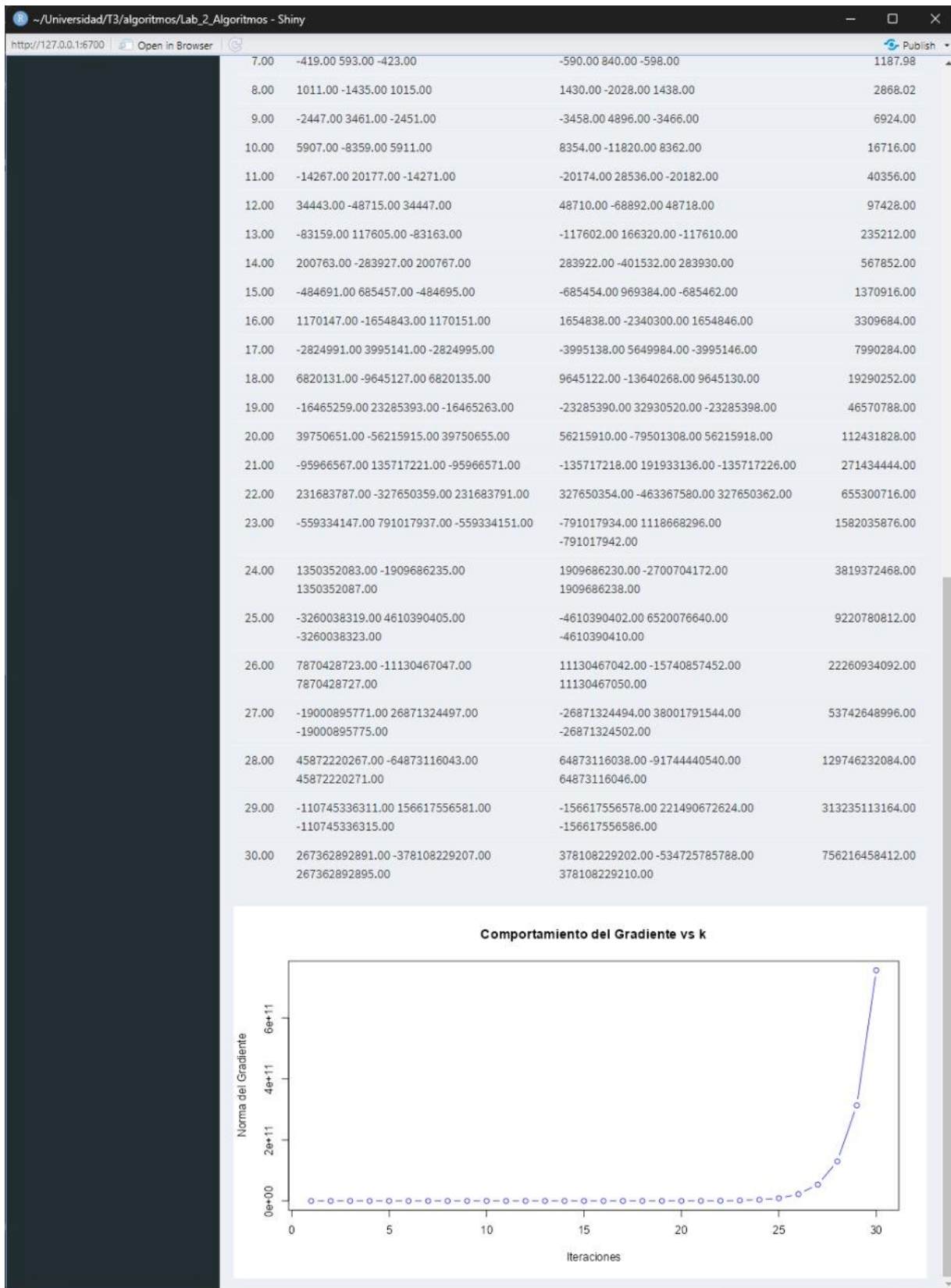


0.01

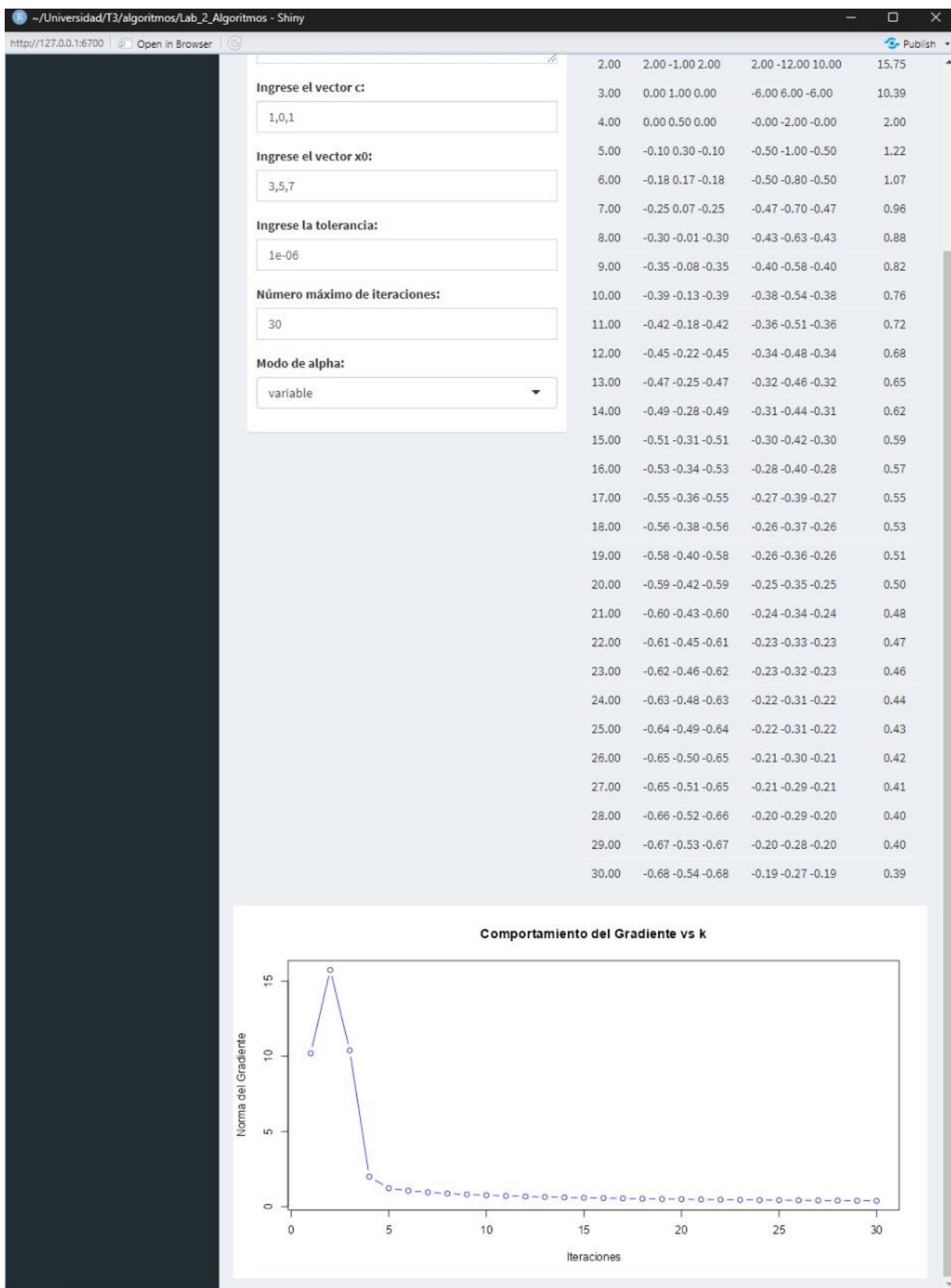


0.5



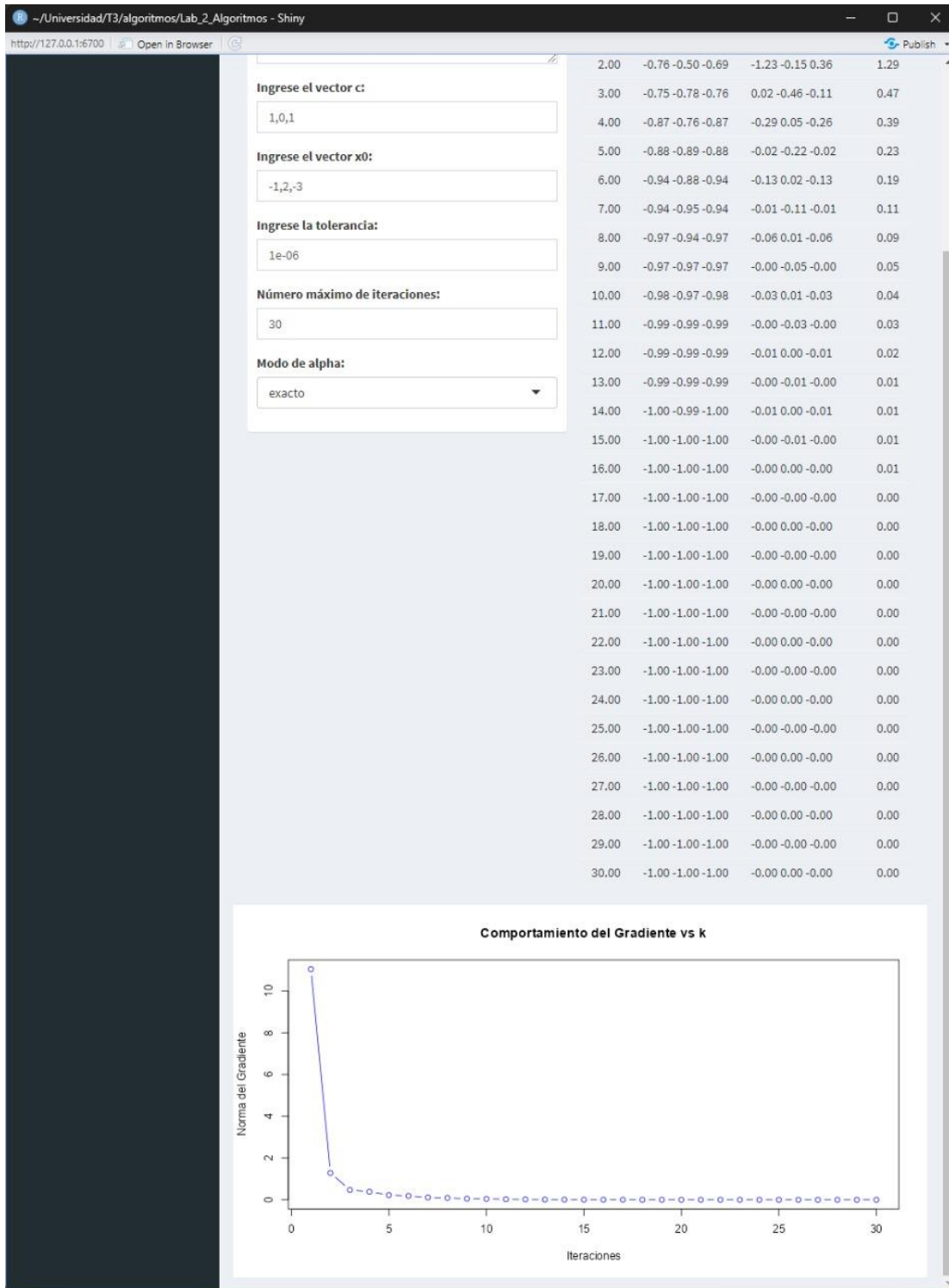


Step size variable:



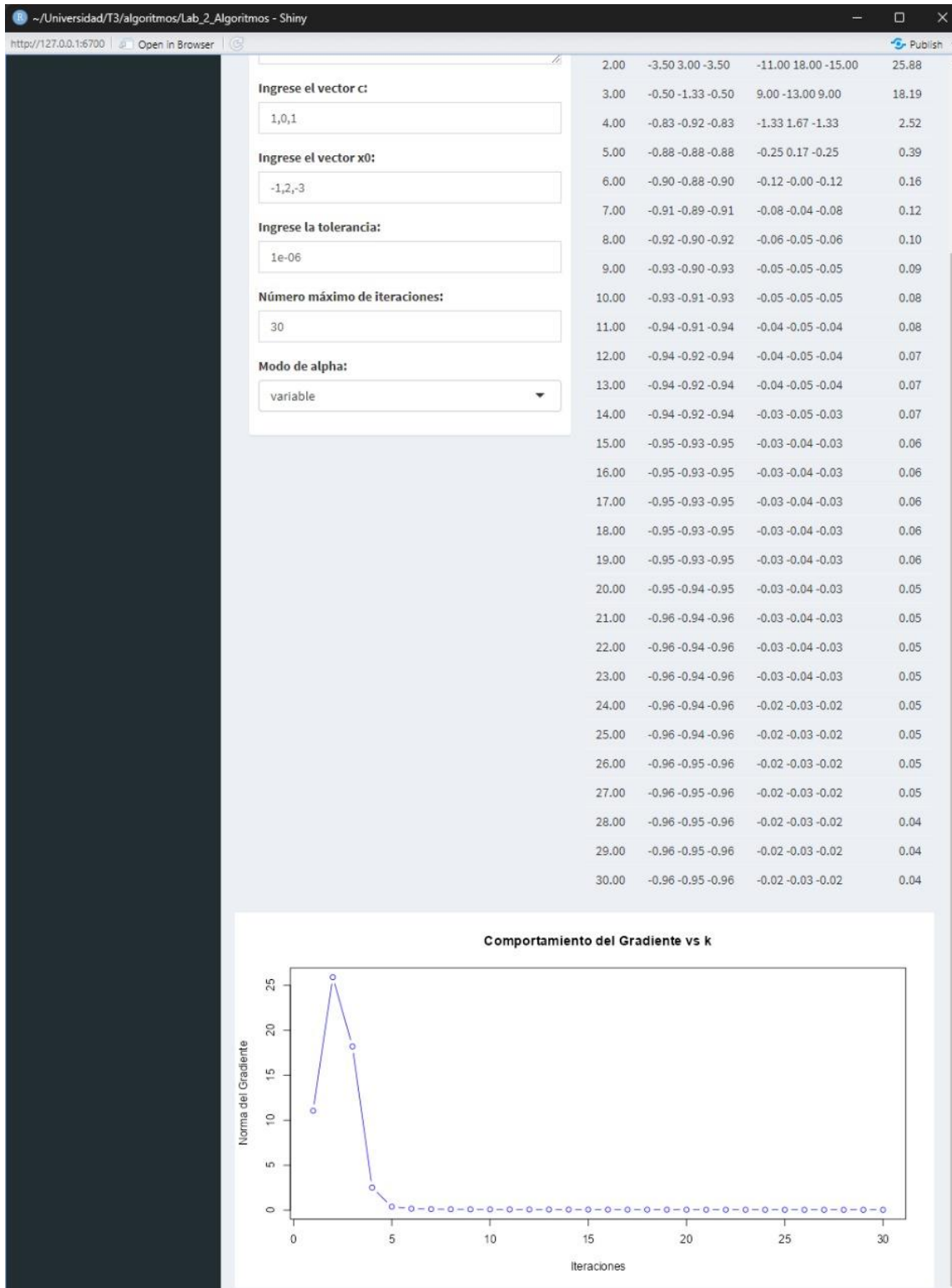
$x_0 = [-1, 2, -3]$

Exacto



$x_0 = [-1, 2, -3]$

variable



Funcion Cuadratica: $f(x) = \frac{1}{2}x^T Q x + c^T x$

Ingrese la matriz Q:

2,-1,0

-1,2,-1

0,-1,2

Ingrese el vector c:

1,0,1

Ingrese el vector x0:

-1,2,-3

Ingrese la tolerancia:

1e-06

Número máximo de iteraciones:

1000

Modo de alpha:

constante

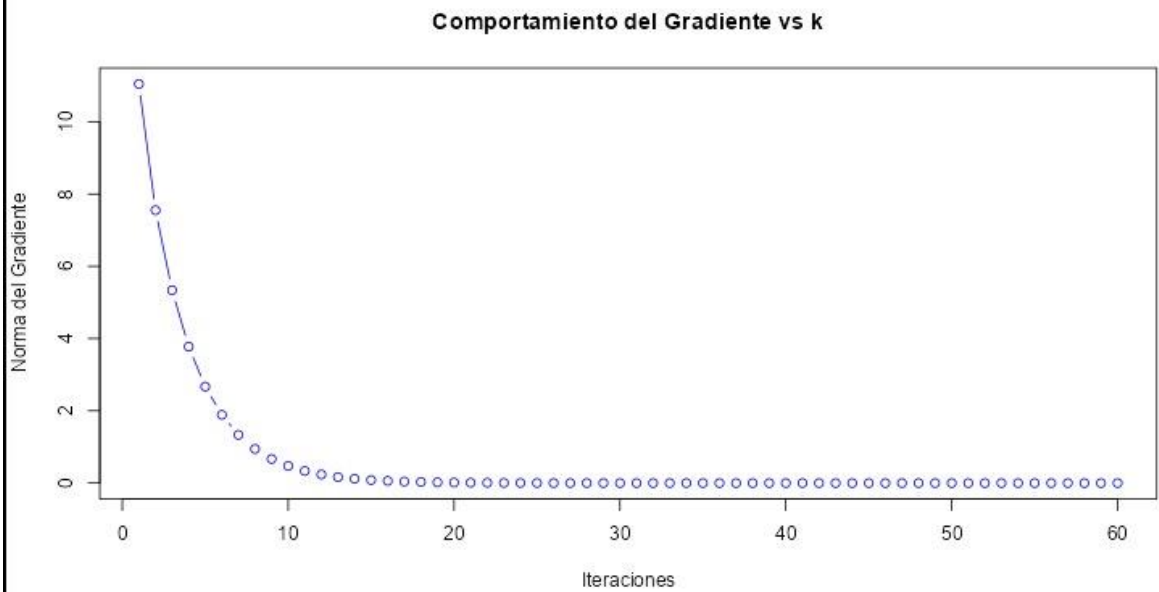
Valor de alpha:

0.5

Resolver

Iter	Xn	P_k	P_grad
1.00	0.50 -2.00 0.50	3.00 -8.00 7.00	11.05
2.00	-1.50 0.50 -1.50	-4.00 5.00 -4.00	7.55
3.00	-0.25 -1.50 -0.25	2.50 -4.00 2.50	5.34
4.00	-1.25 -0.25 -1.25	-2.00 2.50 -2.00	3.77
5.00	-0.62 -1.25 -0.62	1.25 -2.00 1.25	2.67
6.00	-1.12 -0.62 -1.12	-1.00 1.25 -1.00	1.89
7.00	-0.81 -1.12 -0.81	0.62 -1.00 0.62	1.33
8.00	-1.06 -0.81 -1.06	-0.50 0.62 -0.50	0.94
9.00	-0.91 -1.06 -0.91	0.31 -0.50 0.31	0.67
10.00	-1.03 -0.91 -1.03	-0.25 0.31 -0.25	0.47
11.00	-0.95 -1.03 -0.95	0.16 -0.25 0.16	0.33
12.00	-1.02 -0.95 -1.02	-0.12 0.16 -0.12	0.24
13.00	-0.98 -1.02 -0.98	0.08 -0.12 0.08	0.17
14.00	-1.01 -0.98 -1.01	-0.06 0.08 -0.06	0.12
15.00	-0.99 -1.01 -0.99	0.04 -0.06 0.04	0.08
16.00	-1.00 -0.99 -1.00	-0.03 0.04 -0.03	0.06
17.00	-0.99 -1.00 -0.99	0.02 -0.03 0.02	0.04
18.00	-1.00 -0.99 -1.00	-0.02 0.02 -0.02	0.03
19.00	-1.00 -1.00 -1.00	0.01 -0.02 0.01	0.02
20.00	-1.00 -1.00 -1.00	-0.01 0.01 -0.01	0.01
21.00	-1.00 -1.00 -1.00	0.00 -0.01 0.00	0.01
22.00	-1.00 -1.00 -1.00	-0.00 0.00 -0.00	0.01
23.00	-1.00 -1.00 -1.00	0.00 -0.00 0.00	0.01
24.00	-1.00 -1.00 -1.00	-0.00 0.00 -0.00	0.00
25.00	-1.00 -1.00 -1.00	0.00 -0.00 0.00	0.00
26.00	-1.00 -1.00 -1.00	-0.00 0.00 -0.00	0.00
27.00	-1.00 -1.00 -1.00	0.00 -0.00 0.00	0.00
28.00	-1.00 -1.00 -1.00	-0.00 0.00 -0.00	0.00
29.00	-1.00 -1.00 -1.00	0.00 -0.00 0.00	0.00
30.00	-1.00 -1.00 -1.00	-0.00 0.00 -0.00	0.00
31.00	-1.00 -1.00 -1.00	0.00 -0.00 0.00	0.00
32.00	-1.00 -1.00 -1.00	-0.00 0.00 -0.00	0.00
33.00	-1.00 -1.00 -1.00	0.00 -0.00 0.00	0.00
34.00	-1.00 -1.00 -1.00	-0.00 0.00 -0.00	0.00
35.00	-1.00 -1.00 -1.00	0.00 -0.00 0.00	0.00
36.00	-1.00 -1.00 -1.00	-0.00 0.00 -0.00	0.00

51.00	-1.00	-1.00	-1.00	0.00	-0.00	0.00	0.00
52.00	-1.00	-1.00	-1.00	-0.00	0.00	-0.00	0.00
53.00	-1.00	-1.00	-1.00	0.00	-0.00	0.00	0.00
54.00	-1.00	-1.00	-1.00	-0.00	0.00	-0.00	0.00
55.00	-1.00	-1.00	-1.00	0.00	-0.00	0.00	0.00
56.00	-1.00	-1.00	-1.00	-0.00	0.00	-0.00	0.00
57.00	-1.00	-1.00	-1.00	0.00	-0.00	0.00	0.00
58.00	-1.00	-1.00	-1.00	-0.00	0.00	-0.00	0.00
59.00	-1.00	-1.00	-1.00	0.00	-0.00	0.00	0.00
60.00	-1.00	-1.00	-1.00	-0.00	0.00	-0.00	0.00



Problema 2

$x_0 = (0; 0)^T$ y un step-size de $_k = 0.05$ para todo k

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Algoritmos en la

Problema 1

Problema 2

Rosenbrock's Function: $f(x_1, x_2) = 100(x_2 - x_1^2)^2 + (1 - x_1)^2$

Ingrese el vector X:

0,0

Valor de alpha:

0.05

Ingrese el Error:

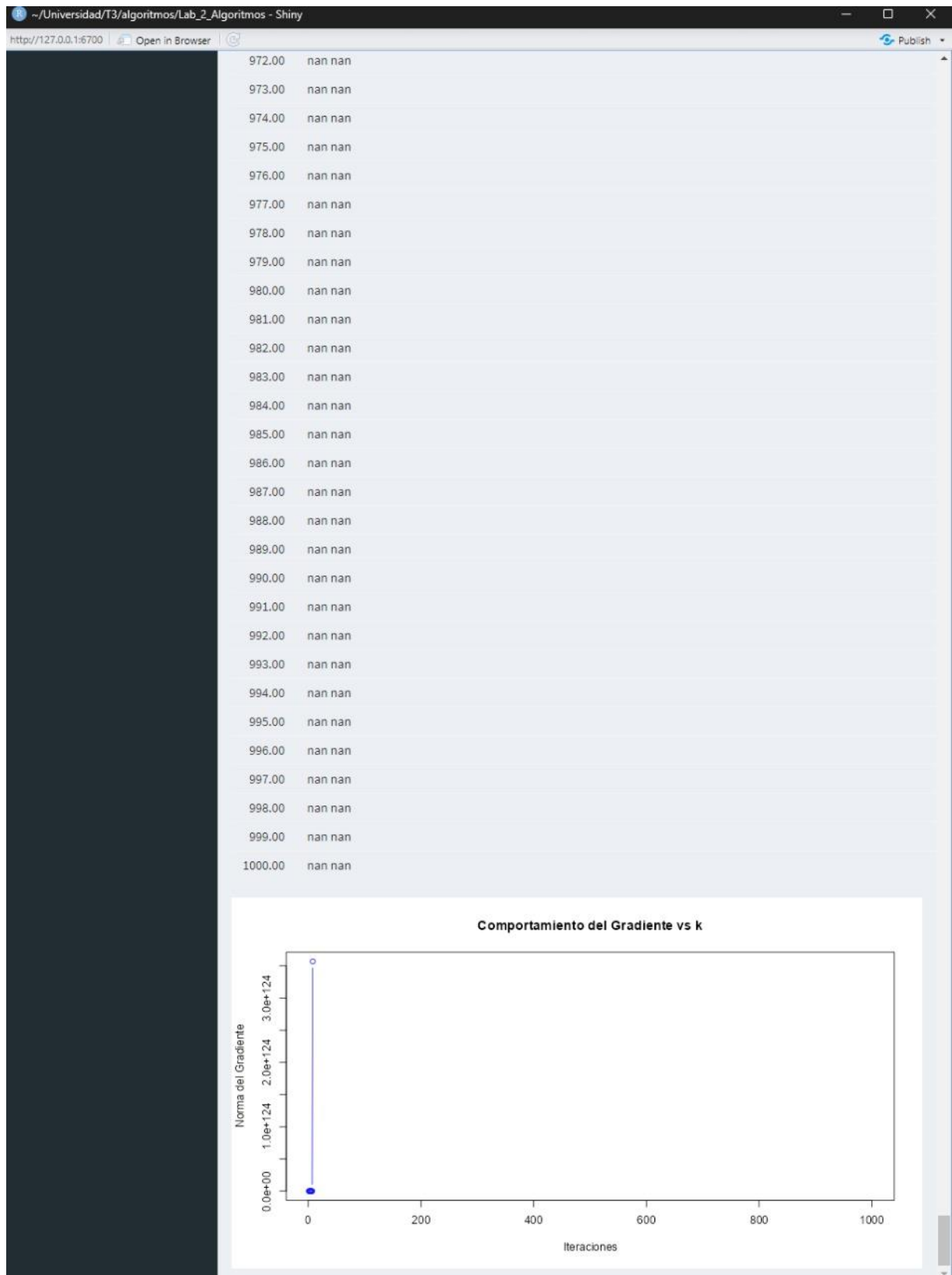
1e-08

Número máximo de iteraciones:

1000

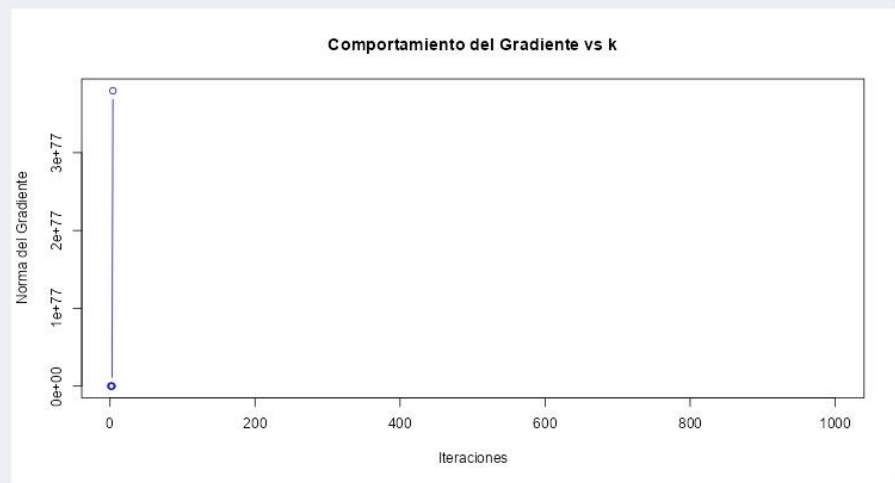
Resolver

Iter	Xn
1.00	0.10 0.00
2.00	0.17 0.10
3.00	0.49 -0.61
4.00	-7.92 7.95
5.00	8678.67 556.12
6.00	-13073350411199.66 753188804.78
7.00	44687977683085753474136896755011476783104.00 1709124909740142724743430144.00
8.00	-1784851547338886403155135149313538080959021308270725078914813340310087634032210888150148004787184
9.00	inf 31856950460380169769304761053801702897964488389871532479089266026206108601838365116117476866528365
10.00	nan inf
11.00	nan nan
12.00	nan nan
13.00	nan nan
14.00	nan nan
15.00	nan nan
16.00	nan nan
17.00	nan nan
18.00	nan nan
19.00	nan nan
20.00	nan nan
21.00	nan nan
22.00	nan nan
23.00	nan nan
24.00	nan nan
25.00	nan nan



$x_0 = (2,0)$

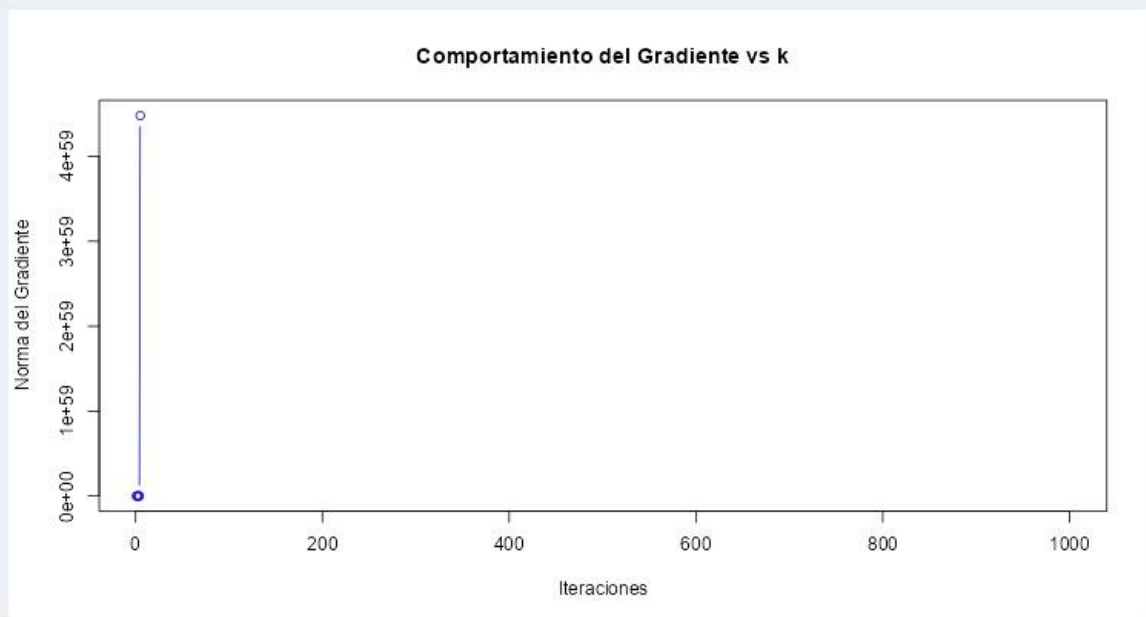
990.00	nan nan
991.00	nan nan
992.00	nan nan
993.00	nan nan
994.00	nan nan
995.00	nan nan
996.00	nan nan
997.00	nan nan
998.00	nan nan
999.00	nan nan
1000.00	nan nan



$x_0 = (0.2)$

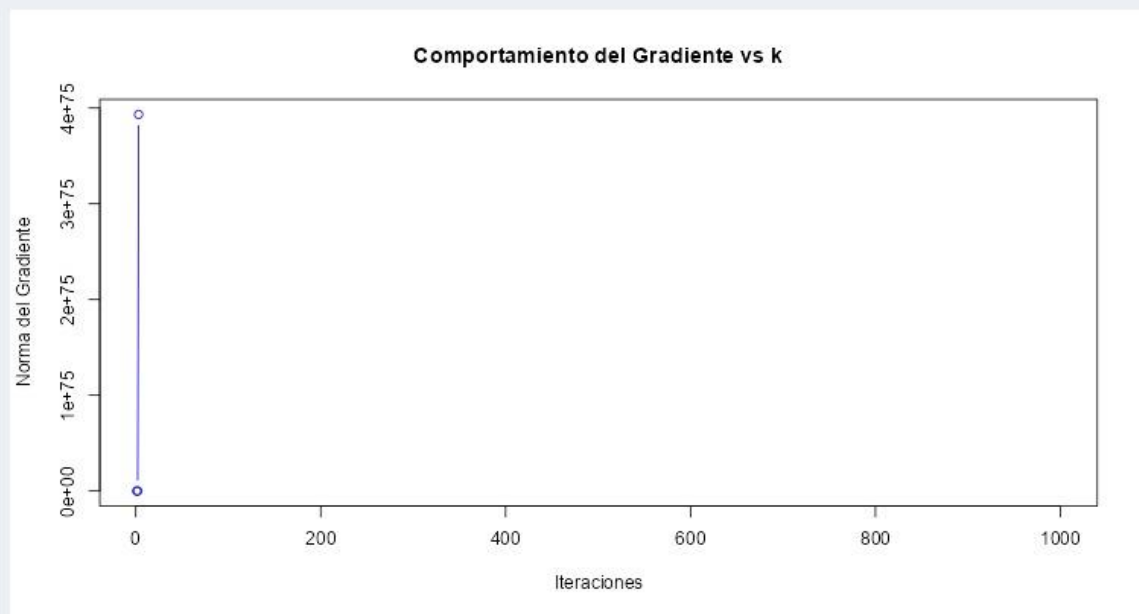
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990.00	nan nan
991.00	nan nan
992.00	nan nan
993.00	nan nan
994.00	nan nan
995.00	nan nan
996.00	nan nan
997.00	nan nan
998.00	nan nan
999.00	nan nan
1000.00	nan nan



$\mathbf{x}_0 = (134, 235)$

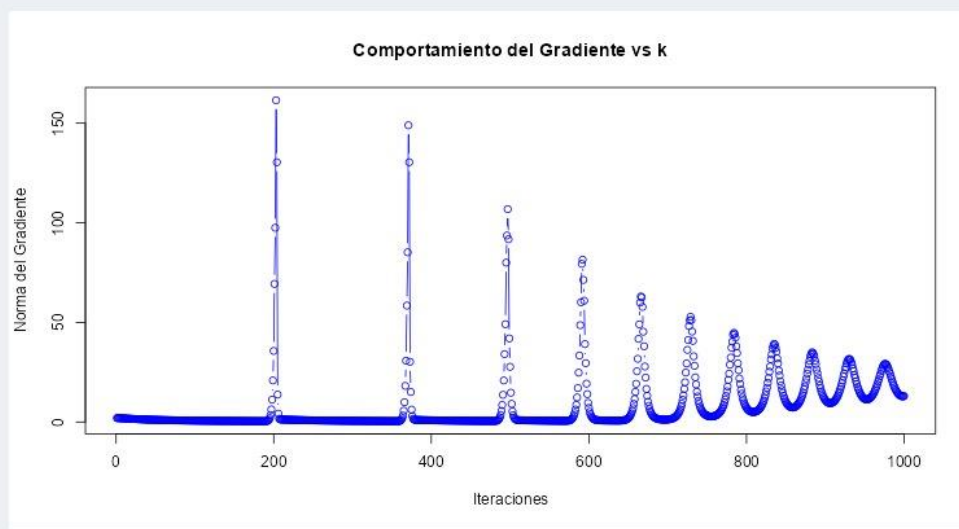
992.00	nan nan
993.00	nan nan
994.00	nan nan
995.00	nan nan
996.00	nan nan
997.00	nan nan
998.00	nan nan
999.00	nan nan
1000.00	nan nan



$\alpha_k = 0.001$

$x_0 = (0,0)$

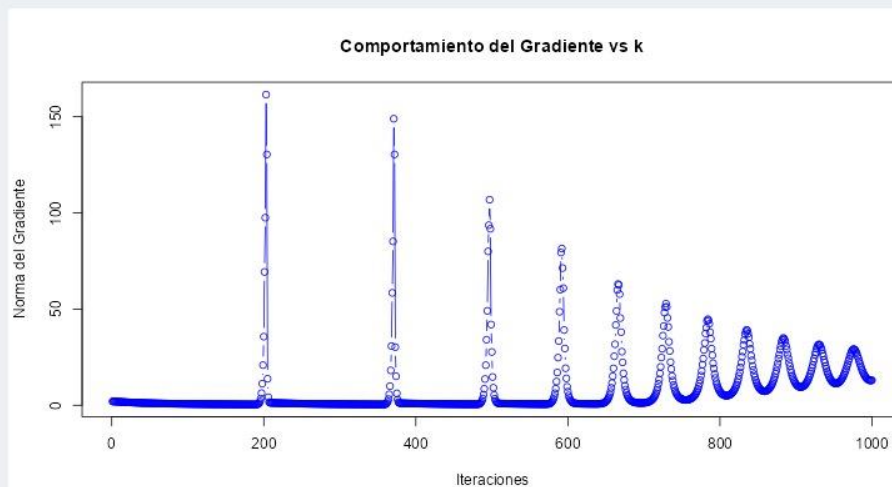
975.00	0.45	0.31	-21.17	19.92	29.07
976.00	0.55	0.20	20.09	-21.20	29.20
977.00	0.44	0.30	-21.04	20.01	29.03
978.00	0.54	0.20	19.59	-20.85	28.61
979.00	0.44	0.29	-19.95	19.28	27.74
980.00	0.53	0.19	18.41	-19.59	26.89
981.00	0.44	0.28	-18.21	17.94	25.56
982.00	0.53	0.20	16.83	-17.76	24.47
983.00	0.45	0.28	-16.22	16.30	23.00
984.00	0.52	0.20	15.15	-15.76	21.86
985.00	0.45	0.27	-14.30	14.64	20.47
986.00	0.52	0.20	13.59	-13.88	19.42
987.00	0.45	0.27	-12.63	13.14	18.23
988.00	0.52	0.21	12.25	-12.28	17.34
989.00	0.46	0.27	-11.28	11.88	16.39
990.00	0.52	0.21	11.18	-11.00	15.68
991.00	0.46	0.27	-10.25	10.89	14.96
992.00	0.52	0.22	10.38	-10.04	14.44
993.00	0.47	0.27	-9.52	10.17	13.93
994.00	0.52	0.22	9.84	-9.37	13.59
995.00	0.47	0.27	-9.06	9.69	13.27
996.00	0.52	0.22	9.52	-8.97	13.08
997.00	0.48	0.27	-8.85	9.44	12.94
998.00	0.52	0.23	9.42	-8.80	12.89
999.00	0.48	0.27	-8.87	9.40	12.92
1000.00	0.53	0.23	9.53	-8.87	13.02



$\alpha_k = 0.001$

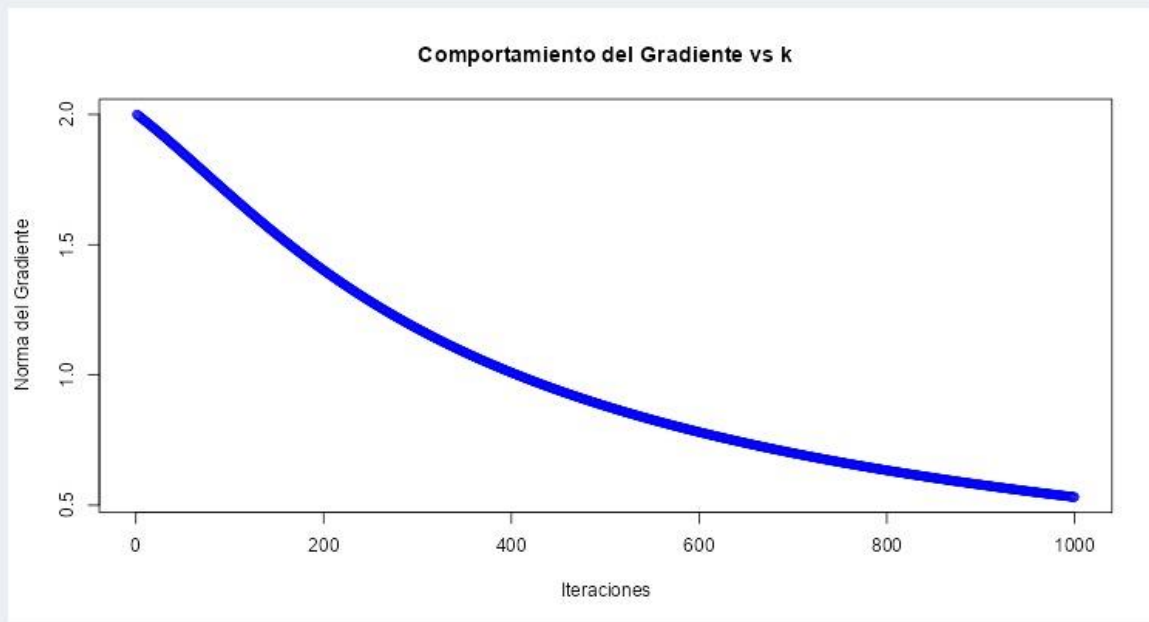
$x_0 = (0,0)$

975.00	0.45	0.31	-21.17	19.92	29.07
976.00	0.55	0.20	20.09	-21.20	29.20
977.00	0.44	0.30	-21.04	20.01	29.03
978.00	0.54	0.20	19.59	-20.85	28.61
979.00	0.44	0.29	-19.95	19.28	27.74
980.00	0.53	0.19	18.41	-19.59	26.89
981.00	0.44	0.28	-18.21	17.94	25.56
982.00	0.53	0.20	16.83	-17.76	24.47
983.00	0.45	0.28	-16.22	16.30	23.00
984.00	0.52	0.20	15.15	-15.76	21.86
985.00	0.45	0.27	-14.30	14.64	20.47
986.00	0.52	0.20	13.59	-13.88	19.42
987.00	0.45	0.27	-12.63	13.14	18.23
988.00	0.52	0.21	12.25	-12.28	17.34
989.00	0.46	0.27	-11.28	11.88	16.39
990.00	0.52	0.21	11.18	-11.00	15.68
991.00	0.46	0.27	-10.25	10.89	14.96
992.00	0.52	0.22	10.38	-10.04	14.44
993.00	0.47	0.27	-9.52	10.17	13.93
994.00	0.52	0.22	9.84	-9.37	13.59
995.00	0.47	0.27	-9.06	9.69	13.27
996.00	0.52	0.22	9.52	-8.97	13.08
997.00	0.48	0.27	-8.85	9.44	12.94
998.00	0.52	0.23	9.42	-8.80	12.89
999.00	0.48	0.27	-8.87	9.40	12.92
1000.00	0.53	0.23	9.53	-8.87	13.02



0.0007

991.00	0.59 0.34	0.35 0.41	0.54
992.00	0.59 0.34	0.35 0.41	0.53
993.00	0.59 0.34	0.35 0.41	0.53
994.00	0.59 0.34	0.34 0.41	0.53
995.00	0.59 0.34	0.34 0.41	0.53
996.00	0.59 0.34	0.34 0.41	0.53
997.00	0.59 0.34	0.34 0.41	0.53
998.00	0.59 0.35	0.34 0.41	0.53
999.00	0.59 0.35	0.34 0.41	0.53
1000.00	0.59 0.35	0.34 0.41	0.53



3. SECCIÓN DOCUMENTAL DE CONCLUSIONES

- 1) **¿Que sucede con el algoritmo para las distintas elecciones de α_k ?** Con los con un valor de 0.5 el algoritmo tiende a tener un descenso de gradiente bastante rapido, y con un valor de 0.001, el descenso de gradiente lo hace de forma lineal
- 2) **¿Afecta la elección del punto inicial x_0 el comportamiento del algoritmo?** No, los cambios en x_0 no afectan significativamente el comportamiento del algoritmo
- 3) **¿Qué característica particular tiene esta función?** Los valores con un valor de Alpha = 0.05 tienden a infinito rápidamente