

# 數值分析 Quiz 3

C24106082 陳宏彰

## 17. Gauss-Seidel

輸出：

```
n(20):
result: [-7.73502692e+00 -2.07259422e+00 -5.55349941e-01 -1.48805549e-01
-3.98722562e-02 -1.06834754e-02 -2.86164519e-03 -7.63105388e-04
-1.90776351e-04 -5.31736131e-12 1.90776340e-04 7.63105380e-04
2.86164517e-03 1.06834753e-02 3.98722562e-02 1.48805549e-01
5.55349941e-01 2.07259421e+00 7.73502692e+00 2.88675135e+01] 21 1.0e
difference: [-4.36020997e-10 -4.34338787e-10 -3.30445893e-10 -1.93611904e-10
-9.26321242e-11 -3.85449450e-11 -1.65153603e-11 -1.01933349e-11
-9.58856811e-12 -1.03059017e-11 -1.57903706e-11 6.21950972e-12
-1.04503784e-11 -9.39417988e-12 -8.63850658e-12 -8.46800408e-12
-8.45057357e-12 -8.45545856e-12 4.84519092e-11 -1.55182533e-11]
average diff: 7.344718557402047e-10
```

## 18. conjugate gradient

輸出：

```
n(20): 20
result: [-7.73502692e+00 -2.07259421e+00 -5.55349941e-01 -1.48805549e-01
-3.98722562e-02 -1.06834753e-02 -2.86164518e-03 -7.63105381e-04
-1.90776345e-04 1.69406589e-20 1.90776345e-04 7.63105381e-04
2.86164518e-03 1.06834753e-02 3.98722562e-02 1.48805549e-01
5.55349941e-01 2.07259421e+00 7.73502692e+00 2.88675135e+01] 9
difference: [ 0.00000000e+00 0.00000000e+00 8.88178420e-16 -1.11022302e-16
-2.77555756e-17 6.93889390e-18 3.46944695e-18 -4.77048956e-18
4.22838847e-18 1.76182853e-19 -4.44522891e-18 3.46944695e-18
-3.46944695e-18 0.00000000e+00 2.77555756e-17 0.00000000e+00
0.00000000e+00 -1.77635684e-15 3.55271368e-15 0.00000000e+00]
average diff: 4.0718657139714276e-15
```

# 速度差異

benchmark tool: [hyperfine](#)

n	Gauss-Seidel(ms)	conjugate gradient(ms)
100	179.8±8.7	100.9±14.8
200	340.4±7.3	100.8±6.2
300	633.2±13.9	103.0±5.7
400	1020.0±14.9	109.0±6.6
500	1535.7±28.9	118.5±5.4
600	2168.0±39.8	129.6±6.4
700	2920.8±52.0	141.7±6.7
800	3763.8±68.2	162.0±12.2
900	4726.6±97.5	183.9±22.7
1000	5879.5±73.4	199.7±13.4

Gauss-Seidel和conjugate gradient

