

數值分析作業五報告

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Q1. 迭代結果:

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Gauss-Seidel method:
Iterator Times: 456
20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000
20.000 24.945 22.916 21.940 21.391 21.047 20.818 20.663 20.562 20.505 20.486 20.505 20.562 20.663 20.818 21.047 21.391 21.940 22.916 24.945 30.000
30.000 26.864 24.781 23.451 22.577 21.980 21.563 21.273 21.081 20.971 20.935 20.971 21.081 21.273 21.563 21.980 22.577 23.451 24.781 26.864 30.000
30.000 27.731 25.891 24.507 23.485 22.732 22.180 21.784 21.517 21.362 21.312 21.362 21.517 21.784 22.180 22.732 23.485 24.507 25.891 27.731 30.000
30.000 28.170 26.546 25.200 24.125 23.284 22.641 22.167 21.841 21.650 21.588 21.650 21.841 22.167 22.641 23.284 24.125 25.200 26.546 28.170 30.000
30.000 28.402 26.921 25.624 24.531 23.638 22.933 22.401 22.030 21.810 21.738 21.810 22.030 22.401 22.933 23.638 24.531 25.624 26.921 28.402 30.000
30.000 28.518 27.113 25.842 24.735 23.805 23.053 22.475 22.066 21.823 21.743 21.823 22.066 22.475 23.053 23.805 24.735 25.842 27.113 28.518 30.000
30.000 28.556 27.172 25.896 24.764 23.794 22.998 22.379 21.938 21.674 21.587 21.674 21.938 22.379 22.998 23.794 24.764 25.896 27.172 28.556 30.000
30.000 28.534 27.122 25.808 24.629 23.610 22.765 22.104 21.632 21.349 21.257 21.349 21.632 22.104 22.765 23.610 24.629 25.808 27.122 28.534 30.000
30.000 28.460 26.973 25.585 24.335 23.250 22.349 21.642 21.136 20.832 20.731 20.832 21.136 21.642 22.349 23.250 24.335 25.585 26.973 28.460 30.000
30.000 28.333 26.724 25.224 23.876 22.707 21.739 20.980 20.437 20.111 20.003 20.111 20.437 20.980 21.739 22.707 23.876 25.224 26.724 28.333 30.000
30.000 28.148 26.366 24.713 23.236 21.965 20.918 20.103 19.522 19.174 19.038 19.174 19.522 20.103 20.918 21.965 23.236 24.713 26.366 28.148 30.000
30.000 27.894 25.878 24.026 22.389 20.998 19.865 18.991 18.373 18.005 17.882 18.005 18.373 18.991 19.865 20.998 22.389 24.026 25.878 27.894 30.000
30.000 27.550 25.226 23.123 21.298 19.774 18.553 17.624 16.974 16.589 16.462 16.589 16.974 17.624 18.553 19.774 21.298 23.123 25.226 27.550 30.000
30.000 27.081 24.352 21.942 19.905 18.248 16.949 15.979 15.309 14.916 14.787 14.916 15.309 15.979 16.949 18.248 19.905 21.942 24.352 27.081 30.000
30.000 26.422 23.161 20.386 18.132 16.363 15.017 14.034 13.367 12.979 12.853 12.979 13.367 14.034 15.017 16.363 18.132 20.386 23.161 26.422 30.000
30.000 25.445 21.483 18.310 15.876 14.055 12.721 11.775 11.144 10.783 10.665 10.783 11.144 11.775 12.721 14.055 15.876 18.310 21.483 25.445 30.000
30.000 23.875 19.018 15.494 13.006 11.260 10.038 9.199 8.652 8.342 8.242 8.342 8.652 9.199 10.038 11.260 13.006 15.494 19.018 23.875 30.000
30.000 21.037 15.220 11.641 9.395 7.939 6.973 6.331 5.921 5.693 5.619 5.693 5.921 6.331 6.973 7.939 9.395 11.641 15.220 21.037 30.000
30.000 15.055 9.182 6.454 4.995 4.129 3.583 3.231 3.010 2.888 2.849 2.888 3.010 3.231 3.583 4.129 4.995 6.454 9.182 15.055 30.000
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SOR method with $w=1.2$ 結果幾乎一樣(因為誤差 <0.0001)，但迭代次數為 313 次

Q2.a 改 boundary condition:

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boundary condition with bx = by = 100.0:
Iterator Times: 348
100.000 100.000 100.000 100.000 100.000 100.000 100.000 100.000 100.000 100.000 100.000 100.000 100.000 100.000 100.000 100.000 100.000 100.000 100.000 100.000
100.000 99.726 99.458 99.205 98.972 98.765 98.589 98.448 98.345 98.282 98.261 98.282 98.345 98.448 98.589 98.765 98.972 99.205 99.458 99.726 100.000
100.000 99.444 98.903 98.390 97.918 97.499 97.143 96.858 96.649 96.523 96.480 96.523 96.649 96.858 97.143 97.499 97.918 98.390 98.903 99.444 100.000
100.000 99.148 98.319 97.533 96.811 96.170 95.626 95.190 94.872 94.679 94.614 94.679 94.872 95.190 95.626 96.170 96.811 97.533 98.319 99.148 100.000
100.000 98.830 97.691 96.613 95.623 94.745 94.001 93.405 92.971 92.707 92.619 92.707 92.971 93.405 94.001 94.745 95.623 96.613 97.691 98.830 100.000
100.000 98.481 97.002 95.605 94.323 93.188 92.226 91.458 90.899 90.560 90.446 90.560 90.899 91.458 92.226 93.188 94.323 95.605 97.002 98.481 100.000
100.000 98.090 96.234 94.450 92.875 91.457 90.258 89.302 88.608 88.187 88.046 88.187 88.608 89.302 90.258 91.457 92.875 94.450 96.234 98.090 100.000
100.000 97.647 95.362 93.207 91.240 89.507 88.046 86.885 86.043 85.534 85.364 85.534 86.043 86.885 88.046 89.507 91.240 93.207 95.362 97.647 100.000
100.000 97.136 94.359 91.747 89.371 87.286 85.535 84.148 83.146 82.542 82.342 82.542 83.146 84.148 85.535 87.286 89.371 91.747 94.359 97.136 100.000
100.000 96.540 93.190 90.052 87.210 84.731 82.659 81.027 79.852 79.144 78.908 79.144 79.852 81.027 82.659 84.731 87.210 90.052 93.190 96.540 100.000
100.000 95.832 91.809 88.060 84.688 81.767 79.345 77.448 76.090 75.275 75.003 75.275 76.090 77.448 79.345 81.767 84.688 88.060 91.809 95.832 100.000
100.000 94.980 90.155 85.691 81.714 78.304 75.504 73.331 71.785 70.862 70.555 70.862 71.785 73.331 75.504 78.304 81.714 85.691 90.155 94.980 100.000
100.000 93.934 88.139 82.836 78.173 74.232 71.038 68.586 66.859 65.832 65.492 65.832 66.859 68.586 71.038 74.232 78.173 82.836 88.139 93.934 100.000
100.000 92.618 85.632 79.339 73.912 69.411 65.828 63.118 61.230 60.117 59.750 60.117 61.230 63.118 65.828 69.411 73.912 79.339 85.632 92.618 100.000
100.000 90.907 82.430 74.978 68.724 63.673 59.744 56.829 54.826 53.656 53.272 53.656 54.826 56.829 59.744 63.673 68.724 74.978 82.430 90.907 100.000
100.000 88.579 78.202 69.419 62.334 56.814 52.647 49.628 47.588 46.411 46.026 46.411 47.588 49.628 52.647 56.814 62.334 69.419 78.202 88.579 100.000
100.000 85.207 72.381 62.161 54.378 48.601 44.403 41.446 39.488 38.372 38.010 38.372 39.488 41.446 44.403 48.601 54.378 62.161 72.381 85.207 100.000
100.000 79.867 63.953 52.467 44.416 38.808 34.918 32.265 30.547 29.580 29.268 29.580 30.547 32.265 34.918 38.808 44.416 52.467 63.953 79.867 100.000
100.000 70.310 51.097 39.339 32.011 27.298 24.196 22.151 20.854 20.134 19.903 20.134 20.854 22.151 24.196 27.298 32.011 39.339 51.097 70.310 100.000
100.000 50.274 30.788 21.780 16.992 14.176 12.415 11.288 10.585 10.198 10.075 10.198 10.585 11.288 12.415 14.176 16.992 21.780 30.788 50.274 100.000
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b 改 source function:

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source function with s = 50000.0:
Iterator Times: 328
20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000 20.000
20.000 25.370 23.774 23.242 23.152 23.278 23.515 23.795 24.060 24.251 24.321 24.251 24.060 23.795 23.515 23.278 23.152 23.242 23.774 25.370 30.000
30.000 27.708 26.483 26.041 26.090 26.445 26.985 27.605 28.192 28.623 28.783 28.623 28.192 27.605 26.985 26.445 26.090 26.041 26.483 27.708 30.000
30.000 28.977 28.410 28.350 28.721 29.428 30.376 31.448 32.482 33.265 33.566 33.265 32.482 31.448 30.376 29.428 28.721 28.350 28.410 28.977 30.000
30.000 29.790 29.828 30.229 31.015 32.170 33.642 35.328 37.035 38.388 38.951 38.388 37.035 35.328 33.642 32.170 31.015 30.229 29.828 29.790 30.000
30.000 30.354 30.886 31.721 32.901 34.586 36.696 39.197 41.901 44.310 45.464 44.310 41.901 39.197 36.696 34.586 32.901 31.721 30.886 30.354 30.000
30.000 30.742 31.639 32.629 34.435 36.571 39.350 42.862 47.073 51.486 54.286 51.486 47.073 42.862 39.350 36.571 34.435 32.629 31.639 30.742 30.000
30.000 30.974 32.098 33.521 35.398 37.904 41.271 45.829 52.043 60.274 68.709 60.274 52.043 45.829 41.271 37.904 35.398 33.521 32.098 30.974 30.000
30.000 31.055 32.258 33.761 35.731 38.376 41.999 47.142 54.995 68.857 100.003 68.857 54.995 47.142 42.000 38.376 35.731 33.761 32.258 31.055 30.000
30.000 30.988 32.118 33.534 35.390 37.870 41.209 45.744 51.938 60.158 68.589 60.158 51.938 45.744 41.209 37.870 35.390 33.534 32.118 30.988 30.000
30.000 30.780 31.692 32.865 34.426 36.504 39.224 42.685 46.857 51.246 54.038 51.246 46.857 42.685 39.224 36.504 34.426 32.865 31.692 30.780 30.000
30.000 30.441 31.005 31.807 32.946 34.497 36.498 38.915 41.558 43.930 45.072 43.930 41.558 38.915 36.498 34.497 32.946 31.807 31.005 30.441 30.000
30.000 29.977 30.080 30.413 31.054 32.040 33.356 34.918 36.530 37.844 38.392 37.844 36.530 34.919 33.356 32.040 31.054 30.413 30.080 29.977 30.000
30.000 29.389 28.923 28.712 28.818 29.251 29.969 30.873 31.800 32.524 32.807 32.524 31.800 30.873 29.969 29.251 28.818 28.712 28.923 29.389 30.000
30.000 28.657 27.511 26.694 26.254 26.176 26.395 26.805 27.273 27.645 27.789 27.645 27.273 26.805 26.395 26.176 26.254 26.694 27.511 28.657 30.000
30.000 27.727 25.772 24.298 23.329 22.806 22.629 22.680 22.840 22.995 23.057 22.995 22.840 22.680 22.629 22.806 23.329 24.298 25.772 27.727 30.000
30.000 26.481 23.550 21.397 19.959 19.090 18.633 18.447 18.414 18.436 18.451 18.436 18.414 18.447 18.633 19.090 19.959 21.397 23.550 26.481 30.000
30.000 24.645 20.552 17.779 16.020 14.962 14.366 14.063 13.920 13.885 13.875 13.885 13.920 14.063 14.366 14.962 16.020 17.779 20.552 24.645 30.000
30.000 21.547 16.234 13.149 11.380 10.371 9.807 9.508 9.360 9.297 9.281 9.297 9.360 9.508 9.807 10.371 11.380 13.149 16.234 21.547 30.000
30.000 15.308 9.686 7.204 5.979 5.334 4.985 4.800 4.706 4.664 4.652 4.664 4.706 4.800 4.985 5.334 5.979 7.204 9.686 15.308 30.000
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Q3.迭代速度分析如下:可以得知當 $w = 1.75$ 時迭代速度最快(60 次)

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w = 1.000 Iterator Times: 456
w = 1.050 Iterator Times: 416
w = 1.100 Iterator Times: 379
w = 1.150 Iterator Times: 345
w = 1.200 Iterator Times: 313
w = 1.250 Iterator Times: 284
w = 1.300 Iterator Times: 257
w = 1.350 Iterator Times: 231
w = 1.400 Iterator Times: 206
w = 1.450 Iterator Times: 183
w = 1.500 Iterator Times: 161
w = 1.550 Iterator Times: 140
w = 1.600 Iterator Times: 119
w = 1.650 Iterator Times: 98
w = 1.700 Iterator Times: 76
w = 1.750 Iterator Times: 60
w = 1.800 Iterator Times: 81
w = 1.850 Iterator Times: 100
w = 1.900 Iterator Times: 154
w = 1.950 Iterator Times: 290
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Q4.作圖如上圖(按 z 可以挑整色光區間、 $+/-$ 可以變換 Q1-2 間的 4 種 T)

因為只有不同的 w 結果幾乎一樣，所以沒有紀錄。

Q5.心得:這次的作業有沒有說明完全是兩個不同次元的等級，色光溫度間的轉換也讓我想了一陣子，學到不少。