

과제1) Discuss the convergence speed of the method.

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C:\WINDOWS\system32\cmd.exe

Bracket of Root # 1 : [2.000000 , 3.000000]
Bracket of Root # 2 : [5.000000 , 6.000000]
Bracket of Root # 3 : [8.000000 , 9.000000]

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Roots Using Bisection # 1 : 2.404826      The Number of Iteration 20
Roots Using Bisection # 2 : 5.520078      The Number of Iteration 20
Roots Using Bisection # 3 : 8.653728      The Number of Iteration 20
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Roots Using Linear interpolation # 1 : 2.404826 The Number of Iteration 6
Roots Using Linear interpolation # 2 : 5.520078 The Number of Iteration 4
Roots Using Linear interpolation # 3 : 8.653728 The Number of Iteration 4
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Roots Using Secant # 1 : 2.404825      The Number of Iteration 5
Roots Using Secant # 2 : 5.520078      The Number of Iteration 5
Roots Using Secant # 3 : 8.653728      The Number of Iteration 4
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Roots Using Newton-Raphson # 1 : 2.404825      The Number of Iteration 3
Roots Using Newton-Raphson # 2 : 5.520078      The Number of Iteration 3
Roots Using Newton-Raphson # 3 : 8.653728      The Number of Iteration 3
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Roots Using Newton with bracketing # 1 : 2.404825      The Number of Iteration 3
Roots Using Newton with bracketing # 2 : 5.520078      The Number of Iteration 3
Roots Using Newton with bracketing # 3 : 8.653728      The Number of Iteration 3
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Roots Using Muller # 1 : 2.404825      The Number of Iteration 4
Roots Using Muller # 2 : 5.520078      The Number of Iteration 4
Roots Using Muller # 3 : 8.653728      The Number of Iteration 4
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-----For My New Function-----
Bracket of Root # 1 : [1.900000 , 2.028571]
Bracket of Root # 2 : [4.985716 , 5.114287]
Bracket of Root # 3 : [7.942861 , 8.071432]
Roots Using Newton with bracketing # 1 : 2.000000      The Number of Iteration 18
Roots Using Newton with bracketing # 2 : 5.000000      The Number of Iteration 18
Roots Using Newton with bracketing # 3 : 8.000000      The Number of Iteration 18
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계속하려면 아무 키나 누르십시오 . . .
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우선 각 방법론의 수렴속도를 위의 결과만을 가지고 비교를 해 보았을 경우에는 다음과 같은 결론이 나온다.

$$Newton - Raphson \cong Newton\ with\ bracketing \leq Muller \leq Secant \leq Linear\ interpolation < Bisection$$

- 1) Newton-Raphson과 Newton with bracketing은 속도차이가 거의 없을 만하다. 왜냐하면, bracketing은 찾고자 하는 범위 내에서 Newton-Raphson을 사용하기 위해서 안전장치를 걸어둔 것과 같기 때문이다.
- 2) Secant와 Muller의 방법을 비교했을 때, Muller가 근소하게 더 빠르다. 왜냐하면 Secant는 단순히 직선으로 근사를 한 것이지만, Muller는 2차 방정식을 이용하여 더욱 자세히 근사를 한 것이기 때문이다.
- 3) 실제로 배운대로 Bisection 방법이 제일 느렸다.

과제 2) Solve one interesting nonlinear equation you want to solve using the routine of rtsafe.c in NR in C.

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C:\WINDOWS\system32\cmd.exe
-----For My New Function-----
Bracket of Root # 1 : [1.900000 , 2.028571]
Bracket of Root # 2 : [4.985716 , 5.114287]
Bracket of Root # 3 : [7.942851 , 8.071432]
Roots Using Newton with bracketing # 1 : 2.000000      The Number of Iteration 18
Roots Using Newton with bracketing # 2 : 5.000000      The Number of Iteration 18
Roots Using Newton with bracketing # 3 : 8.000000      The Number of Iteration 18
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Roots Using Bisection # 1 : 2.000000      The Number of Iteration 17
Roots Using Bisection # 2 : 5.000000      The Number of Iteration 16
Roots Using Bisection # 3 : 8.000000      The Number of Iteration 17
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Maximum number of iterations exceeded in rtnewt
Roots Using Newton-Raphson # 1 : 0.000000      The Number of Iteration 20
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Maximum number of iterations exceeded in rtnewt
Roots Using Newton-Raphson # 2 : 0.000000      The Number of Iteration 20
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Maximum number of iterations exceeded in rtnewt
Roots Using Newton-Raphson # 3 : 0.000000      The Number of Iteration 20
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계속하려면 아무 키나 누르십시오 . . .
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사용한 비선형 방정식은 $f(x) = (x - 2)(x - 5)(x - 8)$ 이다.

해는 정확하게 찾았고, 각 해에 대해서 모두 18번의 Iteration이 있었다.

위의 과제1과 다르게 매우 많은 Iteration이 있었는데, 이를 분석하기 위해서 $f(x)$ 에 대해서 Bisection과 Newton-Raphson 방법을 적용해 보았다. 그 결과, Bisection 방법과 거의 횟수가 비슷했고, Newton-Raphson 방법은 해당 구간에서 벗어나서 Iteration동안에 전혀 적용되지 못함을 알 수 있었다.

따라서, 위의 함수에 대해서 Newton-Raphson 방법은 실질적으로 거의 적용되지 못했고, Bisection위주로 적용되었기 때문에 위와 같은 결과가 나왔음을 알 수 있다.

