Jacob Leonard

Math 467

Project #1

1. Analytically Compute the Gradient and Hessian of the Function:
2. Gradient:
3. Hessian:

1. Roots:
2. Gradient Along Root Values;
   1. = [0,0]

x = [-2,2], y = ix+1

x = [-2,2], y = ix-1

* 1. = [0,0]

x = [-2,2], y = ix+i

* 1. = [0,0]

x = [-2,2], y = ix-i

1. Gradient Near Root Values: D = +.04
   1. These lines are parallel to the root lines, but have different gradients.
   2. = [-1.4698, - 1.4698i]

x = [-2,2}, y = ix+1.04

* Increasing the y value along this root by .04 produces a negative gradient, meaning the function is decreasing
  1. = [1.1107, 1.1107i]

x = [-2,2}, y = ix-.96

* Increasing the y value along this root by .04 produces a positive gradient, meaning the function is increasing in value
  1. = [-0.1789 + 1.2698i, -1.2698 - 0.1789i]

x = [-2,2}, y = ix+i+.04

* Increasing the y value along this root by .04 produces a negative Y gradient, negative real valued X gradient and positive imaginary Y gradient
  1. = [-0.1789 - 1.2698i 1.2698 - 0.1789i]

x = [-2,2}, y = ix-i+.04

* Increasing the y value along this root by .04 produces a negative X gradient, positive real valued Y gradient and negative imaginary Y gradient

1. Gradient Near Root Values: D = -.04
   1. These lines are parallel to the root lines, but had different gradients
   2. = [1.1107, 1.1107i]

x = [-2,2}, y = ix+.96

* Decreasing the y value along this root by .04 produces a positive gradient, meaning the function is increasing
  1. = [-1.4698 , - 1.4698i]

x = [-2,2}, y = ix-1.04

* Decreasing the y value along this root by .04 produces a negative gradient, meaning the function is decreasing
  1. = [-0.1789 - 1.2698i , 1.2698 - 0.1789i]

x = [-2,2}, y = ix+i-.04

* Decreasing the y value along this root by .04 produces a negative X gradient, positive real valued Y gradient and negative imaginary Y gradient
  1. = [-0.1789 + 1.2698i , -1.2698 - 0.1789i]

x = [-2,2}, y = ix-i-.04

* Decreasing the y value along this root by .04 produces a negative Y gradient, negative real valued X gradient and positive imaginary X gradient

1. Hessian Along Root Values:

x = [-2,2], y = ix+1

x = [-2,2], y = ix-1

x = [-2,2], y = ix+i

x = [-2,2], y = ix-i

1. Hessian Near Root Values: D = .04
   1. These lines are parallel to the root lines, but have different Hessians.
   2. = [-44.8995, -44.8995i, -44.8995i , 44.8995]

x = [-2,2}, y = ix+1.04

* Increasing the y value along this root by .04 produces a highly negative gradient, except a highly positive quadratic y term
  1. = [1.1107 , 1.1107i, -21.7160i ,21.7160 ]

x = [-2,2}, y = ix-.96

* Increasing the y value along this root by .04 produces a highly positive quadratic y term
  1. = [-0.1789 + 1.2698i, -1.2698 - 0.1789i,  
      -11.4484 +30.6966i, -30.6966 -11.4484i]

x = [-2,2}, y = ix+i+.04

* Increasing the y value along this root by .04 produces a negative real valued gradient, with a large imaginary quadratic y term
  1. = [-0.1789 - 1.2698i, -1.2698 - 0.1789i,  
      11.4484 +30.6966i, -30.6966 +11.4484i]

x = [-2,2}, y = ix-i+.04

* Increasing the y value along this root by .04 produces a large negative real valued quadratic y term

1. Hessian Near Root Values: D = -.04
   1. These lines are parallel to the root lines, but have different Hessians.
   2. = [-21.7160 , -21.7160i, -21.7160i, 21.7160 ]

x = [-2,2}, y = ix+1.04

* Decreasing the y value along this root by .04 produces a highly negative quadratic x term, and a highly positive quadratic y term
  1. = [-1.4698 ,- 1.4698i, .8995i , 44.8995]

x = [-2,2}, y = ix-.96

* Decreasing the y value along this root by .04 produces a highly positive quadratic y term
  1. = -[0.1789 - 1.2698i , 1.2698 - 0.1789i,

11.4484 +30.6966i, -30.6966 +11.4484i]

x = [-2,2}, y = ix+i+.04

* Decreasing the y value along this root by .04 produces a large negative real valued quadratic y term, with a large imaginary quadratic y term
  1. = [-0.1789 + 1.2698i, -1.2698 - 0.1789i

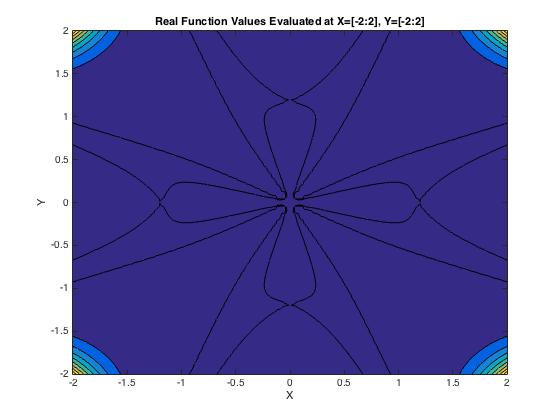
-11.4484 +30.6966i, -30.6966 -11.4484i]

x = [-2,2}, y = ix-i+.04

* Decreasing the y value along this root by .04 produces a negative real valued gradient with a highly negative real/imaginary quadratic term

Evaluating the function at all the points on the intervals:

1. Graph of the real values



1. Graph of the imaginary values

