

0.0.1 Initials

Function:

$$w^2(-2+y) + x^2(-3+w) + y^2(-1+x) \quad (1)$$

Gradient Vector:

$$\begin{bmatrix} 2(-3+w)x + y^2 \\ w^2 + 2(-1+x)y \\ 2w(-2+y) + x^2 \end{bmatrix} \quad (2)$$

Hessian Matrix:

$$\begin{bmatrix} 2(-3+w) & 2y & 2x \\ 2y & 2(-1+x) & 2w \\ 2x & 2w & 2(-2+y) \end{bmatrix} \quad (3)$$

Start Value: (w =_i 1.0, y =_i 0.0, x =_i 1.0) Function at point: -4.0

0.0.2 Iteration 1

Gradient at (w =_i 1.0, y =_i 0.0, x =_i 1.0)

$$\begin{bmatrix} -4 \\ 1 \\ -3 \end{bmatrix} \quad (4)$$

Hessian at (w =_i 1.0, y =_i 0.0, x =_i 1.0)

$$\begin{bmatrix} -4 & 0 & 2 \\ 0 & 0 & 2 \\ 2 & 2 & -4 \end{bmatrix} \quad (5)$$

Inverse of Hessian

$$\begin{bmatrix} -0.25 & 0.25 & 0 \\ 0.25 & 0.75 & 0.5 \\ 0 & 0.5 & -0 \end{bmatrix} \quad (6)$$

(w =_i 0.5, y =_i 1.75, x =_i -0.25) Function at point:

$$-4.0469 \quad (7)$$

Diff of function values between two iterations:

$$0.046875 \quad (8)$$

0.0.3 Iteration 2

Gradient at (w =_i 0.5, y =_i 1.75, x =_i -0.25)

$$\begin{bmatrix} 4.3125 \\ -4.125 \\ -0.1875 \end{bmatrix} \quad (9)$$

Hessian at (w =_i 0.5, y =_i 1.75, x =_i -0.25)

$$\begin{bmatrix} -5 & 3.5 & -0.5 \\ 3.5 & -2.5 & 1 \\ -0.5 & 1 & -0.5 \end{bmatrix} \quad (10)$$

Inverse of Hessian

$$\begin{bmatrix} 0.125 & 0.625 & 1.125 \\ 0.625 & 1.125 & 1.625 \\ 1.125 & 1.625 & 0.125 \end{bmatrix} \quad (11)$$

(w =_i 2.375, y =_i 4.0, x =_i 2.0) Function at point:

$$24.781 \quad (12)$$

Diff of function values between two iterations:

$$28.828 \quad (13)$$

0.0.4 Iteration 3

Gradient at (w =_i 2.375, y =_i 4.0, x =_i 2.0)

$$\begin{bmatrix} 13.5 \\ 13.641 \\ 13.5 \end{bmatrix} \quad (14)$$

Hessian at (w =_i 2.375, y =_i 4.0, x =_i 2.0)

$$\begin{bmatrix} -1.25 & 8 & 4 \\ 8 & 2 & 4.75 \\ 4 & 4.75 & 4 \end{bmatrix} \quad (15)$$

Inverse of Hessian

$$\begin{bmatrix} -0.42577 & -0.38008 & 0.87711 \\ -0.38008 & -0.61398 & 1.1092 \\ 0.87711 & 1.1092 & -1.9443 \end{bmatrix} \quad (16)$$

(w =_i 1.6516388761991792, y =_i 2.5322064869803587, x =_i 1.0913659205116488) Function at point:

$$0.43165 \quad (17)$$

Diff of function values between two iterations:

$$24.35 \quad (18)$$

0.0.5 Iteration 4

Gradient at (w =_i 1.6516388761991792, y =_i 2.5322064869803587, x =_i 1.0913659205116488)

$$\begin{bmatrix} 3.469 \\ 3.1906 \\ 2.9491 \end{bmatrix} \quad (19)$$

Hessian at (w =_i 1.6516388761991792, y =_i 2.5322064869803587, x =_i 1.0913659205116488)

$$\begin{bmatrix} -2.6967 & 5.0644 & 2.1827 \\ 5.0644 & 0.18273 & 3.3033 \\ 2.1827 & 3.3033 & 1.0644 \end{bmatrix} \quad (20)$$

Inverse of Hessian

$$\begin{bmatrix} -0.1453 & 0.024668 & 0.2214 \\ 0.024668 & -0.10351 & 0.27064 \\ 0.2214 & 0.27064 & -0.3544 \end{bmatrix} \quad (21)$$

(w =_i 1.0653027177675614, y =_i 1.9787526896164094, x =_i 0.8637658180657077) Function at point:

$$-2.001 \quad (22)$$

Diff of function values between two iterations:

$$2.4326 \quad (23)$$

0.0.6 Iteration 5

Gradient at (w =_i 1.0653027177675614, y =_i 1.9787526896164094, x =_i 0.8637658180657077)

$$\begin{bmatrix} 0.57321 \\ 0.59572 \\ 0.70082 \end{bmatrix} \quad (24)$$

Hessian at (w =_i 1.0653027177675614, y =_i 1.9787526896164094, x =_i 0.8637658180657077)

$$\begin{bmatrix} -3.8694 & 3.9575 & 1.7275 \\ 3.9575 & -0.27247 & 2.1306 \\ 1.7275 & 2.1306 & -0.042495 \end{bmatrix} \quad (25)$$

Inverse of Hessian

$$\begin{bmatrix} -0.094073 & 0.079965 & 0.18496 \\ 0.079965 & -0.058588 & 0.31333 \\ 0.18496 & 0.31333 & -0.30349 \end{bmatrix} \quad (26)$$

(w =_i 0.9853183804875232, y =_i 1.7482324173687027, x =_i 0.7404263040235104) Function at point:

$$-2.1423 \quad (27)$$

Diff of function values between two iterations:

$$0.14129 \quad (28)$$

0.0.7 Iteration 6

Gradient at (w =_i 0.9853183804875232, y =_i 1.7482324173687027, x =_i 0.7404263040235104)

$$\begin{bmatrix} 0.07287 \\ 0.063262 \\ 0.052089 \end{bmatrix} \quad (29)$$

Hessian at (w =_i 0.9853183804875232, y =_i 1.7482324173687027, x =_i 0.7404263040235104)

$$\begin{bmatrix} -4.0294 & 3.4965 & 1.4809 \\ 3.4965 & -0.51915 & 1.9706 \\ 1.4809 & 1.9706 & -0.50354 \end{bmatrix} \quad (30)$$

Inverse of Hessian

$$\begin{bmatrix} -0.085635 & 0.11062 & 0.18108 \\ 0.11062 & -0.0038774 & 0.31015 \\ 0.18108 & 0.31015 & -0.23959 \end{bmatrix} \quad (31)$$

(w =_i 0.9649815248632138, y =_i 1.7242611657519602, x =_i 0.730235991788498) Function at point:

$$-2.144 \quad (32)$$

Diff of function values between two iterations:

$$0.0016771 \quad (33)$$

0.0.8 Iteration 7

Gradient at (w =_i 0.9649815248632138, y =_i 1.7242611657519602, x =_i 0.730235991788498)

$$\begin{bmatrix} 0.0009891 \\ 0.00090214 \\ 0.0010788 \end{bmatrix} \quad (34)$$

Hessian at (w =_i 0.9649815248632138, y =_i 1.7242611657519602, x =_i 0.730235991788498)

$$\begin{bmatrix} -4.07 & 3.4485 & 1.4605 \\ 3.4485 & -0.53953 & 1.93 \\ 1.4605 & 1.93 & -0.55148 \end{bmatrix} \quad (35)$$

Inverse of Hessian

$$\begin{bmatrix} -0.08339 & 0.11486 & 0.18111 \\ 0.11486 & 0.0027144 & 0.31367 \\ 0.18111 & 0.31367 & -0.23593 \end{bmatrix} \quad (36)$$

(w =_i 0.9647739419525763, y =_i 1.7238067081747834, x =_i 0.7300194636787573) Function at point:

$$-2.144 \quad (37)$$

Diff of function values between two iterations:

$$4.2412 \cdot 10^{-7} \quad (38)$$

0.0.9 Iteration 8

Gradient at (w = 0.9647739419525763, y = 1.7238067081747834, x = 0.7300194636787573)

$$\begin{bmatrix} 2.9643 \cdot 10^{-7} \\ 2.399 \cdot 10^{-7} \\ 2.3556 \cdot 10^{-7} \end{bmatrix} \quad (39)$$

Hessian at (w = 0.9647739419525763, y = 1.7238067081747834, x = 0.7300194636787573)

$$\begin{bmatrix} -4.0705 & 3.4476 & 1.46 \\ 3.4476 & -0.53996 & 1.9295 \\ 1.46 & 1.9295 & -0.55239 \end{bmatrix} \quad (40)$$

Inverse of Hessian

$$\begin{bmatrix} -0.083365 & 0.11493 & 0.18111 \\ 0.11493 & 0.0028418 & 0.3137 \\ 0.18111 & 0.3137 & -0.23582 \end{bmatrix} \quad (41)$$

(w = 0.9647738685591329, y = 1.7238065995294303, x = 0.7300194181561234) Function at point:

$$-2.144 \quad (42)$$

Diff of function values between two iterations:

$$2.8866 \cdot 10^{-14} \quad (43)$$

0.0.10 Iteration 9

Gradient at (w = 0.9647738685591329, y = 1.7238065995294303, x = 0.7300194181561234)

$$\begin{bmatrix} 1.9096 \cdot 10^{-14} \\ 1.5099 \cdot 10^{-14} \\ 1.8097 \cdot 10^{-14} \end{bmatrix} \quad (44)$$

Hessian at (w = 0.9647738685591329, y = 1.7238065995294303, x = 0.7300194181561234)

$$\begin{bmatrix} -4.0705 & 3.4476 & 1.46 \\ 3.4476 & -0.53996 & 1.9295 \\ 1.46 & 1.9295 & -0.55239 \end{bmatrix} \quad (45)$$

Inverse of Hessian

$$\begin{bmatrix} -0.083365 & 0.11493 & 0.18111 \\ 0.11493 & 0.0028418 & 0.3137 \\ 0.18111 & 0.3137 & -0.23582 \end{bmatrix} \quad (46)$$

(w = 0.964773868559129, y = 1.7238065995294223, x = 0.7300194181561199) Function at point:

$$-2.144 \quad (47)$$

Diff of function values between two iterations:

$$4.4409 \cdot 10^{-16} \quad (48)$$

0.0.11 Iteration 10

Gradient at (w = 0.964773868559129, y = 1.7238065995294223, x = 0.7300194181561199)

$$\begin{bmatrix} -8.8818 \cdot 10^{-16} \\ 1.1102 \cdot 10^{-16} \\ -2.2204 \cdot 10^{-16} \end{bmatrix} \quad (49)$$

Hessian at (w = 0.964773868559129, y = 1.7238065995294223, x = 0.7300194181561199)

$$\begin{bmatrix} -4.0705 & 3.4476 & 1.46 \\ 3.4476 & -0.53996 & 1.9295 \\ 1.46 & 1.9295 & -0.55239 \end{bmatrix} \quad (50)$$

Inverse of Hessian

$$\begin{bmatrix} -0.083365 & 0.11493 & 0.18111 \\ 0.11493 & 0.0028418 & 0.3137 \\ 0.18111 & 0.3137 & -0.23582 \end{bmatrix} \quad (51)$$

(w = 0.9647738685591292, y = 1.7238065995294225, x = 0.7300194181561199) Function at point:

$$-2.144 \quad (52)$$

Diff of function values between two iterations:

$$4.4409 \cdot 10^{-16} \quad (53)$$