Objective function f(X) = x12 + x22 , Minimize

(0, 0)

where, -10 <= x1, x2 <= 10

If I say **Maximize** then there are 4 solutions -10, 10

10, -10

-10, -10

10, 10

In GWO, **the first step is initialization** by using uniform distribution for e.g., 5 grey wolves (solutions) can be generated in the given search space as follows:

x1  x2

|  |  |  |
| --- | --- | --- |
| X1 | -2.9668 | -4.2832 |
| X2 | 6.6166 | 5.1440 |
| X3 | 1.7053 | 5.0746 |
| X4 | 0.9945 | -2.3911 |
| X5 | 8.3439 | 1.3564 |

Table 1 Position Matrix

|  |  |  |
| --- | --- | --- |
| X1 | -2.9668 | -4.2832 |
| X2 | 6.6166 | 5.1440 |
| X3 | 1.7053 | 5.0746 |
| X4 | 0.9945 | -2.3911 |
| X5 | 8.3439 | 1.3564 |

All the five solutions having their respective dimension values lies between -10 and +10.

|  |
| --- |
| 27.1477 |
| 70.2401 |
| 28.6596 |
| 6.7063 |
| 71.4604 |

Second step is to calculate the fitness of every solution:

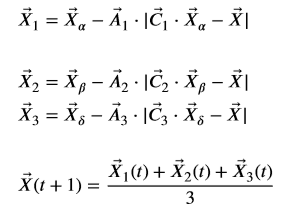
Table 2 Fitness matrix

Alpha\_position = [0.9945,-2.3911]

Beta\_position = [-2.9668,-4.2832]

Delta\_position = [1.7053,5.0746]

**Step III Calculation of Next Positions of Solutions (Grey Wolves)**

****

Calculation of first dimension for X1

* A = 2 \* a \* r1 – a;
* C=2 \* r2;
* Let r1 = 0.3 and r2 = 0.7;
* a is linearly decreasing from 2 to 0. So, in first iteration its value will be approximately equals to 2.

a = 2 - 2 \*(Current iteration number/ maximum Iteration)

**For first dimension w.r.t Alpha wolf**

X11(t+1) = 0.9945 - (-0.8) ABS (1.4 \* 0.9945 - .29668) = 4.4818

**For second dimension w.r.t Alpha wolf**

X12(t+1) = -2.3911 - (-0.8) ABS (1.4 \* -2.3911 – (-4.2832)) = -1.64

For first grey wolf

With respect to alpha wolf the next position is 4.4818, -1.64

With respect to Beta wolf the next position is -2.0174 -2.9126

With respect to Delta wolf the next position is 5.9887 14.1847

**For first dimension w.r.t Beta wolf**

X11(t+1) = -2.9668 - (-0.8)ABS( 1.4 \* -2.9668 – (-2.9668)) = -2.0174

**For second dimension w.r.t Beta wolf**

X12(t+1) = -4.2832 - (-0.8)ABS( 1.4 \* -4.2832 – (-4.2832)) = -2.9126

**For first dimension w.r.t Delta wolf**

X11(t+1) = 1.7053 - (-0.8)ABS( 1.4 \* 1.7053 – (-2.9668)) = 5.9887

**For second dimension w.r.t Delta wolf**

X12(t+1) = 5.0746 - (-0.8)ABS( 1.4 \* 5.0746 – (-4.2832)) = 14.1847

Calculate the final next position :

**X11(t+1) =( 4.4818 +(-2.0174) + 5.9887 )/3 = 2.8177.**

**X12(t+1) = (-1.64 +(-2.9126) + 14.1847)/3 = 3.2099**

**Next position of X1 will be (2.8122, 3.2099)**

Next Position of X2 will be (5.30, 5.224796)

**X1 who is Alpha ,who is Beta and Who is Delta**

**X2 Fitness Matrix**

**X3**

**X4**

**X5**

**X1 who is Alpha ,who is Beta and Who is Delta**

**X2 Fitness Matrix**

**X3**

**X4**

**X5**

**A=**