

NAME- Vimal Joshi

ROLL NO=20201430

COURSE=BSC(H) Computer Science

NEWTON DIVIDED DIFFERENCE INTERPOLATING  
POLYNOMIAL

P.I COMPUTING DIVIDED DIFFERENCE

```
NthDividedDiff[x0_, f0_, startindex_, endindex_] :=  
Module[{x = x0, f = f0, i = startindex, j = endindex, answer},  
  If[i == j, Return[f[[i]]], answer =  
    
$$\frac{(NthDividedDiff[x, f, i + 1, j] - NthDividedDiff[x, f, i, j - 1])}{x[[j]] - x[[i]]};$$
  
  Return[answer]];  
];  
x = {0, 1, 3};  
f = {1, 3, 55};  
NthDividedDiff[x, f, 1, 2]  
2  
  
x = {0, 1, 3};  
f = {1, 3, 55};  
NthDividedDiff[x, f, 2, 3]  
26  
  
NthDividedDiff[x, f, 1, 3]  
8  
  
x = {-1, 0, 1, 2};  
f = {5, 1, 1, 11};  
NthDividedDiff[x, f, 1, 2]  
-4  
  
NthDividedDiff[x, f, 2, 3]  
0  
  
NthDividedDiff[x, f, 1, 3]  
2
```

```
NthDividedDiff[x, f, 2, 4]
```

```
5
```

```
NthDividedDiff[x, f, 1, 4]
```

```
1
```

```
NewtonDDPoly[x0_, f0_] :=
```

```
Module[{x1 = x0, f = f0, n, newtonPolynomial, k, j},
```

```
  n = Length[x1];
```

```
  newtonPolynomial[y_] = 0;
```

```
  For[i = 1, i ≤ n, i++,
```

```
    prod[y_] = 1;
```

```
    For[k = 1, k ≤ i - 1, k++,
```

```
      prod[y_] = prod[y] * (y - x1[[k]])];
```

```
    newtonPolynomial[y_] =
```

```
      newtonPolynomial[y] + NthDividedDiff[x1, f, 1, i] * prod[y];
```

```
  Return[newtonPolynomial[y]];];
```

```
nodes = {0, 1, 3};
```

```
values = {1, 3, 55};
```

```
NewtonDDPoly[nodes, values]
```

```
1 + 2 y + 8 (-1 + y) y
```

```
Simplify[1 + 2 y + 8 (-1 + y) y]
```

```
1 - 6 y + 8 y2
```

```
nodes = {-1, 0, 1, 2};
```

```
values = {5, 1, 1, 11};
```

```
NewtonDDPoly[nodes, values]
```

```
5 - 4 (1 + y) + 2 y (1 + y) + (-1 + y) y (1 + y)
```

```
Simplify[5 - 4 (1 + y) + 2 y (1 + y) + (-1 + y) y (1 + y)]
```

```
1 - 3 y + 2 y2 + y3
```