Practical 9

Lagrange Interpolation

Q1. Find the unique polynomial of degree 2 or less such that f(0) = 1, f(1) = 3, f(3) = 55.

```
Lagrange[x0_, f0_] :=
 Module[{xi = x0, fi = f0, n, m, polynomial},
  n = Length[xi]; m = Length[fi];
  If[ n ≠ m,
   Print["List of points and function
     values are not of same size"]; Return[];];
  For[i = 1, i ≤ n, i++, L[i, x_] = (Product[(x - xi[[j]])/(xi[[i]] - xi[[j]]), {j, 1, i-1}])
     (Product[(x - xi[[j]])/(xi[[i]] - xi[[j]]), {j, i+1, n}]);];
  polynomial[x_] = Sum[L[k, x] * fi[[k]], {k, 1, n}];
  Return[polynomial[x]];]
nodes = {0, 1, 3}; values = {1, 3, 55};
lagrangepolynomial[x_] = Lagrange[nodes, values]
```

$$\frac{1}{3}(1-x)(3-x)+\frac{3}{2}(3-x)x+\frac{55}{6}(-1+x)x$$

```
lagrangepolynomial[x_] = Simplify[lagrangepolynomial[x]];
Print["Lagrange Polynomial = ",
  lagrangepolynomial[x]];
```

Lagrange Polynomial = $1-6x+8x^2$

Q2. Find the unique polynomial of degree 2 or less such that f (1) = 1, f (3) = 27, f (4) = 64. Estimate f(1.5).

```
nodes = {1, 3, 4}; values = {1, 27, 64};
lagrangepolynomial[x_] = Lagrange[nodes, values]
```

$$\frac{1}{6}(3-x)(4-x)+\frac{27}{2}(4-x)(-1+x)+\frac{64}{3}(-3+x)(-1+x)$$

```
lagrangepolynomial[x_] = Simplify[lagrangepolynomial[x]];
Print["Lagrange Polynomial = ",
 lagrangepolynomial[x]];
```

Lagrange Polynomial = $12 - 19\,x + 8\,x^2$

```
lagrangepolynomial[1.5]
```

1.5