

PRACTICAL-6(a): Lagrange interpolation polynomial

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COURSE:- B.Sc.(H) COMPUTER SCIENCE

Lagrange interpolation polynomial

PI

```
LagrangePolynomial[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 samesize"];  
  Return[]];  
For[i = 1, i ≤ n, i++,  
  L[i, x_] =  $\left( \prod_{j=1}^{i-1} \frac{x - xi[[j]]}{xi[[i]] - xi[[j]]} \right) \left( \prod_{j=i+1}^n \frac{x - xi[[j]]}{xi[[i]] - xi[[j]]} \right);$   
  polynomial[x_] =  $\sum_{k=1}^n L[k, x] * fi[[k]];$   
  Return[polynomial[x]];]
```

```
nodes = {0, 1, 3};  
values = {1, 3, 55};  
LagrangePolynomial[x_] = LagrangePolynomial[nodes, values]
```

List of points and function values are not of samesize

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

$$\text{Expand}\left[\frac{1}{3}(1-x)(3-x) + \frac{3}{2}(3-x)x + \frac{55}{6}(-1+x)x\right]$$

$$1 - 6x + 8x^2$$

Q-2

```
nodes = {0, 1, 3}
values = {1, 3};
lagrangePolynomial[x_] = LagrangePolynomial[nodes, values]
{0, 1, 3}
```

List of points and function values are not of samesize

 **Part:** Part 3 of {1, 3} does not exist.

$$\frac{1}{3}(1-x)(3-x) + \frac{3}{2}(3-x)x + \frac{1}{6}(-1+x)x \{1, 3\} \llbracket 3 \rrbracket$$

P-2

```
nodes = {1, 3, 5, 7, 9};
values = {N[Log[1]], N[Log[3]], N[Log[5]], N[Log[7]], N[Log[9]]};
lagrangePolynomial[x_] = LagrangePolynomial[nodes, values]
```

List of points and function values are not of samesize

$$0. + 0.0114439(5-x)(7-x)(9-x)(-1+x) + 0.0251475(7-x)(9-x)(-3+x)(-1+x) +$$

$$0.0202699(9-x)(-5+x)(-3+x)(-1+x) + 0.00572194(-7+x)(-5+x)(-3+x)(-1+x)$$

$$\text{Simplify}\left[0. + 0.011443878006959476(5-x)(7-x)(9-x)(-1+x) +\right.$$

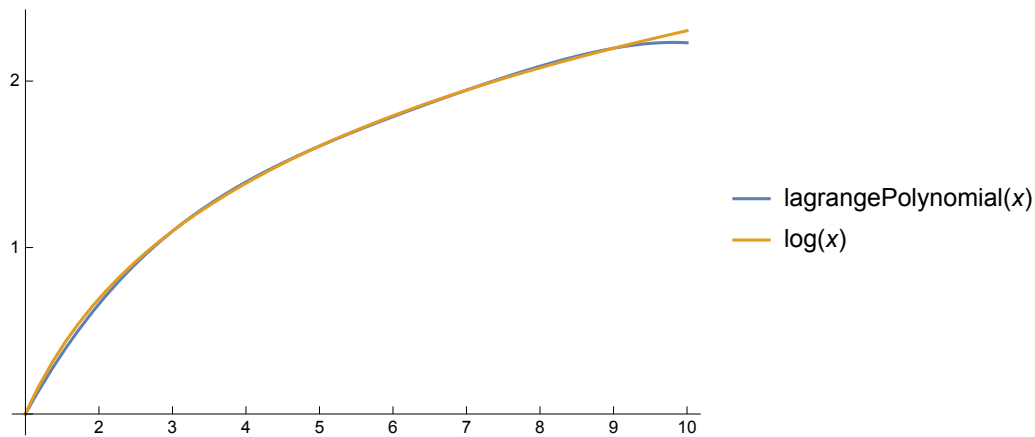
$$0.025147467381782817(7-x)(9-x)(-3+x)(-1+x) +$$

$$0.020269897385992844(9-x)(-5+x)(-3+x)(-1+x) +$$

$$0.005721939003479738(-7+x)(-5+x)(-3+x)(-1+x)\left.] \right.$$

$$-0.987583 + 1.18991x - 0.223608x^2 + 0.0221231x^3 - 0.000844369x^4$$

```
Plot[{lagrangePolynomial[x], Log[x]}, {x, 1, 10},
  Ticks -> {Range[0, 10]}, PlotLegends -> "Expressions"]
```



```
nodes = {-1, 0, 1, 2};
values = {5, 1, 1, 11};
lagrangePolynomial[x_] = LagrangePolynomial[nodes, values]
```

List of points and function values are not of samesize

$$-\frac{5}{6} (1-x) (2-x) x + \frac{1}{2} (1-x) (2-x) (1+x) + \frac{1}{2} (2-x) x (1+x) + \frac{11}{6} (-1+x) x (1+x)$$

Simplify[

$$-\frac{5}{6} (1-x) (2-x) x + \frac{1}{2} (1-x) (2-x) (1+x) + \frac{1}{2} (2-x) x (1+x) + \frac{11}{6} (-1+x) x (1+x)]$$

$$1 - 3x + 2x^2 + x^3$$

```
lagrangePolynomial[1.5]
```

4.375