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Course: Bsc. (h) Computer Science

Lagrange interpolation polynomial

P1

```
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_] = (∏_{j=1}^{i-1} (x - xi[[j]])/(xi[[i]] - xi[[j]])) (∏_{j=i+1}^{n} (x - xi[[j]])/(xi[[i]] - xi[[j]]));];
  polynomial[x_] = ∑_{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.
```

$$\frac{1}{3}(1-x)(3-x)+\frac{3}{2}(3-x)x+\frac{1}{6}(-1+x)x\{1,3\}[[3]]$$

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]
```

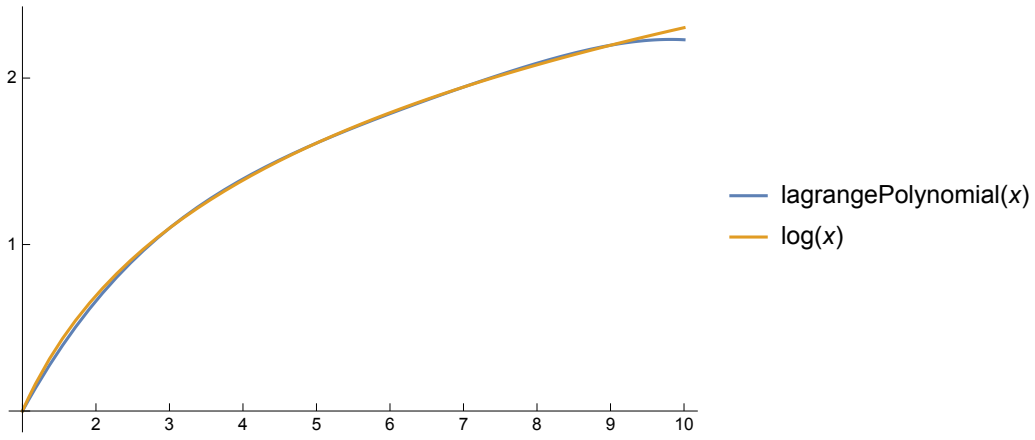
```
List of points and function values are not of samesize
```

$$0.+0.0114439(5-x)(7-x)(9-x)(-1+x)+0.0251475(7-x)(9-x)(-3+x)(-1+x)+0.0202699(9-x)(-5+x)(-3+x)(-1+x)+0.00572194(-7+x)(-5+x)(-3+x)(-1+x)$$

```
Simplify[0.` + 0.011443878006959476` (5 - x) (7 - x) (9 - x) (-1 + x) +
  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)]
```

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

```
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[
  -5/6 (1 - x) (2 - x) x + 1/2 (1 - x) (2 - x) (1 + x) + 1/2 (2 - x) x (1 + x) + 11/6 (-1 + x) x (1 + x)]
```

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

```
lagrangePolynomial[1.5]
```

```
4.375
```