Practical 6(a)

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COURSE : BSc(hons)Computer Science

SEMESTER : 4

Lagrange Interpolation Polynomial

P-1

```
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 same size"];
   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]];]
```

Q1

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

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

```
Expand[1/3 (1 - x) (3 - x) + 3/2 (3 - x) x + 55/6 (-1 + x) x]
```

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

Q2

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

```
List of points and function values are not of same size
```

P 2

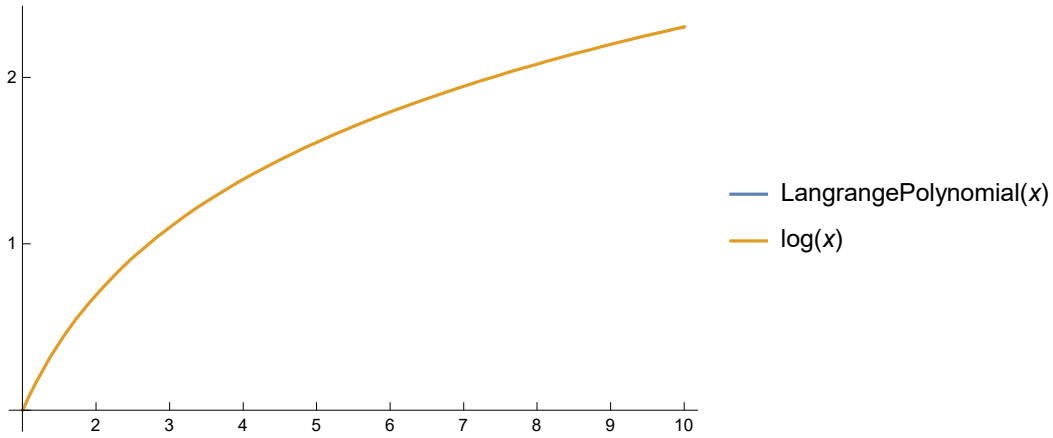
```
nodes = {1, 3, 5, 7, 9};
values = {N[Log[1]], N[Log[3]], N[Log[5]], N[Log[7]], N[Log[9]]};
LagrangePolynomial[x_] = LagrangePolynomial[nodes, values]
```

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

```
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[{LangrangePolynomial[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]
```

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

```
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
```