PRACTICAL 6(a)

Aim: To find the interpolating polynomial for some given data using Lagrange interpolation.

ASSIGNMENT

1 *Q1.Construct the Lagrange interpolation polynomial for the data:*

x	*1*	*2*	*3*	*5*
f(x)	*3*	*6*	*19*	*99*

Hence, interpolate at x = 6.

(%i7)
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kill(all)$
p = p: [
    [1, 3],
    [2, 6],
    [3, 19],
    [5, 99]
];
n: length(p)$
Y: 0$
for i: 1 thru n do (
    l_i: 1,
    for j: 1 thru n do (
        if notequal(i, j) then
            l_i: l_i · (x - p[j][1]) / (p[i][1] - p[j][1])
    ),
    Y: Y + l_i · p[i][2],
    print("iteration", i, "=>", Y, "=>", expand(Y))
)$
'f(x) = f: expand(Y);
print("f(6) =", ev(f, x = 6))$
wxplot2d([f, [discrete, map(first, p),
     map(second, p)]], [x, -2, 10], [legend, "f(x)", "given"]);
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(%o1) $p=[[1,3],[2,6],[3,19],[5,99]]$

$$\text{iteration } 1 \Rightarrow \frac{3\,(2-x)\,(x-5)\,(x-3)}{8} \Rightarrow -\frac{3\,x^3}{8}+\frac{15\,x^2}{4}-\frac{93\,x}{8}+\frac{45}{4}$$

$$\text{iteration } 2 \Rightarrow 2\,(x-5)\,(x-3)\,(x-1)+\frac{3\,(2-x)\,(x-5)\,(x-3)}{8} \Rightarrow \frac{13\,x^3}{8}-\frac{57\,x^2}{4}+\frac{275\,x}{8}-\frac{75}{4}$$

$$\text{iteration } 3 \Rightarrow -\frac{19\,(x-5)\,(x-2)\,(x-1)}{4}+2\,(x-5)\,(x-3)\,(x-1)+\frac{3\,(2-x)\,(x-5)\,(x-3)}{8} \Rightarrow -\frac{25\,x^3}{8}+\frac{95\,x^2}{4}-\frac{371\,x}{8}+\frac{115}{4}$$

$$\text{iteration } 4 \Rightarrow \frac{33\,(x-3)\,(x-2)\,(x-1)}{8}-\frac{19\,(x-5)\,(x-2)\,(x-1)}{4}+2\,(x-5)\,(x-3)\,(x-1)+\frac{3\,(2-x)\,(x-5)\,(x-3)}{8} \Rightarrow x^3-x^2-x+4$$

(%o5) $f(x)=x^3-x^2-x+4$

$f(6) = 178$