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Exercise 7

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Question 1: Interpolation

Below are the function values of a function f at nodes x_i, $i = 0, 1, 2, 3$

x_i	1	2	4	8
f_i	0	-2	-1	2

a) Determine the Lagrange interpolation polynomial for the above data points and evaluate the polynomial at $x = 3$.

b) Evaluate the interpolation polynomial at $x = 3$ using the Barycentric formula.

c) Evaluate the interpolation polynomial at $x = 5$ using the algorithm for Aitken-Neville interpolation.

Question 2: Lagrange Interpolation

The following table of values is given by the function $f : x \mapsto y = f(x)$

x_i	1.9	2.3	3.2	4.0
$y_i = f(x_i)$	-3.0	-1.0	2.0	4.0

Find the approximate root $x^* \in [0, 3]$ of the function $f(x)$, i.e. $f(x^*) = 0$ using the following procedure : use the y_i points as the reference points and x_i as reference values to construct the Lagrange polynomial $P_n(y)$. Evaluate the polynomial $P_n(y = 0)$ to obtain x^*.

Question 3: Spline Interpolation

Set-up a periodic spline interpolator through the data points

x_i	0	1/2	1	3/2	2
x_i	0	1	0	-1	0

Evaluate them at $x = 1/4$

Question 4: Programming task

a) Write a program to evaluate the Spline interpolation function.

b) Apply the program to the data $(x_j = -5 + 2(j - 1), f(x_j))$ $j = 1, 2, ..6$ for $f(x) = 1/(1 + x^2)$. Evaluate the spline function for the x values $-4, -2, 0, 2, 4$

c) solve b) again using the MATLAB function spline.