# Einführung in die Numerik

SoSe 2019

# Aufgabenblatt 11

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1.

$x_0 = -1, y_0 = f(x_0) = 0,$

$x_1 = 0, y_1 = f(x_1) = 3,$

$x_2 = 1, y_2 = f(x_2) = 2,$

$x_3 = 1, y_3 = f(x_3) = 60,$

$x = 2,$

$n = 3,$

$i = 0, L_{0.0} = 0, d_0 = 3,$

$i = 1, L_{1.0} = 3, d_1 = 2,$

$i = 2, L_{2.0} = 2, d_2 =, 1$

$i = 3, L_{3.0} = 60, d_3 = -1,$

$k = 1, i = 0, L_{0,1} = \frac{3 \cdot 3 - 2 \cdot 0}{0-(-1)} = 9,$

$i = 1, L_{1,1} = \frac{2 \cdot 2 - 1 \cdot 3}{1-0} = 1,$

$i = 2, L_{2,1} = \frac{1 \cdot 60 - (-1) \cdot 2}{3-1} = 31,$

$k = 2, i = 0, L_{0,2} = \frac{3 \cdot 1 - 1 \cdot 9}{1-(-1)} = -3,$

$i = 1, L_{1,2} = \frac{2 \cdot 31 - (-1) \cdot 1}{3-0} = 21,$

$k = 3, i = 0, L_{0,3} = \frac{3 \cdot 21 - (-1) \cdot (-3)}{3 - (-1)} = 15,$

$y = 15,$

$p(2) = 15.$

2.

$x_0 = 0, y_0 = q(x_0) = -3,$

$x_1 = 1, y_1 = q(x_1) = -3,$

$x_2 = 2, y_2 = q(x_2) = -1,$

$x_3 = 3, y_3 = q(x_3) = 9,$

$n = 3,$

$x = -2,$

$i = 0, L_{0,0} = -3, d_0 = -2,$

$i = 1, L_{1,0} = -3, d_1 = -3,$

$i = 2, L_{2,0} = -1, d_2 = -4,$

$i = 3, L_{3,0} = 9, d_3 = -5,$

$k = 1, i = 0, L_{0,1} = \frac{-2 \cdot (-3) - (-3) \cdot (-3)}{1 - 0} = -3,$

$i = 1, L_{1,1} = \frac{-3 \cdot (-1) - (-4) \cdot (-3)}{2 - 1} = -9,$

$i = 2, L_{2,1} = \frac{-4 \cdot 9 - (-5) \cdot (-1)}{3 - 2} = -41,$

$k = 2, i = 0, L_{0,2} = \frac{-2 \cdot (-9) - (-4) \cdot (-3)}{2 - 0} = 3,$

$i = 1, L_{1,2} = \frac{-3 \cdot (-41) - (-5) \cdot (-9)}{3 - 2} = 39,$

$k = 3, i = 0, L_{0,3} = \frac{-2 \cdot 39 - (-5) \cdot 3}{3 - 0} = -21,$

$y = -21,$

$q(-2) = -21,$

$x_0 = 0, y_0 = q(x_0) = -3,$

$x_1 = 1, y_1 = q(x_1) = -3,$

$x_2 = 2, y_2 = q(x_2) = -1,$

$x_3 = 3, y_3 = q(x_3) = 9,$

$x_4 = -2, y_4 = q(x_4) = -21,$

$n = 4,$

$x = -1,$

$i = 0, L_{0,0} = -3, d_0 = -1,$

$i = 1, L_{1,0} = -3, d_1 = -2,$

$i = 2, L_{2,0} = -1, d_2 = -3,$

$i = 3, L_{3,0} = 9, d_3 = -4,$

$i = 4, L_{4,0} = -21, d_4 = 1,$

$k = 1, i = 0, L_{0,1} = \frac{-1 \cdot (-3) - (-2) \cdot (-3)}{1-0} = -3,$

$i = 1, L_{1,1} = \frac{-2 \cdot (-1) - (-3) \cdot (-3)}{2-1} = -7,$

$i = 2, L_{2,1} = \frac{-3 \cdot 9 - (-4) \cdot (-1)}{3-2} = -31,$

$i = 3, L_{3,1} = \frac{-4 \cdot (-21) - 1 \cdot 9}{-2-3} = -15,$

$k = 2, i = 0, L_{0,2} = \frac{-1 \cdot (-7) - (-3) \cdot (-3)}{2-0} = -1,$

$i = 1, L_{1,2} = \frac{-2 \cdot (-31) - (-4) \cdot (-7)}{3-1} = 17,$

$i = 2, L_{2,2} = \frac{-3 \cdot (-15) - 1 \cdot (-31)}{-2-2} = -19,$

$k = 3, i = 0, L_{0,3} = \frac{-1 \cdot 17 - (-4) \cdot (-1)}{3-0} = -7,$

$i = 1, L_{1,3} = \frac{-2 \cdot (-19) - 1 \cdot 17}{-2-1} = -7,$

$k = 4, i = 0, L_{0,4} = \frac{-1 \cdot (-7) - 1 \cdot (-7)}{-2-0} = -7,$

$y = -7,$

$q(-1) = -7.$

3.

$p(n) = \sum_{k=1}^{n} k^3,$

$p(1) = 1,$

$p(2) = 9,$

$p(3) = 36,$

$p(4) = 100,$

$p(5) = 225,$

$x_0 = 1, y_0 = p(x_0) = 1,$

$x_1 = 2, y_1 = p(x_1) = 9,$

$x_2 = 3, y_2 = p(x_2) = 36,$

$x_3 = 4, y_3 = p(x_3) = 100,$

$x_4, = 5, y_4 = p(x_4) = 225,$

$n = 4,$

$i = 0, \Delta_{0,0} = 1,$

$i = 1, \Delta_{1,0} = 9,$

$i = 2, \Delta_{2,0} = 36,$

$i = 3, \Delta_{3,0} = 100,$

$i = 4, \Delta_{4,0} = 225,$

$k = 1, i = 0, \Delta_{0,1} = \frac{9-1}{2-1} = 8,$

$i = 1. \Delta_{1,1} = \frac{36-9}{3-2} = 27,$

$i = 2, \Delta_{2,1} = \frac{100-36}{4-3} = 64,$

$i = 3, \Delta_{3,1} = \frac{225-100}{5-4} = 125,$

$k = 2, i = 0, \Delta_{0,2} = \frac{27-8}{3-1} = \frac{19}{2},$

$i = 1, \Delta_{1,2} = \frac{64-27}{4-2} = \frac{37}{2},$

$i = 2, \Delta_{2,2} = \frac{125-64}{5-3} = \frac{61}{2},$

$k = 3, i = 0, \Delta_{0,3} = \frac{\frac{37}{2}-\frac{19}{2}}{4-1} = 3,$

$i = 1, \Delta_{1,3} = \frac{\frac{61}{2}-\frac{37}{2}}{5-2} = 4,$

$k = 4, i = 0, \Delta_{0,4} = \frac{4-3}{5-1} = \frac{1}{4},$

$x = x,$

$y = \frac{1}{4},$

$i = 4 - 1 = 3, y = 3 + (x - 4) \cdot \frac{1}{4} = \frac{1}{4} \cdot x + 2,$

$i = 2, y = \frac{19}{2} + (x - 3) \cdot (\frac{1}{4} \cdot x + 2) = \frac{1}{4} \cdot x^2 + \frac{5}{4} \cdot x + \frac{7}{2},$

$i = 1, y = 8 + (x - 2) \cdot (\frac{1}{4} \cdot x^2 + \frac{5}{4} \cdot x + \frac{7}{2}) = \frac{1}{4} \cdot x^3 + \frac{3}{4} \cdot x^2 + x + 1,$

$i = 0, y = 1 + (x - 1) \cdot (\frac{1}{4} \cdot x^3 + \frac{3}{4} \cdot x^2 + x + 1) = \frac{1}{4} \cdot x^4 + \frac{1}{2} \cdot x^3 + \frac{1}{4} \cdot x^2.$

4.

(1) $f(x) = g(x) \cdot h(x).$

(2) $f[x_0, ..., x_n] \overset{(1)}{=} \sum_{j=0}^{n} g[x_0, ...x_j] \cdot h[x_j, ..., x_n].$