UNIVERSIDAD POLITÉCNICA PUERTO RICO

Computer Science

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Numerical analysis for computer science mayors

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Assignment **Pr**oblems

1. **F**ind **t**he **La**grange **f**orm of **inte**rpolating **pol**ynomial **p**2(x) **t**hat **inte**rpolates **t**he **fu**nction **f**(x)=e-$^{x^2}$ at **t**he **n**odes x0 = 1, x_1= 0 **a**nd x_2 =1. **Fu**rther, **fi**nd **t**he **v**alue of **p2**(-0.9) **(**use 6-digit **rou**nding). **Co**mpare **t**he **v**alue **w**ith **t**he **t**rue **v**alue **f(**-0.9) **(**use 6-digit **rou**nding). **F**ind **t**he **per**centage **e**rror in **t**his **calc**ulation.

Assig 10: Part 1

$f(x) = e^{-x^2}$ $\quad x = -0.9$

$x_0 = 1 \quad x_1 = 0 \quad x_2 = -1$

$P_2(x) = L_0(x) f(x_0) + L_1(x) f(x_1) + L_2(x) f(x_2)$

$L_0(x) = \frac{(x-x_1)(x-x_2)}{(x_0-x_1)(x_0-x_2)} \quad L_1(x) = \frac{(x-x_0)(x-x_2)}{(x_1-x_0)(x_1-x_2)} \quad L_2(x) = \frac{(x-x_0)(x-x_1)}{(x_2-x_0)(x_2-x_1)}$

$f(x_0) = f(1) = e^{-1^2} = e^{-1} \approx 0.367879$
$f(x_1) = f(0) = e^{-0^2} = e^0 = 1$
$f(x_2) = f(-1) = e^{-(-1)^2} = e^{-1} \approx 0.367879$

$L_0(x) = \frac{(x-0)(x+1)}{(1-0)(1+1)} = \frac{x(x+1)}{2}$
$L_1(x) = \frac{(x-1)(x+1)}{(0-1)(0+1)} = -(x^2-1)$
$L_2(x) = \frac{(x-1)(x-0)}{(-1-1)(-1-0)} = \frac{x(x-1)}{2}$

$P_2(x) = \frac{x(x+1)}{2} * 0.367879 + -(x^2-1) * 1 + \frac{x(x-1)}{-2} * 0.367879$

$L_0(-0.9) = \frac{-0.9(-0.9+1)}{2} = -0.045$
$L_1(-0.9) = -(0.9^2-1) = 0.19$
$L_2(-0.9) = \frac{-0.9(-1.9)}{-2} = 0.855$

$P_2(-0.9) = (-0.045) * 0.367879 + 0.19 * 1 + 0.855 * 0.367879$
$P_2(-0.9) \approx -0.016555 + 0.19 + 0.314537 \approx 0.487982$

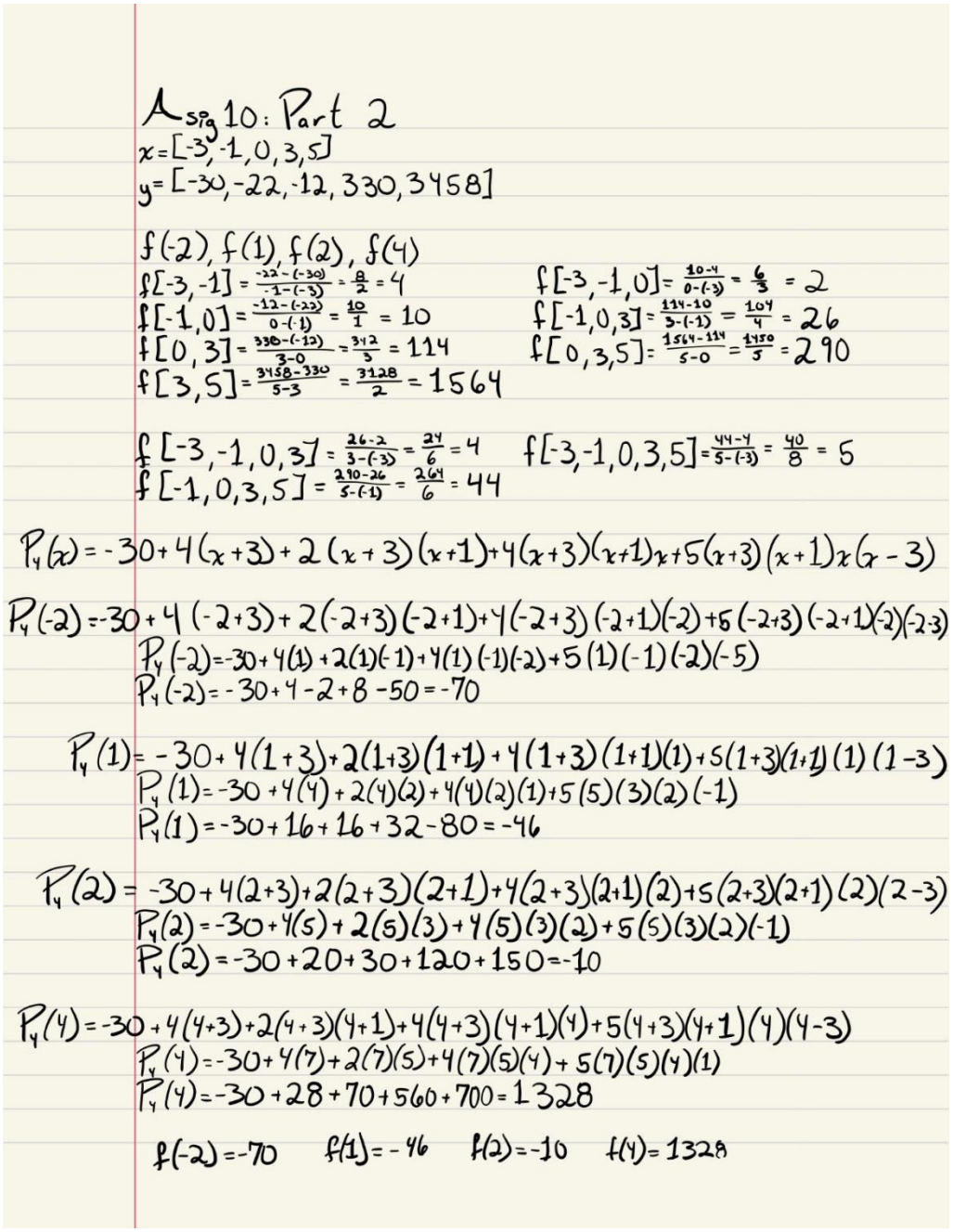
$f(-0.9) = e^{-(-0.9)^2} = e^{-0.81} \approx 0.444858$

Percentage Error $= \left| \frac{0.487982 - 0.444858}{0.444858} \right| \times 100 \approx 9.70\%$

2. **F**ind **t**he **Ne**wton **f**orm of **inter**polating **pol**ynomial **f**or **t**he **d**ata

x	-3	-1	0	3	5
y	-30	-22	-12	330	3458

and **int**erpolate **t**he **fol**lowing **va**lues **f**(-2), **f**(1), **f**(2), **f**(4).



3. Corroborate your previous problems solution using MATLAB. Add to the pdf file the MATLAB output for each of the problems.