Computational and Numerical Methods

Group 16

Set 7 (17-09-2018): Spline Interpolation

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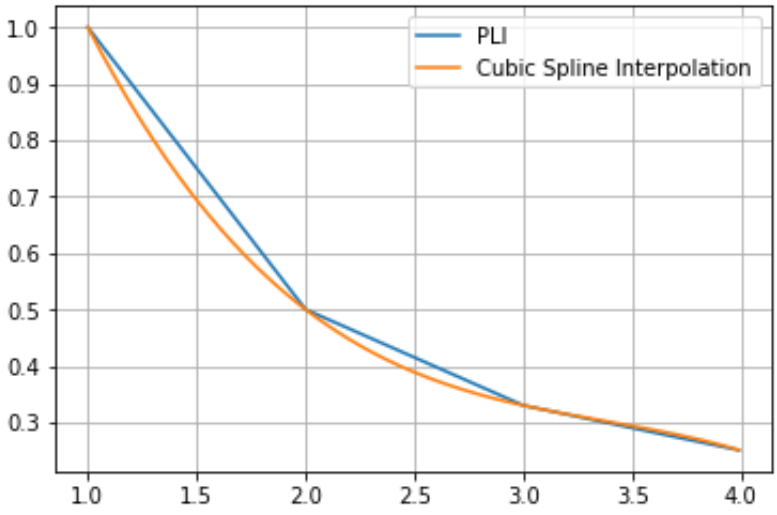
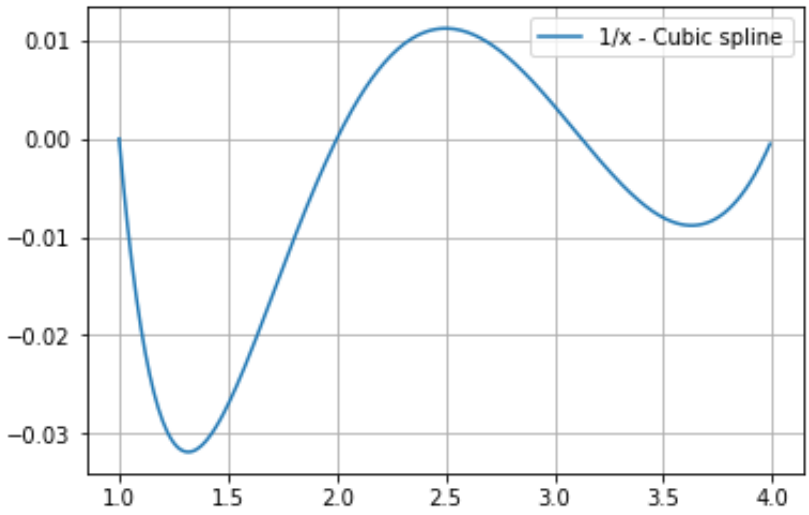
Parth Shah 201601086

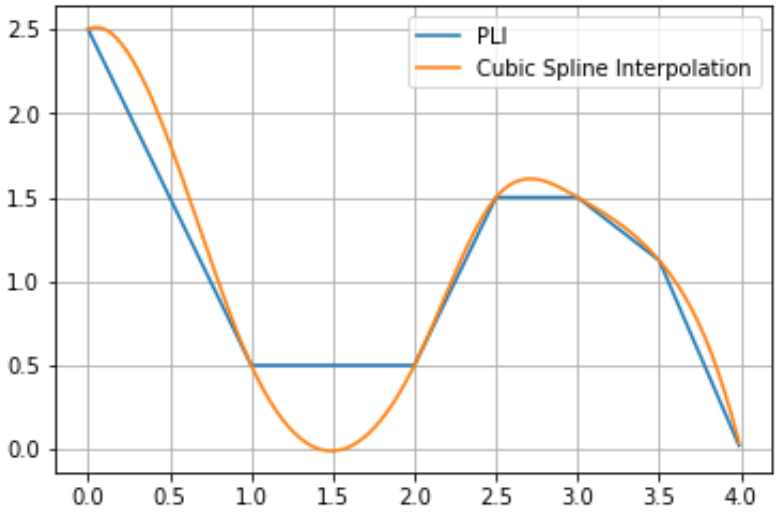
Show Code

Q1 Cubic spline interpolation of $1/x$:

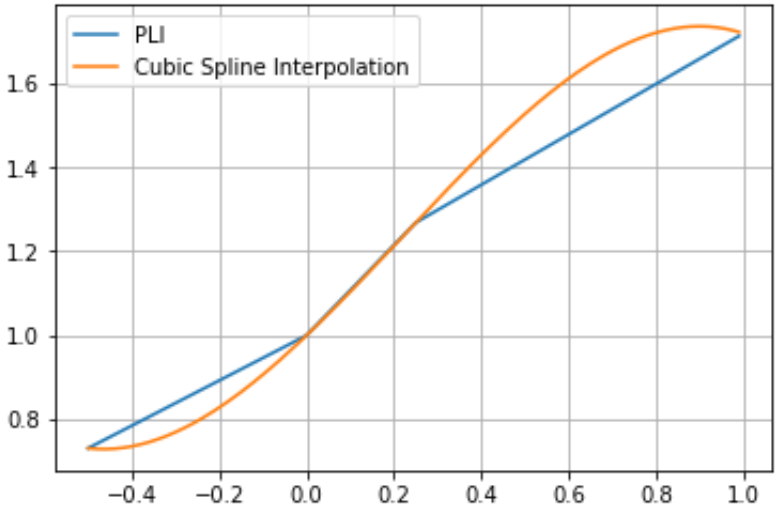


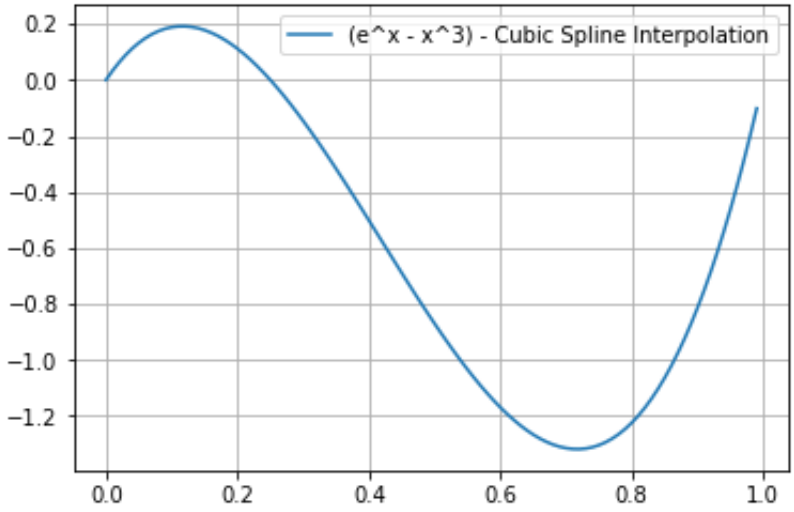


Q2: Q5 of Set-6



Q3 $y = e^x - x^3$





Now doing theory questions 1, 2, 3 and 4.

Q1 (0,1),(1,1) and (2,5)

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Newton's divided difference coefficients are:
[0.  1.  1.5]
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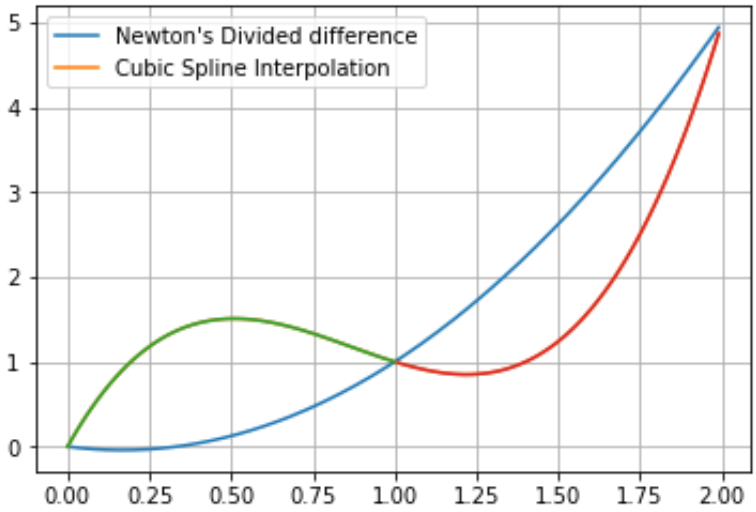
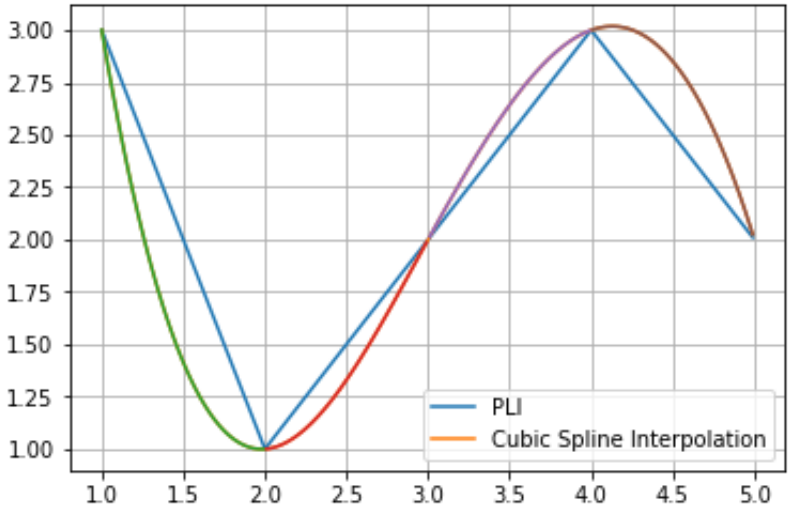


f(x) =

$$\begin{cases} 7.5 \cdot 10^{-1} \cdot x^3 + 2.5 \cdot 10^{-1} \cdot x, & \text{if } x \in [0, 1], \\ -7.5 \cdot 10^{-1} \cdot x^3 + 4.5 \cdot x^2 + -4.25 \cdot x + 1.5, & \text{if } x \in (1, 2]. \end{cases}$$

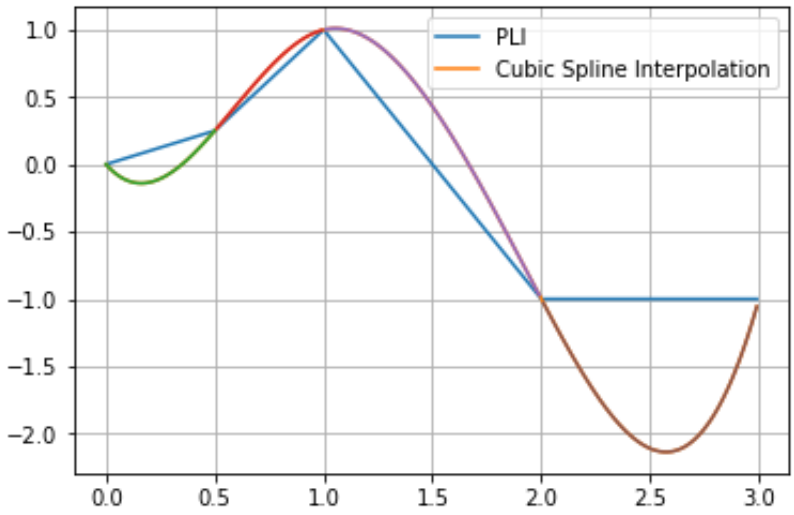
Q2 $x = [1, 5]\ y = (3, 1, 2, 3, 2)$



f(x) =

$$\begin{cases} 7.6786 \cdot 10^{-1} \cdot x^3 - 2.3036 \cdot x^2 - 4.6429 \cdot 10^{-1} \cdot x + 5, & \text{if } x \in [1, 2], \\ -8.3929 \cdot 10^{-1} \cdot x^3 + 7.3393 \cdot x^2 - 1.9750 \cdot 10^{1} \cdot x + 1.7857 \cdot 10^{1}, & \text{if } x \in (2, 3], \\ -4.1071 \cdot 10^{-1} \cdot x^3 + 3.4821 \cdot x^2 - 8.1786 \cdot x + 6.2857, & \text{if } x \in (3, 4], \\ 4.8214 \cdot 10^{-1} \cdot x^3 - 7.2321 \cdot x^2 + 3.4679 \cdot 10^{1} \cdot x - 5.0857 \cdot 10^{1}, & \text{if } x \in (4, 5]. \end{cases}$$

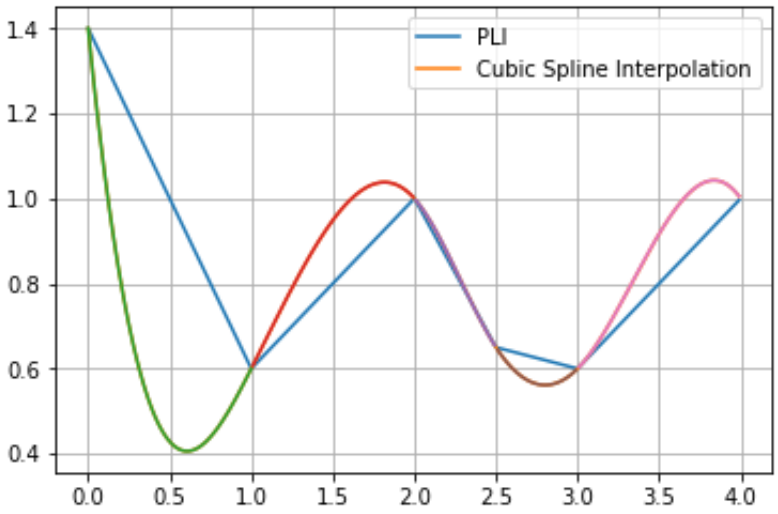
Q3 $x = (0, 0.5, 1, 2, 3)$ $y = (0, 0.25, 1, -1, -1)$



f(x) =

$$\begin{cases} 1.8095 \cdot x^3 + 4.7619 \cdot 10^{-2} \cdot x, & \text{if } x \in [0, 0.5], \\ -5.0476 \cdot x^3 + 1.0286 \cdot 10^{1} \cdot x^2 - 5.0952 \cdot x + 8.5714 \cdot 10^{-1}, & \text{if } x \in (0.5, 1], \\ 2.5238 \cdot x^3 + -1.2429 \cdot 10^{1} \cdot x^2 + 1.7619 \cdot 10^{1} \cdot x - 6.7143, & \text{if } x \in (1, 2], \\ -9.0476 \cdot 10^{-1} \cdot x^3 + 8.1429 \cdot x^2 - 2.3524 \cdot 10^{1} \cdot x + 2.0714 \cdot 10^{1}, & \text{if } x \in (2, 3]. \end{cases}$$

Q4 $x = [0, 1, 2, 2.5, 3, 4]$
$y = [1.4, 0.6, 1, 0.65, 0.6, 1]$



f(x) =

$$\begin{cases} 4.4647 \cdot 10^{-1} \cdot x^3 + -1.2465 \cdot x + 1.4, & \text{if } x \in [0, 1], \\ -1.0324 \cdot x^3 + 4.4365 \cdot x^2 - 5.6830 \cdot x + 2.8788, & \text{if } x \in (1, 2], \\ 2.0166 \cdot x^3 - 1.3857 \cdot 10^1 \cdot x^2 + 3.0905 \cdot 10^1 \cdot x - 2.1513 \cdot 10^1, & \text{if } x \in (2, 2.5], \\ -6.5228 \cdot 10^{-1} \cdot x^3 + 6.1593 \cdot x^2 - 1.9137 \cdot 10^1 \cdot x + 2.0188 \cdot 10^1, & \text{if } x \in (2.5, 3], \\ -9.6266 \cdot 10^{-2} \cdot x^3 + 1.1552 \cdot x^2 - 4.1245 \cdot x + 5.1759, & \text{if } x \in (3, 4]. \end{cases}$$