

CSE 330: Spring 2024
Assignment-3 [CO4]
Total Marks: 20

1. Consider the function $f(x) = x \ln(x)$. Now answer the following:

(a) (2 marks) Evaluate the numerical derivative of $f(x)$ at $x = 1.0$ with step size $h = 0.1$ using the **forward and central difference** methods up to 5 significant figures.

(b) (4 marks) Compute the upper bound of the truncation error of $f(x)$ at $x = 1.0$ using $h = 0.1$ for the **backward and central difference** methods up to 5 significant figures.

(c) (4 marks) **Deduce** an expression for D_h^1 from D_h by replacing h by $(4h/3)$ using the Richardson extrapolation method.

2. (3+2 marks) The following Data set is generated by the function $f(x) = x \cos(x) - x + \sin(x)$.

x	1.1	1.2	1.3
f(x)	0.2902	0.1669	0.01131

Based on the above data, compute $f'(1.2)$ using the **Central Difference** method, and also calculate the **relative error**. Use 4 significant figures.

3. Consider the function $f(x) = 4x^3 - 9e^{7x}$. Now answer the following:

a) (3 marks) Compute $D_{0.2}^{(1)}$ at $x = 2.7$ using **Richardson extrapolation** method up to 4 significant figures.

b) (2 marks) Compute $D_{0.2}^{(2)}$ at $x = 2.7$ using **Richardson extrapolation** method up to 4 significant figures.