Assignment- [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 $\mathbf{D^{(1)}_{0.2}}$ at **x = 2.7** using **Richardson extrapolation** method up to 4 significant figures.
b) (2 marks) Compute $\mathbf{D^{(2)}_{0.2}}$ at **x = 2.7** using **Richardson extrapolation** method up to 4 significant figures.