National University of Computer and Emerging Sciences, Lahore Campus				
	Course:	Numerical Computing	Course Code:	CS2008
	Program:	BSCS/BSR/BSSE	Semester:	V
	Duration:	60 min	Total Marks:	40
	Paper Date:	Sep 30, 2023	Weight	15
	Section:	L	Page(s):	1
	Exam:	Sessional - I	Roll No:	
Instruction/Notes:	Attempt All Questions			

Q 1. Derive formula for numerical differentiation based on Newton's backward difference interpolation. Use the obtained formula to find $f'(120)$ for the following data **Points (10)**

x	75	90	105	120
$f(x)$	38.2	43.2	40.9	37.7

Q 2. Evaluate f (25), given that f (20) = 2765, f (23) = 3261, f (26) = 3454, f (29) = 3929 using Bessel's interpolation formula given below: **Points (10)**

$$y_p = \frac{y_o + y_1}{2} + (p - 0.5)\,\Delta y_o + \frac{p(p-1)}{2!}\left[\frac{\Delta^2 y_o + \Delta^2 y_{-1}}{2}\right] + \frac{(p-0.5)p(p-1)}{3!}\Delta^3 y_{-1} + \frac{(p+1)p(p-1)(p-2)}{4!}\left[\frac{\Delta^4 y_{-2} + \Delta^4 y_{-1}}{2}\right]$$

Q 3. Suppose that if $f(0) = 1, f(0.5) = 2.5, f(1) = 2, f(0.25) = f(0.75) = \beta$. Find the value of β if the Composite Simpson rule gives the value of 2.75 for $\int_0^1 f(x)dx$ **Points (10)**

Q 4. Determine the values of h and N that will ensure an approximation error less than 0.00001 when approximating $\int_0^1 e^x\,dx$ by employing composite Trapezoidal rule? **Points (10)**