The University of Zambia
Department of Mathematics and Statistics
MAT 4119 - Engineering Mathematics III
Tutorial Sheet 4

2023

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1. Using $\sin(0.1) = 0.9983$ and $\sin(0.2) = 0.19867$, find an approximate value of $\sin(0.18)$ by Lagrange interpolation. Obtain a bound on the truncation error.

2. Evaluate $\sqrt{155}$ by using Lagrange interpolation formula from the following data:

x	150	152	154
y=$\sqrt{x}$	12.247	12.239	12.410

3. The following table gives the normal weight of a baby during the first six months of life. Use Newton's divided difference formula to estimate the weight of the baby at the age of 4 months.

Age in months	0	2	3	5	6
Weight in Kg	3.0	3.7	4.5	5.2	6.3

4. Approximate $f(0.05)$ and $f(0.65)$ using the following data and the Newton forward- or backward- difference formula:

x	0.0	0.2	0.4	0.6	0.8
f(x)	1.00000	1.22140	1.49182	1.82212	2.22554

5. Using Newton forward- or backward- interpolation find the annual premium at the ages of 27 and 33 from the following data:

Age in years	24	28	32	36	40
Annual premium	28.06	30.19	32.75	34.94	40

6. Given the data $(0, 0), (1, 1), (2, 4)$, fit a quadratic spline to the function f defined by this set of points and use it to approximate $f(1.5)$.

7. Given the data $f(0) = 0, f(1) = 1, f(2) = 2$,
   (a) construct the natural cubic spline S that interpolates the data.
   (b) determine the clamped cubic spline S that interpolates the data and satisfies $S'(0) = S'(2) = 1$.

8. A natural cubic spline S on $[0, 2]$ is defined by

$$\begin{cases} 1 + 2x - x^3, & \text{if } x \in [0, 2] \\ 2 + b(x-1) + c(x-1)^2 + d(x-1)^3, & \text{if} x \in [1, 2]. \end{cases}$$

   Find the values of b, c, and d.