MAT 3005 Applied Numerical Methods

Digital Assignment

Answer all the questions

Instructions: Write the solution in your note book and get signature from the faculty. After verification, upload the pdf copy in VTOP.

1. *Find f(x) as a polynomial in x for the following data by Newton's divided difference formula*

x	*-4*	*-1*	*0*	*2*	*5*
f(x)	*1245*	*33*	*5*	*9*	*1335*

2. *Using Lagrange interpolation, find the unique polynomial P(x) of degree 2 or less such that P(1) = 1, P(3) = 27, P(4) = 64.*
3. *Using Newton's divided difference method, find f(1.5) using the data f(1.0) = 0.7651977, f(1.3) = 0.6200860, f(1.6) = 0.4554022, f(1.9) = 0.2818186, and f(2.2) = 0.1103623.*
4. *Obtain the cubic spline approximation valid in the interval [1, 2], for the function given in the tabular form, under the natural cubic spline conditions*
   f "(0) = M(0) = 0, and f "(3) = M(3) = 0. Hence, interpolate at x = 1.5.

x	*0*	*1*	*2*	*3*
f(x)	*1*	*4*	*10*	*8*

5. *Evaluate* $\int_0^2 e^x \, dx$ *using the Simpson's rules with h = 1 and h = 1/2. Compare with exact solution. Improve the result using Romberg integration.*
6. *Evaluate* $\int_0^6 \frac{dx}{1+x^2}$ *(i) trapezoidal rule, (ii) Simpson's rule. Also, check the result by actual integration.*
7. *Evaluate the integral* $I = \int_1^2 \frac{2x}{1+x^4} dx$ *using Gauss two point and three point rules. Compare with the exact solution* $I = \tan^{-1}(4) - (\pi/4)$.
8. *Given* $y' = x^3 + y$, $y(0) = 2$, *compute y(0.2), y(0.4) and y(0.6) using the Runge-Kutta method of fourth order.*

9. *Obtain the solution by the fourth order Runge-Kutta method $y'' + y' + y = 0$, $y(0) = 1$, $y'(0) = 0$, find the value of $y(0.1)$.*
10. *Using the Adams-Bashforth predictor-corrector equations, evaluate $y(1.4)$, if y satisfies $\frac{dy}{dx} + \frac{y}{x} = \frac{1}{x^2}$ and $y(1) = 1$, $y(1.1) = 0.996$, $y(1.2) = 0.986$, $y(1.3) = 0.972$.*