Assignment # 2

Problem # 1: Consider the function $f(x) = e^{x} + e^{-x}$. In the following, the interpolating polynomial, $p_4(x)$ is computed by using Taylor expansion. To do so, do the following tasks:

1. [2 Marks] Using Taylor expansion of $e^{\pm x}$, write $f(x)$ as an infinite series.
2. [2 Marks] Find the values of $a_0,\ a_1, \cdots, a_4$ if the function is interpolated by degree four polynomial $p_4(x)$
3. [2 Marks] Compute: $f(0.1)$ and $p_4(0.1)$ up to seven significant figures.
4. [2 Marks] Find the percent error for interpolating $f(x)$ by $p_4(x)$

Problem # 2: Consider the same function $f(x) = e^{x} + e^{-x}$ again. Now, we are going to find the interpolating polynomial by using Vandermonde matrix method:

1. [2 Marks] Construct the Vandermonde matrix V if $f(x)$ passes through the nodes $-1,\ 0$ and 1.
2. [2 Marks] Compute: $\det(V)$
3. [2 Marks] Find the inverse matrix V^{-1}. Note that you may use any advanced calculator, online resources and/or mathematical software to find the inverse, but show 2/3 steps or explanation or formula that indicates that you understand what you are doing.

4. [2 Marks] The coefficients a_0, a_1, a_2 of the interpolating polynomial $p_2(x)$ can be computed by using the equation below:

$$\begin{pmatrix} a_0 \\ a_1 \\ a_2 \end{pmatrix} = V^{-1} \begin{pmatrix} f(x_0) \\ f(x_1) \\ f(x_2) \end{pmatrix},$$

where the symbols have their usual meanings. Using V^{-1} and the function values at the nodal points, find the values of a_0, a_1, a_2 up to five decimal places.

5. [2 Marks] Write down the expression for $p_2(x)$. Also compute $p_2(0.1)$ and $f(0.1)$ up to five decimal places.

6. [2 Marks] Find the percent error of interpolating $f(0.1)$ by $p_2(0.1)$.

Submission of the Assignment # 2:

- Solve all the problems above.
- Prepare a title page including Your Name, Your ID#, Theory Section #.
- Prepare a single .pdf or .jpg file containing the tile page and the solution pages.
- To submit your assignment solution, visit the Submission Link (Click here). This will take you to a Google Form link.
- Fill up the Google Form link with correct information and upload the file there. You are done.

‹ Previous

Next ›