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QOUESTIONS

1.MEANING OF NUMERICAL METHODS

2.MATHEMATICAL APPROACH TO NUMERICAL ETHODS

3.ADVANTAGE AND DISAVANTAGE OF BUILDING MATHEMATICAL MODELS

ANSWER FOR QUISTION NUMBER 1

Numerical methods is an area of mathematics and computer science that creates, analyses and implements algorithms for obtaining numerical solutions to problems in the real world. This problem may arise throughout natural sciences, social sciences, engineering and business. The academic area of numerical analysis ranges from theoretical mathematics to computer science issues. This is concerned with all aspects of the numerical solution of a problem, from the theoretical development and understanding of numerical methods to their practical implementation as reliable and efficient computer programs.

Numerical analysis software can be found in popular software packages e.g. spread sheet programs where it allows a user to evaluate fairly detailed models even when the user is unaware of the underlying mathematics. soft wares to implement common numerical analysis procedures must be reliable, accurate and efficient moreover it must be written so as to be easily portable between different computers. Most popular programming language for implanting numerical analysis methods is Fortran a language developed in the 1950’s that continue to be updated to meet changing needs ,other languages, such as C,C++,and java.

Numerical algorithms are almost as old as human civilization. The Rhind Papyrus (˜1650 BC) of ancient Egypt describes a root finding method for solving a simple equation. Archimedes of Syracuse (287212 BC) created much new mathematics, including the “method of exhaustion” for calculating lengths, areas, and volumes of geometric figures. When used as a method to find approximations, it is in much the spirit of modern numerical integration; and it was an important precursor to the development of the calculus by Isaac Newton and Gottfried Leibnitz. A major impetus to developing numerical procedures was the invention of the calculus by Newton and Leibnitz, as this led to accurate mathematical models for physical reality, first in the physical sciences and eventually in the other sciences, engineering, medicine, and business. These mathematical models cannot usually be solved explicitly, and numerical methods to obtain approximate solutions are needed. Another important aspect of the development of numerical methods was the creation of logarithms by Napier (1614) and others, giving a much simpler manner of carrying out the arithmetic operations of multiplication, division, and exponentiation. Newton created a number of numerical methods for solving a variety of problems, and his name is attached today to generalizations of his original ideas. Of special note is his work on root finding and polynomial interpolation. Following Newton, many of the giants of mathematics of the 18th and 19th centuries made major contributions to the numerical solution of mathematical problems. Foremost among these are Leon hard Euler (1707-1783), Joseph-Louis Lagrange (1736-1813), and Karl Friedrich Gauss (1777-1855). Up to the late 1800's.

ANSWER FOR QUESTION NUMBER TWO

The following is categorization of the mathematical theory underlying numerical analysis

Numerical linear and nonlinear algebra. This refers to problems involving the solution of systems of linear and nonlinear equations, possibly with a very large number of variables. Many problems in applied mathematics involve solving systems of linear equations, with the linear system occurring naturally in some cases and as a part of the solution process in other cases. Linear systems are usually written using matrix-vector notation, $Ax = b$, with the matrix of coefficients for the system, x the column vector of the unknown variables $x1,...,xn$, and a given column vector. For small to moderate sized linear systems (say $n \leq 1000$), the favourite numerical method is Gaussian elimination and its variants. For larger linear systems, there are a variety of approaches depending on the structure of the coefficient matrix A. Nonlinear problems are often treated numerically by reducing them to a sequence of linear problem. There are numerous other approaches to solving nonlinear systems, most based on using some type of approximation using linear functions

Approximation Theory. This category covers the approximation of functions and methods based on using such approximations. When evaluating a function $f(x)$ with a real or complex number, keep in mind that a computer or calculator can only do a finite number of operations. Moreover, these operations are the basic arithmetic operations of addition, subtraction, multiplication, and division, together with comparison operations such as determining whether $x>y$is true or false. With the four basic arithmetic operations, we can evaluate polynomials and rational functions, which are polynomials divided by polynomials. Including the comparison operations, we can evaluate different polynomials or rational functions on different sets of real numbers x. The evaluation of all other functions, e.g. $f(x)=\sqrt{x}$ or 2x, must be reduced to the evaluation of a polynomial or rational function that approximates the given function with sufficient accuracy. All function evaluations on calculators and computers are accomplished in this manner

Solving differential and integral equations;Most mathematical models used in the natural sciences and engineering are based on ordinary differential equations, partial differential equations, and integral equations. The numerical methods for these equations are primarily of two types. The first type approximates the unknown function in the equation by a simpler function, often a polynomial or piecewise polynomial function, choosing it to satisfy the original equation approximately. Among the best known of such methods is the finite element method for solving partial differential equations. The second type of numerical method approximates the derivatives or integrals in the equation of interest, generally solving approximately for the solution function at a discrete set of points. s. Most numerical methods for solving differential and integral equations involve both approximation theory and the solution of quite large linear and nonlinear systems.

Advantages of mathematical models

-use of models of constructing costly plants and warehouses in locations that do not best meet the present and future needs of the customers.

-a model indicates gaps that are not immediately apparent, and after testing the character of the failure might give a clue to the model's deficiencies.

-models have the advantage of time, since results can be obtained within a relatively short time

-because of the constant squeeze on profits, the cost and time saving that MS models allow make them decision-making tools of great value to the manager

Disadvantages of mathematical models

Models are incomplete-Models are abstractions of reality. Real-world systems are complex and composed of many interrelated components. A "good" model must attempt to capture all the critical elements of the real-world system. This is something that is virtually impossible to do in modelling social systems. Thus, an important inherent limitation is made of what is left out.

Models are created to represent a system based on historical information. Yet, models are used to forecast what will happen in the future. If there are significant changes in the real-world system, the quality of the model suffers.

The operation status of a model may be unclear One of the major problems facing potential users is determining the model's status. Models take months and sometimes years to build, and many model builders frequently revise their models. At any one time, several versions of a model may exist. Frequently, full documentation does not exist because of the dynamic nature of model development. Thus, a user is faced with the need to determine the exact characteristics of the version of the model being used before the results can be understood. While this seems obvious, it is not always simple to do, and thus it is not always done.

Input data may be uncertain; Problems with data used in building models were discussed above. Another type of data problem stems from exogenous input to the model. Uncertainty surrounding the values of the exogenous input variables compounds the difficulty of determining the accuracy of model output. Future-year values of these variables are forecasts, often from other models, and the accuracy of these values is uncertain