INTERPOLATION AND LEAST-SQUARES

Lesson 1 (Self-Revision)

1. Linear regression is one form of interpolation. (T or F)

2. In a difference table, if the nth order differences are constant, it does not necessarily mean the function is n^{th} degree polynomial. It can be an exponential function. (T or F)

3. Differences of any functions will always get smaller as the order of differences n increases. (T or F)

4. We can always fix up the errors in a difference table, regardless how many points there are, provided we know the degree of underlying function. (T or F)

5. If we construct differences of polynomial functions, we can always obtain a column of constant coefficients. (T or F)

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INTERPOLATION AND LEAST-SQUARES

Lesson 2 (Self-Revision)

1. Newton-Gregory polynomials can be applied to unevenly-spaced data, as well as evenly-spaced data. (T or F)

2. It is possible to express transcendental equations exactly by polynomial expressions. (T or F)

3. If $f_n(x)$ is exactly matched by a polynomial $P_n(x)$, there can be another function (for e.g. transcendental function) which fits $f_n(x)$. (T or F)

4. Even if the interpolating function is exact with $f_n(x)$, we should be careful to select the starting point x_o. (T or F)

5. Cubic interpolation requires 4 points, but quadratic interpolation only requires 2 points. (T or F)

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INTERPOLATION AND LEAST-SQUARES

Lesson 3 (Self-Revision)

1. Newton's Divided difference method is only applicable to unevenly-spaced data. (T or F)

2. When Newton's Divided difference is applied to evenly-spaced data, it gives a different function compared to Newton-Gregory method. (T or F)

3. For a set of unevenly-spaced data, if the underlying function $f_n(x)$ is n^{th} degree, then the nth order divided difference is constant. (T or F)

4. exactly matched by a polynomial $P_n(x)$, there can be another function (for e.g. transcendental function) which fits $f_n(x)$. (T or F)

5. Unlike Newton-Gregory method, Newton-Divided Difference can be used to exactly interpolation data produced from transcendental equations, such as a sine function. (T or F)

INTERPOLATION AND LEAST-SQUARES

Lesson 4 (Self-Revision)

1. Lagrangian polynomials, like Newton-Divided difference method, can only be used for unevenly-spaced data. (T or F)

2. For a cubic degree Lagrangian polynomial, it must contain L_o, L_1, L_2, L_3, and f_o, f_1, f_2, f_3. (T or F)

3. Following Q2, each of these L function is a quadratic polynomial. (T or F)

4. In 2-D interpolation, the idea is to hold one variable constant at one time. (T or F)

5. In 2-D interpolation, if the function $f(x,y)$ is quadratic degree in x- as well as y-direction, that function must contain 9 terms. (T or F)

INTERPOLATION AND LEAST-SQUARES

Lesson 5 (Self-Revision)

1. The principle of least-squares is to minimise the sum of errors. (T or F)

2. The higher the degree of least-squares equation used, the more accurate is the curve fitting. (T or F)

3. Least-squares equations generally produce ill-conditioned matrix. (T or F)

4. In solution of ill-conditioned matrix, convergence can be difficult since the answers are sensitive to round-off errors. (T or F)

5. The weights assigned to data are indicative of the reliability of the data. (T or F)

NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION

Lesson 6 (Self-Revision)

1. The polynomial function coincides with the underlying function at discrete points, even if their gradients differ at those points. (T or F)

2. The basis of numerical differentiation is Newton-Gregory formula. (T or F)

3. In one-sided forward difference 1st derivative formula of any degree n, the parameter s is always zero. (T or F)

4. For central difference 1st derivative formula, s is not zero, but is a constant regardless of degree n. (T or F)

5. With more terms added into the 1st derivative formula, the accuracy generally improves. (T or F)

NUMERICAL DIFFERENTIATION
AND
NUMERICAL INTEGRATION

Lesson 7 (Self-Revision)

1. You can only establish the maximum or minimum bounds of errors if you know the underlying function. (T or F)

2. In the error term $f^{n+1}(x)$, x is a particular value of x such that $f^{n+1}(x)$ is a maximum. (T or F)

3. For 1st derivative formula, errors in central difference scheme are generally twice as less as in forward difference scheme. (T or F)

4. In deriving 1st derivative formula, central difference scheme can only be applied to polynomials of even degree. (T or F)

NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION

Lesson 8 (Self-Revision)

1. Newton-Cotes integration method is based on Newton-Gregory formula. (T or F)

2. Simpson's $\frac{1}{3}$ rule yields the same order of accuracy as Simpson's $\frac{3}{8}$ rule. (T or F)

3. Trapezoial rule can be used for both evenly-spaced or non-evenly spaced data. (T or F)

4. Romberg integration method, when applied onto trapezoidal rule, yields the same accuracy as Simpson's $\frac{1}{3}$ rule. (T or F)

NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION

Lesson 9 (Self-Revision)

1. The main idea in Gaussian integration is to position the sampling points so that they are at optimal locations. (T or F)

2. Gauss' formula is accurate up to degree $2(n)+1$, where n is the degree of the function fitting the sampling points. (T or F)

3. For integration of a 5th degree polynomial, we require 3 sampling points. (T or F)

4. The sampling points and weights are always symmetrical about the mid-point of the range. (T or F)

NUMERICAL SOLUTION OF O.D.E.

Lesson 10 (Self-Revision)

1. Order of an O.D.E. refers to the highest derivative in the equation. (T or F)

2. Degree of an O.D.E. refers to the power to which the highest-order derivative is raised. (T or F)

3. Taylor's Series forms the cornerstone of numerical solutions of O.D.E. (T or F)

4. Improved Euler's method incorporates up to h^3 terms in Taylor's series. (T or F)

NUMERICAL SOLUTION OF O.D.E.

Lesson 11 (Self-Revision)

1. In Improved Euler method, an average gradient is used for the interval between x_i and x_{i+1}. (T or F)

2. Runge Kutta method uses terms in Taylor's series up to h^4. (T or F)

3. Runge Kutta method and Improved Euler method are self-starting methods. (T or F)

4. Adam-Moulton's method requires 4 starting points; these can be found either through Euler or Improved Euler's method. (T or F)

5. Adam-Moulton's method yields the same accuracy as Runge Kutta method. (T or F)