Annals of the University of Oradea, Fascicle: Ecotoxicology, Animal Husbandry and Food Science and Technology, Vol. XVII/B 2018

Analele Universitatii din Oradea, Fascicula: Ecotoxicologie, Zootehnie si Tehnologii de Industrie Alimentara, Vol.XVII/B 2018

METHOD OF ADJUSTING NUMERICAL DATA WITH APPLICATIONS IN THE FOOD FIELD

Venter Adela Olimpia*, Iancu Carmen*, Urs Mariana*

*University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048, Oradea, Romania, e-mail:adela_venter@yahoo.ro;ciancu2000@yahoo.com; mariana_mediu@yahoo.com

Abstract

In this paper, we present a applied food study using numerical data.We use the Lagrange interpolation polynomial, in the food industry.The method uses the dependence of fat and protein on yogurt of several types.We chose, the variable x to represent the amount of fat and y the amount of yogurt protein.

We want to determine the mathematical function of derived numerical data, that depends on the two variables, x the amount of fat and y the amount of protein of the yogurt content.Using the method of interpolating and extrapolating Lagrange polynomials, we determine the usefulness of this function by a polynomial of a certain degree that can be used in the future, for other numerical data in the case of yogurt.We chose two important variables for the quality of yogurt, but for the accuracy of the function and for a more detailed study, we can use it more numerical data that give a greater dependence and determine more precisely the mathematical characteristics of the function characterized by a polynomial of a certain degree.

Key words: polynomial,Lagrangepolynomial,function, interpolation, extrapolating

INTRODUCTION

Definition 1.1.(1)Let A $\subseteq \mathbb{R}$be an interval, $\mathfrak{F}(\mathrm{A}) = \{f : \mathrm{A} \to \mathbb{R}\}$, $f \in \mathfrak{F}(\mathrm{A})$ and let$x_1, x_2, \dots, x_n \in A$, n distinct points. By interpolatingf by a function from a class$C \subseteq \mathfrak{F}(\mathrm{A})$we will understand the determination of a function$\varphi \in C$,such that $f(x_i) = \varphi(x_i)$, $\forall\ i = \overline{1,n}$. The points x_i, $i = \overline{1,n}$,are called interpolation points or nodes andφ is the interpolation function associated with f and points x_i , $i = \overline{1,n}$. If C is composed of polynomial functions of degree $\leq n-1$, then φ is called interpolation polynomial associated with$f$ and pointsx_i, $i = \overline{1,n}$.

Remark1.2.(1) In conclusion, to define the interpolar polynomial, we need n distinct real numbers $x_1, x_2, \dots, x_n$ and n arbitrary real numbers$y_1, y_2, \dots, y_n$. We search for a polynomial$P \in \mathbb{R}[X]$of degree$\leq n-1$,satisfying : $P(x_i) = y_i, \forall\ i = \overline{1,n}$.

Example 1.3.(1)We consider three real numbers$x_1, x_2, x_3 \in \mathbb{R}$which are fixed and represent the temperature of a product in three stages with$x_1 < x_2 < x_3$ și $f$and a real function that depends on the temperature defined on a set containing the three points. If $A(x_1, y_1)$, $B(x_2, y_2), C(x_3, y_3)$ are the corresponding planar points where $y_i = f(x_i), i \in \{1,2,3\}$are collinear, then the interpolation polynomial associated with f and points$x_1,\ x_2,\ x_3$is of degree1, so it coincides with a straight line passing throug$A, B, C\ fig$.1.1.

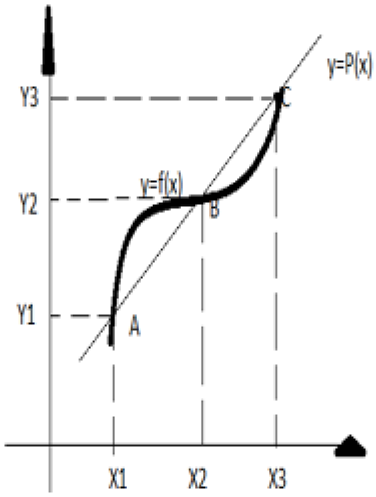

Fig.1

If the points$A, B, C$are non-collinear then the interpolation polynomial is of degree 2, so a parabola passes through$A, B, C\ fig$.2.

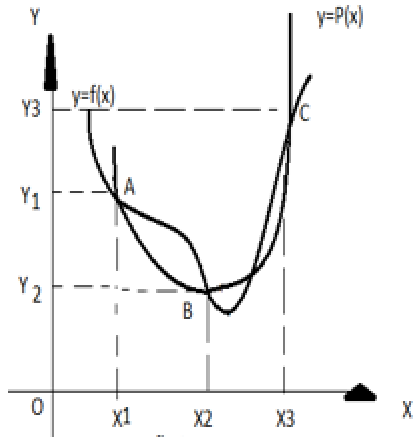

Fig. 2

MATERIAL AND METHOD

Theorem1.4(4)Let A $\subseteq\mathbb{R}$ a set $f : A \to \mathbb{R}$ a function and$x_1, x_2, \ldots, x_n \in A$, n distinct points.$(\exists) P \in \mathbb{R}[X]$a uniquely determined polynomial degree$\leq n-1$, $f(x_i) = P(x_i), \forall\, i = \overline{1,n}$ where the polynomial P can be represented as:

$$P(x) = \sum_{j=1}^{n} f(x_j) \cdot \prod_{i=1}^{n} \frac{x - x_i}{x_j - x_i}, x \in \mathbb{R}, i \neq j, (1.1.)$$

Definition 1.5.(4)Polynomial

$$P(x) = \sum_{j=1}^{n} f(x_j) \cdot \prod_{i=1}^{n} \frac{x - x_i}{x_j - x_i}, x \in \mathbb{R}, i \neq j,$$

It is called the Lagrange interpolar polynomial, associated with the function f and points $x_i, i = \overline{1,n}$ where we will note it with$L_{n-1}(x)$ *or* $L(x_1, x_2, \ldots, x_n; f)$.

Theorem 1.6.(4)If $f : [a, b] \to \mathbb{R}$ function of n derivable and$x_1, x_2, \ldots, x_n \in [a, b]$,
n distint points andP_{n-1}interpolation polynomial associated with f and points x_i , $i = \overline{1,n}$, $\forall x \in [a, b], \exists\, \xi \in (a, b)$ such that

$$f(x) - P_{n-1}(x) = \frac{1}{n!} f^{(n)}(\xi) \prod_{j=1}^{n} (x - x_j) (1.2).$$

Lema 1.7.(4) Let $f : [a, b] \to \mathbb{R}$ a function of n derivable and$x_0, x_1, x_2 \ldots, x_n \in [a, b]$, n+1 distinct points in which$f$is the same value. Then$\exists\, \xi \in (a, b)$, such that$f^{(n)}(\xi) = 0$.

Lema 1.8.(4)Let $f : [a, b] \to \mathbb{R}$ a function of n derivable and $x_1, x_2 \ldots, x_n \in [a, b]$, n distinct points in which$f$is canceled. Then$\forall\, x \in [a, b], \exists\, \xi \in (a, b)$, such that

$$f(x) = \frac{1}{n!} f^{(n)}(\xi) \prod_{j=1}^{n} (x - x_j). (1.3.)$$

Definition 1.11.(4)Let$P_{n-1}$the interpolation polynomial associated with$f : A \to \mathbb{R}$, A a interval and distinct points $x_1, x_2 \ldots, x_n \in A$, we say that$P_{n-1}(x)$represents the value ofinterpolation (or extrapolation) of the function$f$in point$x \in A$, if$x \in [x_m, x_M]$ (respectively$x \notin [x_m, x_M]$) , where

$$x_m = \min_{1 \leq i \leq n} x_i ;\ x_M = \max_{1 \leq i \leq n} x_i. (1.4.)$$

The data used, corresponds to three types of natural yoghurt, for a quantity of 100 grams. We also specify that the numerical data collected is in grams.The numerical data used are the following: $x_1 = 3{,}5, y_1 = 3{,}2$;$x_2 = 3{,}8, y_2 = 3{,}4$;$x_3 = 4, y_3 = 4$.

We will replace the numeric data, in the Lagrange polynomial expression and do all the mathematical calculations.

And if we represent these data used with a millimeter map, we get the branch of the parabola.

The Lagrange interpolation polynomial associated with a function f has the following form:

$$\mathrm{L_{n-1}(x)} \overset{not}{=} P(x) = \sum_{j=1}^{n} f(x_j) \cdot \prod_{i=1}^{n} \frac{x - x_i}{x_j - x_i}, x \in \mathbb{R}, i \neq j, (1.5.)$$

$$i = \overline{1,n};\ \ n = 5,$$

After replacing the numerical data, the Lagrange interpolation polynomial associated with a function f has the form:

$$=> \ L_2(x) = f(x_1)\frac{(x - x_2)(x - x_3)}{(x_1 - x_2)(x_1 - x_3)} + f(x_2)\frac{(x - x_1)(x - x_3)}{(x_2 - x_1)(x_2 - x_3)} + f(x_3)\frac{(x - x_1)(x - x_2)}{(x_3 - x_2)(x_3 - x_1)},$$

$$L_2(x) = 4{,}67x^2 - 33{,}45x + 62{,}98.$$

RESULTS AND DISCUSSION

The results obtained are in accordance with the geometric representation, because the representation of a parabola corresponds to a Lagrange degree 2 polynomial. This result may interfere with other reference values, but it is important to know the healthy intervals of these variables.

CONCLUSIONS

It can go further with studying these variables and functions, for much more details about yogurt, if we know what are the values admitted to preserve health.

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