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FORECASTING THE NUMBER OF STUDENTS FOR SOME OF THE FACULTIES OF THE UNIVERSITY OF SABHA USING MATLAB APPLIED ON THE NEWTON FORWARD FORMULAS AND THE SPLINE INTERPOLATION

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Abstract:-
This study deals with the ideal predictions of the number of students that are expected to be enrolled in some of the faculties of the University of Sabha for the next two years using two methods. The first method is Newton forward formulas Interpolation, and the second method is spline Interpolation and applying them to the Math lab. A comparison between these two methods is conducted. The faculties include in this study are: Faculty of Arts, Faculty of Science, Faculty of Agriculture, Faculty of Medicine and Faculty of Dentistry.The results showed errors in the rate within the expected values of increases as the years increase. In addition, that the Newton's forward method is better than cubic splines method because the splinesmethod Uses a third-order equation and has the property of oscillation, especially in distant predictions.

Keywords:-*Interpolation, Newton forward formulas Interpolation, spline Interpolation.*

INTRODUCTION

As a result of the rapid developments witnessed by science in the scientific and technological fields there have been ways of numerical analysis using Matlab and it got its way into scientific life to overcome many mathematical issues that contain many variables and relatively complicated functions to reach accurate results [1].

The numerical anlysis methods, interpolating are processes of finding the value of y when the value x is known in the table of points [2-4].

We will distinguish between two types:

(1)The first case:

The point required is in the range of the table points and thus the process in this case is called Interior Interpolation.

(2) The second case:

The desired point is outside the table points and the process in this case is Extrapolation. The completion formulas are based on $p_n(x)$ Interpolating Polynomial of degree

$$n : \mathrm{p_n}(x) = a_0 + a_1\mathrm{x} + a_2\,\mathrm{x}^2 + \cdots + \mathrm{a_n x^n} \qquad (1)$$

Which passes through all the data set points given [2, 4, and 5].

Newton Interpolating Polynomial and Interpolation by spline are of the most important numerical methods to Interpolate the data and the use of intermittent interpolation to obtain the optimal results by external interpolation [6, 7].

The data processed is for students who are expected to enrol in the University of Sabha using these two methods as:

(1) Newton's Method Interpolation

The known polynomial Newton for interpolation for data function $y_i = f_i(x)$ (2)

as a function $N_n(x)$ which takes the shape:

$\mathrm{N_n}(x) = a_0 + a_1(\mathrm{x} - \mathrm{x_0}) + a_2\,(\mathrm{x} - \mathrm{x_0})(\mathrm{x} - \mathrm{x_1}) + a_3(\mathrm{x} - \mathrm{x_0})(\mathrm{x} - \mathrm{x_0})(\mathrm{x} - \mathrm{x_2}) + \cdots + a_{n-1}\,(\mathrm{x} - \mathrm{x_0})(\mathrm{x} - \mathrm{x_1})\ldots\,(\mathrm{x} - \mathrm{x_{n-1}})$

$$(3)$$

Newton Forward Interpolating Polynomial is one of Newton's methods of interpolation [3, 8-10].

which symbolize $N_n^f(x)$ in addition it is given as follows :

$$N_n^f(x) = N_n(x_0 + th) = y_0 + t\Delta(y_0) + \frac{t(t-1)}{2!}\Delta^2(y_0) + \cdots +$$

$$\frac{t(t-1)(t-2)\ldots(t-(n-1))}{n!}\Delta^n(y_0) \qquad (4)$$

$$t = \frac{x-x_0}{h}\ , h = x_{i+1} - x_i\ , N_n(x_i) = y_i\ , i = 0,1,\ldots,n-1 \qquad (5)$$

(2) Cubic Spline's Method

The origin of the word spline is derived from the name of a drawing machine used to draw smooth curves. This machine is made of a long, flexible piece of wood with suspended weights [11].

The polynomial is called the Interpolating Polynomial of the third degree, which is continues at all the points of points, as well as the slope and bending of them at these points Is continues [8, 9, 12, 13].

Materials:

The analysis of the data was done by the use of matlab program (version 13).

Table (1) shows the data represent the number of students of some of the faculties of the University of Sebha (Males, Females).

| Faculty of Dentistry		College of Human Medicine		faculty of Agriculture		College of Science		college of Literature	
Females	Males	Females	Males	Females	Males	Females	Males	Females	Males
111	33	385	164	117	244	744	222	898	197
133	30	336	129	132	324	895	365	935	328
130	33	434	182	133	339	1248	418	1103	388
258	92	310	112	158	418	1715	527	1494	498
386	150	186	42	183	496	2181	636	1884	607
216	28	514	141	164	280	2103	521	1859	479
264	29	581	130	193	324	2384	518	2420	672
272	44	584	187	176	286	2311	674	2761	932
345	56	775	222	186	301	2739	875	3040	984
378	70	851	235	181	279	2802	926	3125	979
410	84	927	247	172	241	3227	1101	3530	1105
398	89	1103	299	165	215	2929	941	2889	1483
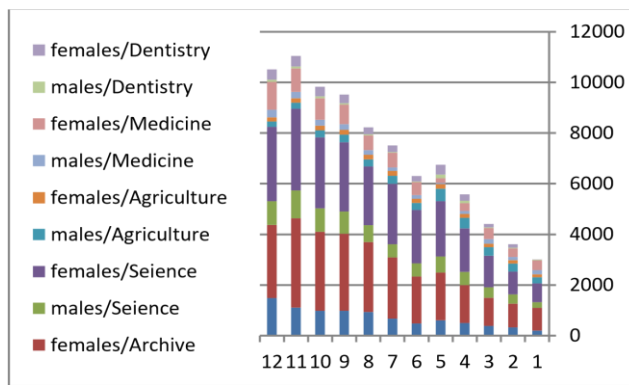
Figure 1: Student data

Results and discussion:

1) Method of Newton's forward difference:

Figures (2-6) shows the numbers of students of the University of Sebha (Males and Females and the total and forecast for the years (2017-2018)
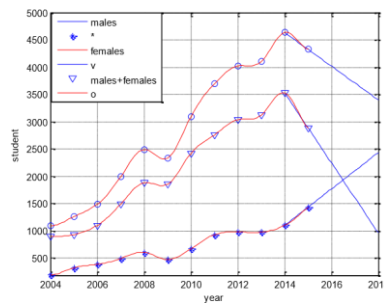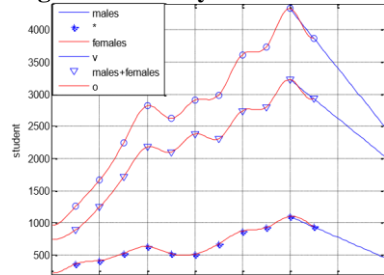
Arts

Figure 2: Faculty of Arts science

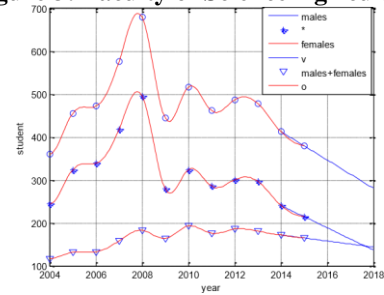**Figure 3: Faculty of Science Agriculture**

Figure 4: College of Agriculture Medicine
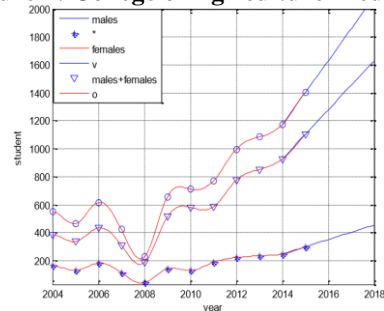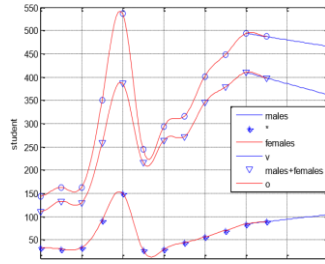

Figure 5: Faculty of Medicine Dentistry

Figure 6: Dental College

2 - Method of cubic plines:

Figures (7-11) shows the numbers of Sebha University students (Males and Females and the sum and forecasting for the years (2017-2018)
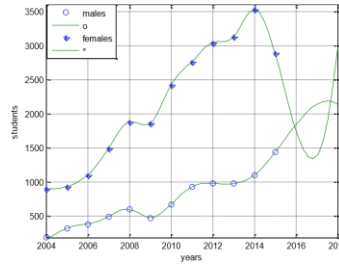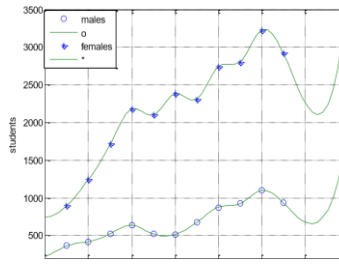
Arts

Figure 7: College of Arts science
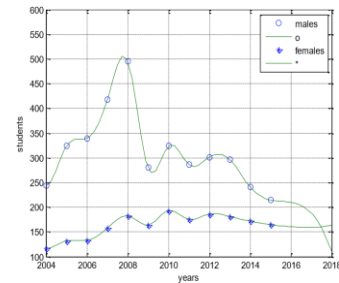

Figure 8: Faculty of Science Agriculture

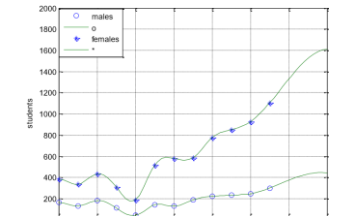
Figure 9: College of Agriculture Medicine

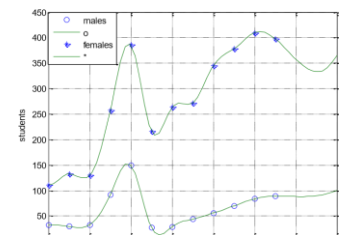**Figure 10: Faculty of Medicine Dentistry**


Figure 11: College of Dentistry

Showing the percentage of error between the two methods:

**Table (2) shows the errors between the two methods using mean values of the predicted methods as a reference.**

| Colleges\ years		2016	2017	2018
college of Literature	Males	1.7	0.02	6.5
	Females	-	8.9	----
College of Science	Males	2.09	8.8	-
	Females	4.4	-	0.07
faculty of Agriculture	Males	5.4	8.3	~
				6.1
	Females	1.3	2.5	
College of Human Medicine	Males	0.4	2.7	1.2
	Females	1.02	1.4	0.5
College of Dentistry	Males	2.1	5.3	1.9
	Females	1.8	5.4	0.5

Comparison of the reslts:

Figures12 (a-c) Show the errors as considering theorem mean value as the reference. There is fluctuation in the values predicted by the methods of cubic plines and Newton's forward difference.
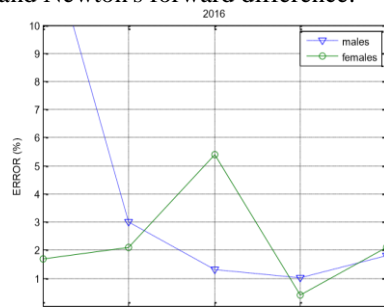
a
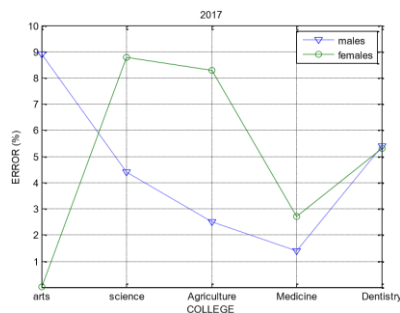
b
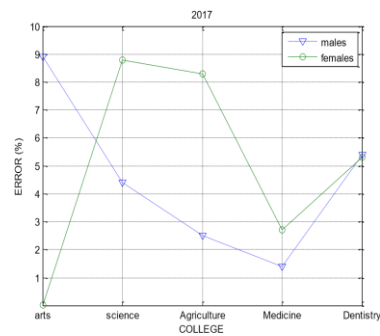
c

Figuar12 (a-c) shows the comparison between colleges

Results:

This study showed that the error rate within the expected values increases as the years increase.

In addition, the results showed that the Newton's forward method is the better than cubic plines method because the plines method uses a third-order equation. And it has the property of oscillation, especially, in distant prediction

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