

**Ghulam Ishaq Khan Institute of Engineering Sciences and Technology**  
**Department of Computer Science**

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**Course Information**

**Course Code:** CS 351L

**Course Title:** Artificial Intelligence Lab

**Instructor:** Mr. Usama Arshad, PhD CS

**Program:** BS Cybersecurity

**Semester:** 5<sup>th</sup>

**Reference for Lab Resources:**

[CS 351L - AI Lab GitHub Repository]

<https://github.com/usamajanjua9/CS-351L---AI-Lab->

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**Lab Task Details**

**Lab Task:** 05

**Lab Title:** Exploring Polynomial Regression and Model Evaluation

**Assigned Date:** 5th October 2024

**Submission Deadline:** 8th October 2024

**Task Type:** Individual

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**Submission Instructions**

- Make a public repository on GitHub with following name:  
CS 351L - AI Lab GitHub Repository\_Your\_reg\_no.
- Submit each completed lab task on repository and share the link to my email with screenshots of output.  
[usama.arshad@giki.edu.pk](mailto:usama.arshad@giki.edu.pk)
- File Naming Convention: [YourName]\_CS351L\_Lab05.ipynb

**Late Submissions:** Will incur a deduction of marks unless approved in advance by the instructor.

## Task Overview

### Scenario:

In this lab, you will explore polynomial regression as an extension of linear regression using Excel. You'll learn how polynomial regression can model complex relationships and compare it with simple linear regression.

### Polynomial regression Equation:

$$Y = a_2X^2 + a_1X + a_0$$

### Steps to Follow:

**1. Data Setup:** Use the same dataset you used before in lab (Hours Studied and Scores).  
- Add a new column called "Hours Squared" by squaring the "Hours Studied" values in Excel.

**2. Set Up Polynomial Regression:**

- Use Excel's LINEST function to create a polynomial regression equation:

$$\text{Score} = a_0 + a_1 \times \text{Hours Studied} + a_2 \times \text{Hours Squared}$$

- Calculate the coefficients ( $a_0$ ,  $a_1$ , and  $a_2$ ) for the polynomial regression.

**3. Calculate Predicted Scores:**

- Create a new column called "Predicted Scores (Polynomial)" using the regression equation and coefficients.

**4. Visualize Polynomial Regression:**

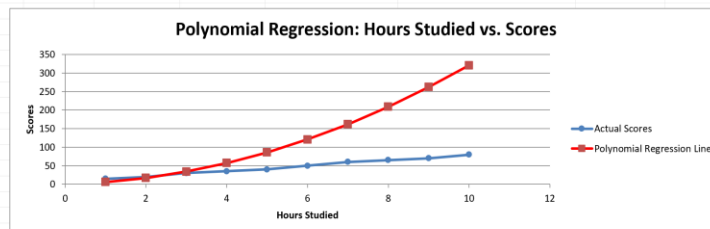
- Create a scatter plot using your data (Hours Studied and Scores) and add the polynomial regression line to the plot.  
- Compare this new polynomial line with the previous linear regression line.

**5. Calculate Errors (Residuals):**

- Create a new column called "Residuals (Polynomial)" to find the difference between the actual scores and the predicted scores.

**6. Example:**

Hours_Studied	Scores	Hours_Squared	Mean_Hours	Mean_Scores	X_minus_meanX	Y_minus_meanY	X_minus_meanX_squared	X_squared_minus_meanX_squared	Predicted_Scores	Residuals	Quadratic Coefficient (a2):	Linear Coefficient (a1):	Intercept (a0):
1	15	1	5.5	46.5	-4.5	-31.5	20.25	-37.5	6	9	3	2	1
2	20	4	5.5	46.5	-3.5	-26.5	12.25	-34.5	17	3			
3	30	9	5.5	46.5	-2.5	-16.5	6.25	-29.5	34	-4			
4	35	16	5.5	46.5	-1.5	-11.5	2.25	-22.5	57	-22			
5	40	25	5.5	46.5	-0.5	-6.5	0.25	-13.5	86	-46			
6	50	36	5.5	46.5	0.5	3.5	0.25	-2.5	121	-71			
7	60	49	5.5	46.5	1.5	13.5	2.25	10.5	162	-102			
8	65	64	5.5	46.5	2.5	18.5	6.25	25.5	209	-144			
9	70	81	5.5	46.5	3.5	23.5	12.25	42.5	262	-192			
10	80	100	5.5	46.5	4.5	33.5	20.25	61.5	321	-241			



-----to err is human-----