CHAPTER 7 — LEAST SQUARES REGRESSION

COMPREHENSION QUESTIONS

for

NUMERICAL METHODS
FOR SCIENTISTS AND ENGINEERS
With Pseudocodes

By Zekeriya ALTAÇ

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7.1 Polynomial Regression

1. What is polynomial regression and how does it differ from linear regression?
2. What is the role of the degree of the polynomial in polynomial regression?
3. How do you fit a polynomial regression model to data?
4. How can you assess the performance of a polynomial regression model?
5. What is overfitting, and how can you detect it in polynomial regression?
6. Given a dataset with one independent variable and one dependent variable, describe how you would approach fitting a polynomial regression model.
7. Why is goodness of fit important in regression analysis?
8. What is r-squared (r^2) and how is it used to assess goodness of fit?
9. How does the adjusted r-squared differ from r-squared?
10. What is residual analysis, and how does it relate to goodness of fit?
11. What are some visual methods for assessing goodness of fit?
12. How can overfitting affect goodness of fit metrics?
13. Define SSR (sum of the squares of residuals) and SSME (sum of the squares of mean deviation).
14. Why might a high r-squared not always indicate a good model?
15. Given a dataset and a model, how would you evaluate the goodness of fit?
16. When comparing two models, how should you use goodness of fit metrics to make a decision?

7.2 Transformation of Variables

1. What is the purpose of transforming variables in regression analysis?
2. What are some common types of variable transformations used in regression?
3. How can you determine if a transformation is needed for a variable?
4. What is a residual plot, and how can it help in assessing the need for variable transformations?
5. How would you apply a logarithmic transformation to a variable in a regression model?
6. After transforming variables, how should you reassess the fit of the regression model?

7.3 Linearization of Nonlinear Models

1. What does it mean to linearize a nonlinear model?
2. Why is linearization useful in least squares regression?
3. What are the most common methods for linearizing nonlinear models?
4. How can you determine the appropriate transformation for linearizing a nonlinear model?
5. What kind of transformation should you use to linearize an exponential growth model?
6. What are the potential limitations of linearizing a nonlinear model?

7.4 Multivariate Regression

1. What is the purpose of a multivariate regression model?
2. What is the general form of a multivariate linear regression equation?
3. What is r-squared, and how is it used in the context of multivariate regression?
4. How can you assess the significance of individual predictors in a multivariate regression model?
5. What is a residual plot, and how can it be used to evaluate the fit of a multivariate regression model?

7.5 Continuous Least Square Regression

1. What is the primary goal of continuous least squares regression?

2. What are the key assumptions underlying continuous least squares regression?
3. How does the least squares method handle residuals when fitting continuous functions?
4. Why might you choose a polynomial function for fitting continuous data using least squares?
5. Describe the process of determining the best-fit parameters in continuous least squares fitting.
6. What role does the choice of the continuous function play in the accuracy of least squares fitting?