Consider the following time series data representing quarterly sales of dishwashers at Big Boys Appliances over the past two years:

|  |  |
| --- | --- |
| Time | Sales |
| 2010 Quarter 1 | 20 |
| 2010 Quarter 2 | 85 |
| 2010 Quarter 3 | 64 |
| 2010 Quarter 4 | 30 |
| 2011 Quarter 1 | 70 |
| 2011 Quarter 2 | 125 |
| 2011 Quarter 3 | 105 |
| 2011 Quarter 4 | 90 |

The scatter plot of the data above shows seasonality with trend. Hence, a time-series regression model with trend and seasonality should be run to forecast the demand.

We denote sales (*Y*) as the depend variable, and denote time (*t*) and seasonality dummy variables ($S\_{2}$, $S\_{3}$, and $S\_{4}$) as independent variables. Here, we choose quarter 1 as the baseline and adopt three seasonality dummy variables, such that $S\_{2}=1$ represents quarter 2, $S\_{3}=1$ represents quarter 3, and $S\_{4}=1$ represents quarter 4. Answer the following questions. Use $α=0.05.$

Use the above variable definition to code the data above.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Time | Sales(Y) | Time (t) | $$S\_{2}$$ | $$S\_{3}$$ | $$S\_{4}$$ |
| 2010 Quarter 1 | 20 |  |  |  |  |
| 2010 Quarter 2 | 85 |  |  |  |  |
| 2010 Quarter 3 | 64 |  |  |  |  |
| 2010 Quarter 4 | 30 |  |  |  |  |
| 2011 Quarter 1 | 70 |  |  |  |  |
| 2011 Quarter 2 | 125 |  |  |  |  |
| 2011 Quarter 3 | 105 |  |  |  |  |
| 2011 Quarter 4 | 90 |  |  |  |  |

1. Copy the data into Excel and run the corresponding multiple regression. Write the estimated multiple regression equation use the variables defined above.
2. Explain the meaning of the coefficients for time (*t*) and for seasonally dummy variable $S\_{2}$. (Note: Use actual variable name and numbers to answer the questions.)
3. Test the overall fitness of the model. (Clearly state the hypotheses.)
4. Which variables in the current regression model are significant? And which are not significant? Justify your answer.