**A wine company collected a data on various factors to study about the quality of wine on the basis of various factors. The data set is as follows:**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *y* | *x*2 | *x*3 | *x*4 | *x*5 | *x*6 | *x*7 | *x*8 | *x*9 | *x*10 |
| 19.2 | 3.85 | 66 | 9.35 | 5.65 | 2.40 | 3.25 | 0.33 | 19 | 0.065 |
| 18.3 | 3.73 | 79 | 11.15 | 6.95 | 3.15 | 3.80 | 0.36 | 21 | 0.076 |
| 17.1 | 3.88 | 73 | 9.40 | 5.75 | 2.10 | 3.65 | 0.40 | 18 | 0.073 |
| 17.3 | 3.86 | 99 | 12.85 | 7.70 | 3.90 | 3.80 | 0.35 | 22 | 0.076 |
| 16.8 | 3.98 | 75 | 8.55 | 5.05 | 2.05 | 3.00 | 0.49 | 12 | 0.060 |
| 16.5 | 3.85 | 61 | 10.30 | 6.20 | 2.50 | 3.70 | 0.38 | 20 | 0.074 |
| 15.8 | 3.93 | 66 | 4.90 | 2.75 | 1.20 | 1.55 | 0.29 | 11 | 0.031 |
| 15.2 | 3.66 | 86 | 6.40 | 4.00 | 1.50 | 2.50 | 0.27 | 19 | 0.050 |
| 15.2 | 3.91 | 78 | 5.80 | 3.30 | 1.40 | 1.90 | 0.40 | 9 | 0.038 |
| 14.0 | 3.47 | 178 | 3.60 | 2.25 | 0.75 | 1.50 | 0.37 | 8 | 0.030 |
| 14.0 | 3.91 | 81 | 3.90 | 2.15 | 1.00 | 1.15 | 0.32 | 7 | 0.023 |
| 13.8 | 3.75 | 108 | 5.80 | 3.20 | 1.60 | 1.60 | 0.38 | 8 | 0.032 |
| 13.6 | 3.90 | 92 | 5.40 | 2.85 | 1.55 | 1.30 | 0.44 | 6 | 0.026 |
| 12.8 | 3.92 | 96 | 5.00 | 2.70 | 1.40 | 1.30 | 0.35 | 7 | 0.026 |
| 18.5 | 3.87 | 89 | 9.15 | 5.60 | 1.95 | 3.65 | 0.46 | 16 | 0.073 |
| 17.3 | 3.97 | 59 | 10.25 | 6.10 | 2.40 | 3.70 | 0.40 | 19 | 0.074 |
| 16.3 | 3.76 | 22 | 8.20 | 5.00 | 1.85 | 3.15 | 0.25 | 25 | 0.063 |
| 16.3 | 3.76 | 77 | 8.35 | 5.05 | 1.90 | 3.15 | 0.37 | 17 | 0.063 |
| 16.0 | 3.98 | 58 | 10.15 | 6.00 | 2.60 | 3.40 | 0.38 | 18 | 0.068 |
| 16.0 | 3.88 | 85 | 6.85 | 4.10 | 1.50 | 2.60 | 0.33 | 16 | 0.052 |
| 15.7 | 3.75 | 120 | 8.80 | 5.50 | 1.85 | 3.65 | 0.39 | 19 | 0.073 |
| 15.5 | 3.98 | 94 | 5.45 | 3.05 | 1.50 | 1.55 | 0.41 | 8 | 0.031 |
| 15.3 | 3.69 | 122 | 8.00 | 5.05 | 1.90 | 3.15 | 0.27 | 23 | 0.063 |
| 15.3 | 3.77 | 144 | 5.60 | 3.35 | 1.10 | 2.25 | 0.36 | 12 | 0.045 |
| 14.8 | 3.74 | 10 | 7.90 | 4.75 | 1.95 | 2.80 | 0.25 | 23 | 0.056 |
| 14.3 | 3.76 | 100 | 5.55 | 3.25 | 1.15 | 2.10 | 0.34 | 12 | 0.042 |
| 14.3 | 3.91 | 73 | 4.65 | 2.70 | 0.95 | 1.75 | 0.36 | 10 | 0.035 |
| 14.2 | 3.60 | 301 | 4.25 | 2.40 | 1.25 | 1.15 | 0.42 | 6 | 0.023 |
| 14.0 | 3.76 | 104 | 8.70 | 5.10 | 2.25 | 2.85 | 0.34 | 17 | 0.057 |
| 13.8 | 3.90 | 67 | 7.40 | 4.40 | 1.60 | 2.80 | 0.45 | 13 | 0.056 |
| 12.5 | 3.80 | 89 | 5.35 | 3.15 | 1.20 | 1.95 | 0.32 | 12 | 0.039 |
| 11.5 | 3.65 | 192 | 6.35 | 3.90 | 1.25 | 2.65 | 0.63 | 8 | 0.053 |

*y*: quality rating (20 maximum)

*x*2: pH

*x*3: Total *SO*2 (ppm)

*x*4: color density

*x*5: wine color

*x*6: polymeric pigment color

*x*7: anthocyanin color

*x*8: total anthocyanins (g/L)

*x*9: degree of ionization of anthocyanins (percent)

*x*10: ionized anthocyanins (percent)

Use R package to analyze the data and give your comments to the following:

1. Use Backward Elimination method to obtain the best regression model.
2. Obtain the adjusted R square.
3. Give your comment about the significance of the overall model.

The evaluation pattern is as follows:

|  |  |  |
| --- | --- | --- |
| Section | Parameters | Marks |
| A | Objective/Aim | 4 |
| B | Analysis | 6 |
| C | Interpretation | 6 |
| D | Timely submission | 4 |
| Total |  | 20 |