**Problem 1**

1)

The regression output to predict mileage is given below

|  |  |  |  |
| --- | --- | --- | --- |
| **Descriptive Statistics** | | | |
|  | Mean | Std. Deviation | N |
| Mileage | 24.6552 | 4.85781 | 58 |
| Weight | 2895.9483 | 502.90337 | 58 |
| Disp | 151.7241 | 54.96436 | 58 |
| Fuel | 4.2019 | .76916 | 58 |
| Small | .2241 | .42066 | 58 |
| Sporty | .1552 | .36523 | 58 |
| Compact | .2586 | .44170 | 58 |
| Medium | .1897 | .39545 | 58 |
| Large | .0517 | .22340 | 58 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model Summaryb** | | | | | | | | | | |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | | Durbin-Watson |
| R Square Change | F Change | df1 | df2 | Sig. F Change |
| 1 | .991a | .982 | .979 | .70869 | .982 | 328.654 | 8 | 49 | .000 | 2.056 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **ANOVAa** | | | | | | |
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|  | Regression | 1320.494 | 8 | 165.062 | 328.654 | .000b |
| Residual | 24.610 | 49 | .502 |  |  |
| Total | 1345.103 | 57 |  |  |  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Coefficientsa** | | | | | | | | |
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | |
| B | Std. Error | Beta | Lower Bound | Upper Bound |
| 1 | (Constant) | 57.488 | 2.072 |  | 27.750 | .000 | 53.325 | 61.651 |
| Weight | -.001 | .001 | -.151 | -2.474 | .017 | -.003 | .000 |
| Disp | .015 | .005 | .175 | 3.362 | .002 | .006 | .025 |
| Fuel | -6.785 | .313 | -1.074 | -21.657 | .000 | -7.415 | -6.156 |
| Small | -2.495 | .808 | -.216 | -3.087 | .003 | -4.119 | -.871 |
| Sporty | -3.097 | .691 | -.233 | -4.481 | .000 | -4.485 | -1.708 |
| Compact | -3.139 | .557 | -.285 | -5.637 | .000 | -4.258 | -2.020 |
| Medium | -2.504 | .473 | -.204 | -5.292 | .000 | -3.455 | -1.553 |
| Large | -2.412 | .732 | -.111 | -3.292 | .002 | -3.884 | -.940 |
| a. Dependent Variable: Mileage | | | | | | | | |

The regression equation is

Mileage = 57.49 – 0.001 \* weight + 0.015 \* Displacement – 6.785 \* Fuel – 2.495 \* Small – 3.097 \* Sporty – 3.139 \* Compact – 2.504 \* Medium – 2.412 \* Large

The coefficient of determination is 0.982, indicating that 98.2% of the variation of Mileage is explained by the regression model

The model goodness of fit was validated using F test for overall significance. The p – value of f test statistic falls well below 0.05, indicating that the estimated regression model is good fit in predicting Mileage

2)

The regression output after ignoring the type is given below

|  |  |  |  |
| --- | --- | --- | --- |
| **Descriptive Statistics** | | | |
|  | Mean | Std. Deviation | N |
| Mileage | 24.6552 | 4.85781 | 58 |
| Weight | 2895.9483 | 502.90337 | 58 |
| Disp | 151.7241 | 54.96436 | 58 |
| Fuel | 4.2019 | .76916 | 58 |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Model Summaryb** | | | | | | | | | | |
| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | Change Statistics | | | | | Durbin-Watson |
| R Square Change | F Change | df1 | df2 | Sig. F Change |
| 1 | .980a | .960 | .958 | .99422 | .960 | 435.596 | 3 | 54 | .000 | 1.205 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **ANOVAa** | | | | | | |
| Model | | Sum of Squares | df | Mean Square | F | Sig. |
| 1 | Regression | 1291.726 | 3 | 430.575 | 435.596 | .000b |
| Residual | 53.378 | 54 | .988 |  |  |
| Total | 1345.103 | 57 |  |  |  |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Coefficientsa** | | | | | | | | |
| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. | 95.0% Confidence Interval for B | |
| B | Std. Error | Beta | Lower Bound | Upper Bound |
| 1 | (Constant) | 50.956 | .887 |  | 57.460 | .000 | 49.178 | 52.734 |
| Weight | .000 | .001 | -.032 | -.514 | .610 | -.002 | .001 |
| Disp | .002 | .004 | .024 | .528 | .600 | -.006 | .010 |
| Fuel | -6.121 | .338 | -.969 | -18.099 | .000 | -6.799 | -5.443 |

The regression equation is

Mileage = 50.956 – 0.000312 \* weight + 0.002 \* Displacement – 6.121 \* Fuel

The coefficient of determination is 0.96, indicating that 96% of the variation of Mileage is explained by the regression model

The model goodness of fit was validated using F test for overall significance. The p – value of f test statistic falls well below 0.05, indicating that the estimated regression model is good fit in predicting Mileage

3)

Model Checking procedures

The F test statistic is

Thus, the value of F test statistic is 0.4312 and its corresponding p – value is 0.81 > 0.05. Since the p –value is greater than 0.05, we conclude that the regression used to validate the F test seems to be identical

**Problem 2**

One of the important SAS procedure is “Upcase, lowcase, propcase”

Function: these functions are mainly used to convert the character value to any one of these three cases, namely upper case, lower case or procase. Procase was normally used to arrange the word in proper case with first letter of the word in capital letter and the remaining letters in small case

Example

Data newdata;

text1 = “I am INTERESTED in doing Maths”

text2 = upcase(text1);

text3 = lowcase(text1);

text4 = procase(text1);

Run;

SAS Codes

Data car;

input car $ Weight Disp Mileage Fuel Type$;

cards;

Eagle Summit 4 2560 97 33 3.030303 Small

Ford Escort 4 2345 114 33 3.030303 Small

Ford Festiva 4 1845 81 37 2.702703 Small

Honda Civic 4 2260 91 32 3.125000 Small

Mazda Protege 4 2440 113 32 3.125000 Small

Mercury Tracer 4 2285 97 26 3.846154 Small

Nissan Sentra 4 2275 97 33 3.030303 Small

Pontiac LeMans 4 2350 98 28 3.571429 Small

Subaru Loyale 4 2295 109 25 4.000000 Small

Subaru Justy 3 1900 73 34 2.941176 Small

Toyota Corolla 4 2390 97 29 3.448276 Small

Toyota Tercel 4 2075 89 35 2.857143 Small

Volkswagen Jetta 4 2330 109 26 3.846154 Small

Chevrolet Camaro V8 3320 305 20 5.000000 Sporty

Dodge Daytona 2885 153 27 3.703704 Sporty

Ford Mustang V8 3310 302 19 5.263158 Sporty

Ford Probe 2695 133 30 3.333333 Sporty

Honda Civic CRX Si 4 2170 97 33 3.030303 Sporty

Honda Prelude Si 4WS 4 2710 125 27 3.703704 Sporty

Nissan 240SX 4 2775 146 24 4.166667 Sporty

Plymouth Laser 2840 107 26 3.846154 Sporty

Subaru XT 4 2485 109 28 3.571429 Sporty

Audi 80 4 2670 121 27 3.703704 Compact

Buick Skylark 4 2640 151 23 4.347826 Compact

Chevrolet Beretta 4 2655 133 26 3.846154 Compact

Chrysler Le Baron V6 3065 181 25 4.000000 Compact

Ford Tempo 4 2750 141 24 4.166667 Compact

Honda Accord 4 2920 132 26 3.846154 Compact

Mazda 626 4 2780 133 24 4.166667 Compact

Mitsubishi Galant 4 2745 122 25 4.000000 Compact

Mitsubishi Sigma V6 3110 181 21 4.761905 Compact

Nissan Stanza 4 2920 146 21 4.761905 Compact

Oldsmobile Calais 4 2645 151 23 4.347826 Compact

Peugeot 405 4 2575 116 24 4.166667 Compact

Subaru Legacy 4 2935 135 23 4.347826 Compact

Toyota Camry 4 2920 122 27 3.703704 Compact

Volvo 240 4 2985 141 23 4.347826 Compact

Acura Legend V6 3265 163 20 5.000000 Medium

Buick Century 4 2880 151 21 4.761905 Medium

Chrysler Le Baron Coupe 2975 153 22 4.545455 Medium

Chrysler New Yorker V6 3450 202 22 4.545455 Medium

Eagle Premier V6 3145 180 22 4.545455 Medium

Ford Taurus V6 3190 182 22 4.545455 Medium

Ford Thunderbird V6 3610 232 23 4.347826 Medium

Hyundai Sonata 4 2885 143 23 4.347826 Medium

Mazda 929 V6 3480 180 21 4.761905 Medium

Nissan Maxima V6 3200 180 22 4.545455 Medium

Oldsmobile Cutlass Ciera 4 2765 151 21 4.761905 Medium

Oldsmobile Cutlass Supreme V6 3220 189 21 4.761905 Medium

Toyota Cressida 6 3480 180 23 4.347826 Medium

Buick Le Sabre V6 3325 231 23 4.347826 Large

Chevrolet Caprice V8 3855 305 18 5.555556 Large

Ford LTD Crown Victoria V8 3850 302 20 5.000000 Large

Chevrolet Lumina APV V6 3195 151 18 5.555556 Van

Dodge Grand Caravan V6 3735 202 18 5.555556 Van

Ford Aerostar V6 3665 182 18 5.555556 Van

Mazda MPV V6 3735 181 19 5.263158 Van

Mitsubishi Wagon 4 3415 143 20 5.000000 Van

Nissan Axxess 4 3185 146 20 5.000000 Van

Nissan Van 4 3690 146 19 5.263158 Van

;

run;

title "cars data";

PROC PRINT DATA=car(obs=5);

RUN;

proc Reg data = car

title "Multiple Regression";

model Mileage= Weight Disp Fuel Type;

run;

proc Reg data = car

title "Multiple Regression";

model Mileage= Weight Disp Fuel;

run;