```
1          OPTIONS NONOTES NOSTIMER NOSOURCE NOSYNTAXCHECK;
68
69         ******************************
70         Exam 2
71         Name: Yelizaveta Semikina
72         Version: Embers version 2
73         ******************************;
74
75
76         ******************************
77         ******** Task 1: DATA *********
78         ******************************;
79
80         /* Question 1: Import Data */
81         TITLE 'Task1 Q1: Import Data';
82
83         FILENAME Rides1 "/home/u62830651/sasuser.v94/Exam2/rides1.csv";
84
85         PROC IMPORT DATAFILE=Rides1
86             OUT=Rides1
87             DBMS=CSV
88             REPLACE;
89         RUN;

NOTE: Unable to open parameter catalog: SASUSER.PARMS.PARMS.SLIST in update mode. Temporary parameter values will be saved to
WORK.PARMS.PARMS.SLIST.
90          /*************************************************************************
91          *   PRODUCT:   SAS
92          *   VERSION:   9.4
93          *   CREATOR:   External File Interface
94          *   DATE:      07DEC22
95          *   DESC:      Generated SAS Datastep Code
96          *   TEMPLATE SOURCE:  (None Specified.)
97          *************************************************************************/
98             data WORK.RIDES1    ;
99             %let _EFIERR_ = 0; /* set the ERROR detection macro variable */
100            infile RIDES1 delimiter = ',' MISSOVER DSD  firstobs=2 ;
101               informat Coaster_ID $7. ;
102               informat Park_ID best32. ;
103               informat Material_Used $5. ;
104               informat MPH best32. ;
105               informat Elevation best32. ;
106               informat Fall_Distance best32. ;
107               informat Distance_Traveled best32. ;
108               informat Ride_Length_Time best32. ;
109               informat Loops best32. ;
110               informat Type best32. ;
111               informat SpeedGroup $6. ;
112               format Coaster_ID $7. ;
113               format Park_ID best12. ;
114               format Material_Used $5. ;
115               format MPH best12. ;
116               format Elevation best12. ;
117               format Fall_Distance best12. ;
118               format Distance_Traveled best12. ;
119               format Ride_Length_Time best12. ;
120               format Loops best12. ;
121               format Type best12. ;
122               format SpeedGroup $6. ;
123            input
124                        Coaster_ID  $
125                        Park_ID
126                        Material_Used  $
127                        MPH
128                        Elevation
129                        Fall_Distance
130                        Distance_Traveled
131                        Ride_Length_Time
132                        Loops
133                        Type
134                        SpeedGroup  $
135            ;
136            if _ERROR_ then call symputx('_EFIERR_',1);  /* set ERROR detection macro variable */
137            run;

NOTE: The infile RIDES1 is:
      Filename=/home/u62830651/sasuser.v94/Exam2/rides1.csv,
      Owner Name=u62830651,Group Name=oda,
      Access Permission=-rw-r--r--,
      Last Modified=05Dec2022:19:01:05,
      File Size (bytes)=9753

NOTE: 200 records were read from the infile RIDES1.
      The minimum record length was 39.
      The maximum record length was 55.
NOTE: The data set WORK.RIDES1 has 200 observations and 11 variables.
NOTE: DATA statement used (Total process time):
```

```
      real time           0.00 seconds
      user cpu time       0.01 seconds
      system cpu time     0.00 seconds
      memory              10526.93k
      OS Memory           34076.00k
      Timestamp           12/07/2022 04:19:33 AM
      Step Count                        24  Switch Count  2
      Page Faults                       0
      Page Reclaims                     222
      Page Swaps                        0
      Voluntary Context Switches        13
      Involuntary Context Switches      0
      Block Input Operations            0
      Block Output Operations           272


200 rows created in WORK.RIDES1 from RIDES1.



NOTE: WORK.RIDES1 data set was successfully created.
NOTE: The data set WORK.RIDES1 has 200 observations and 11 variables.
NOTE: PROCEDURE IMPORT used (Total process time):
      real time           0.13 seconds
      user cpu time       0.06 seconds
      system cpu time     0.02 seconds
      memory              10526.93k
      OS Memory           34592.00k
      Timestamp           12/07/2022 04:19:33 AM
      Step Count                        24  Switch Count  8
      Page Faults                       0
      Page Reclaims                     5309
      Page Swaps                        0
      Voluntary Context Switches        107
      Involuntary Context Switches      0
      Block Input Operations            24
      Block Output Operations           360


138        PROC PRINT DATA = Rides1;
139        RUN;

NOTE: There were 200 observations read from the data set WORK.RIDES1.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           0.39 seconds
      user cpu time       0.39 seconds
      system cpu time     0.00 seconds
      memory              1496.25k
      OS Memory           29608.00k
      Timestamp           12/07/2022 04:19:34 AM
      Step Count                        25  Switch Count  0
      Page Faults                       0
      Page Reclaims                     457
      Page Swaps                        0
      Voluntary Context Switches        1
      Involuntary Context Switches      1
      Block Input Operations            0
      Block Output Operations           136


140
141
142        /* Question 2: Change values to 0 where there is missing data in the xxx column (see PDF for column) */
143        TITLE 'Task1 Q2: Adjust for Missing Data';
144
145        DATA Rides1_Task1;
146        SET Rides1;
147        IF Fall_Distance = . THEN Fall_Distance = 0;
148        RUN;

NOTE: There were 200 observations read from the data set WORK.RIDES1.
NOTE: The data set WORK.RIDES1_TASK1 has 200 observations and 11 variables.
NOTE: DATA statement used (Total process time):
      real time           0.00 seconds
      user cpu time       0.00 seconds
      system cpu time     0.00 seconds
      memory              959.15k
      OS Memory           29868.00k
      Timestamp           12/07/2022 04:19:34 AM
      Step Count                        26  Switch Count  2
      Page Faults                       0
      Page Reclaims                     134
      Page Swaps                        0
      Voluntary Context Switches        13
      Involuntary Context Switches      0
      Block Input Operations            0
      Block Output Operations           264
```

```
149         PROC PRINT DATA = Rides1_Task1;
150         RUN;

NOTE: There were 200 observations read from the data set WORK.RIDES1_TASK1.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           0.41 seconds
      user cpu time       0.41 seconds
      system cpu time     0.00 seconds
      memory              779.65k
      OS Memory           29608.00k
      Timestamp           12/07/2022 04:19:34 AM
      Step Count                        27  Switch Count  0
      Page Faults                       0
      Page Reclaims                     78
      Page Swaps                        0
      Voluntary Context Switches        0
      Involuntary Context Switches      0
      Block Input Operations            0
      Block Output Operations           144


151
152
153         /* Question 3: Create a new character variable */
154         TITLE 'Task1 Q3: Create Character Variable';
155         DATA Rides1_Task1;
156         SET Rides1_Task1;
157         LENGTH LengthGroup $8.;
158         IF Distance_Traveled<=1700 THEN LengthGroup = "Short";
159         IF Distance_Traveled>1700 AND Distance_Traveled<=4000 THEN LengthGroup = "Medium";
160         IF Distance_Traveled>4000 THEN LengthGroup = "Long";

NOTE: There were 200 observations read from the data set WORK.RIDES1_TASK1.
NOTE: The data set WORK.RIDES1_TASK1 has 200 observations and 12 variables.
NOTE: DATA statement used (Total process time):
      real time           0.00 seconds
      user cpu time       0.00 seconds
      system cpu time     0.00 seconds
      memory              960.37k
      OS Memory           29868.00k
      Timestamp           12/07/2022 04:19:34 AM
      Step Count                        28  Switch Count  2
      Page Faults                       0
      Page Reclaims                     122
      Page Swaps                        0
      Voluntary Context Switches        8
      Involuntary Context Switches      0
      Block Input Operations            0
      Block Output Operations           272


161         PROC PRINT DATA = Rides1_Task1;
162         RUN;

NOTE: There were 200 observations read from the data set WORK.RIDES1_TASK1.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           0.42 seconds
      user cpu time       0.42 seconds
      system cpu time     0.00 seconds
      memory              700.93k
      OS Memory           29608.00k
      Timestamp           12/07/2022 04:19:35 AM
      Step Count                        29  Switch Count  0
      Page Faults                       0
      Page Reclaims                     64
      Page Swaps                        0
      Voluntary Context Switches        0
      Involuntary Context Switches      1
      Block Input Operations            0
      Block Output Operations           160


163
164
165
166         /* Question 4: Create a new variable called Ratio */
167         TITLE 'Task1 Q4: Create Ratio';
168         DATA Rides1_Task1;
169         SET Rides1_Task1;
170         Ratio=Elevation/MPH;
171         RUN;

NOTE: There were 200 observations read from the data set WORK.RIDES1_TASK1.
NOTE: The data set WORK.RIDES1_TASK1 has 200 observations and 13 variables.
NOTE: DATA statement used (Total process time):
      real time           0.00 seconds
      user cpu time       0.00 seconds
      system cpu time     0.00 seconds
      memory              961.53k
```

```
      OS Memory           29868.00k
      Timestamp           12/07/2022 04:19:35 AM
      Step Count                        30  Switch Count  2
      Page Faults                       0
      Page Reclaims                     119
      Page Swaps                        0
      Voluntary Context Switches        17
      Involuntary Context Switches      0
      Block Input Operations            0
      Block Output Operations           264


172         PROC PRINT DATA = Rides1_Task1;
173         RUN;

NOTE: There were 200 observations read from the data set WORK.RIDES1_TASK1.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           0.55 seconds
      user cpu time       0.56 seconds
      system cpu time     0.00 seconds
      memory              709.18k
      OS Memory           29608.00k
      Timestamp           12/07/2022 04:19:35 AM
      Step Count                        31  Switch Count  0
      Page Faults                       0
      Page Reclaims                     63
      Page Swaps                        0
      Voluntary Context Switches        0
      Involuntary Context Switches      1
      Block Input Operations            0
      Block Output Operations           160


174
175
176         /* Question 5: Create a New Dataset called High_Ratio and Print it */
177         TITLE 'Task1 Q5: Create Dataset High_Ratio';
178         DATA High_Ratio;
179         SET Rides1_Task1;
180         WHERE Ratio>2.75;
181         KEEP Material_Used Elevation MPH Fall_Distance;
182         RUN;

NOTE: There were 28 observations read from the data set WORK.RIDES1_TASK1.
      WHERE Ratio>2.75;
NOTE: The data set WORK.HIGH_RATIO has 28 observations and 4 variables.
NOTE: DATA statement used (Total process time):
      real time           0.00 seconds
      user cpu time       0.01 seconds
      system cpu time     0.00 seconds
      memory              966.75k
      OS Memory           29868.00k
      Timestamp           12/07/2022 04:19:35 AM
      Step Count                        32  Switch Count  2
      Page Faults                       0
      Page Reclaims                     148
      Page Swaps                        0
      Voluntary Context Switches        12
      Involuntary Context Switches      0
      Block Input Operations            0
      Block Output Operations           264


183         PROC PRINT DATA = High_Ratio;
184         RUN;

NOTE: There were 28 observations read from the data set WORK.HIGH_RATIO.
NOTE: PROCEDURE PRINT used (Total process time):
      real time           0.03 seconds
      user cpu time       0.04 seconds
      system cpu time     0.00 seconds
      memory              614.71k
      OS Memory           29608.00k
      Timestamp           12/07/2022 04:19:35 AM
      Step Count                        33  Switch Count  0
      Page Faults                       0
      Page Reclaims                     64
      Page Swaps                        0
      Voluntary Context Switches        0
      Involuntary Context Switches      1
      Block Input Operations            0
      Block Output Operations           16


185
186
187
188
189
```

```
190
191
192
193         ************************************************
194         ******** Task 2: INTRODUCTORY ANALYSIS *********
195         ************************************************;
196
197         /* Question 6: Compute ONLY values of sample mean / median / std dev / IQR
198         / # Observations / # Missing */
199         TITLE 'Task2 Q6: Summary Statistics';
200         PROC MEANS DATA=Rides1 MEAN MEDIAN STD QRANGE N NMISS;
201         var Ride_Length_Time;
202         RUN;

NOTE: There were 200 observations read from the data set WORK.RIDES1.
NOTE: PROCEDURE MEANS used (Total process time):
      real time           0.02 seconds
      user cpu time       0.02 seconds
      system cpu time     0.01 seconds
      memory              7047.40k
      OS Memory           36044.00k
      Timestamp           12/07/2022 04:19:35 AM
      Step Count                        34  Switch Count  1
      Page Faults                       0
      Page Reclaims                     1884
      Page Swaps                        0
      Voluntary Context Switches        18
      Involuntary Context Switches      1
      Block Input Operations            0
      Block Output Operations           8


203
204
205         /* Question 7: Histogram with density normal and describe it */
206         TITLE 'Task2 Q7: Histogram with Density Normal';
207         /* CODE */
208         PROC SGPLOT DATA=Rides1;
209         HISTOGRAM Fall_Distance;
210         DENSITY Fall_Distance / type=normal;
211         RUN;

NOTE: PROCEDURE SGPLOT used (Total process time):
      real time           2.46 seconds
      user cpu time       0.06 seconds
      system cpu time     0.01 seconds
      memory              8109.09k
      OS Memory           36144.00k
      Timestamp           12/07/2022 04:19:38 AM
      Step Count                        35  Switch Count  1
      Page Faults                       0
      Page Reclaims                     2568
      Page Swaps                        0
      Voluntary Context Switches        326
      Involuntary Context Switches      0
      Block Input Operations            0
      Block Output Operations           776

NOTE: There were 200 observations read from the data set WORK.RIDES1.

212
213
214         /* Describe the histogram */
215         /* Based on the curve we can say that the histogram does not look normal and it is right
216            skewed.*/
217
218
219
220         /* Question 8: Bar Chart */
221         TITLE 'Task2 Q8: Bar Chart';
222         PROC SGPLOT DATA=Rides1;
223         VBAR SpeedGroup;
224         label SpeedGroup='Speed Group';
225         RUN;

NOTE: PROCEDURE SGPLOT used (Total process time):
      real time           0.19 seconds
      user cpu time       0.03 seconds
      system cpu time     0.01 seconds
      memory              2205.40k
      OS Memory           36528.00k
      Timestamp           12/07/2022 04:19:38 AM
      Step Count                        36  Switch Count  2
      Page Faults                       0
      Page Reclaims                     615
      Page Swaps                        0
      Voluntary Context Switches        146
      Involuntary Context Switches      0
      Block Input Operations            0
```

```
      Block Output Operations           368

NOTE: There were 200 observations read from the data set WORK.RIDES1.

226
227
228
229         /* Question 9: Boxplot */
230         TITLE 'Task2 Q9: Boxplot';
231         /* CODE */
232         PROC SGPLOT DATA=Rides1;
233         HBOX Elevation;
234         RUN;

NOTE: PROCEDURE SGPLOT used (Total process time):
      real time           0.18 seconds
      user cpu time       0.03 seconds
      system cpu time     0.01 seconds
      memory              2299.53k
      OS Memory           36400.00k
      Timestamp           12/07/2022 04:19:38 AM
      Step Count                        37  Switch Count  1
      Page Faults                       0
      Page Reclaims                     348
      Page Swaps                        0
      Voluntary Context Switches        178
      Involuntary Context Switches      0
      Block Input Operations            0
      Block Output Operations           400

NOTE: There were 200 observations read from the data set WORK.RIDES1.

235
236
237         /* Are there outliers? */
238         /* Yes, there are outliers to the right of the boxplot. There are five outliers. */
239
240
241
242
243
244
245
246         ************************************************
247         ******** Task 3: INFERENCE *********************
248         ************************************************;
249
250         TITLE 'Task3 Q10, Q11: Inference';
251         /* CODE */
252         PROC TTEST DATA=Rides1 h0=0 sides=2 ALPHA=0.026 plots;
253         class Material_Used;
254         var Distance_Traveled;
255         run;

NOTE: PROCEDURE TTEST used (Total process time):
      real time           0.80 seconds
      user cpu time       0.19 seconds
      system cpu time     0.07 seconds
      memory              11188.43k
      OS Memory           43988.00k
      Timestamp           12/07/2022 04:19:39 AM
      Step Count                        38  Switch Count  45
      Page Faults                       0
      Page Reclaims                     26746
      Page Swaps                        0
      Voluntary Context Switches        1039
      Involuntary Context Switches      0
      Block Input Operations            0
      Block Output Operations           1280


256
257         PROC TTEST DATA=Rides1 h0=-825 sides=u ALPHA=0.026 plots;
258         class Material_Used;
259         var Distance_Traveled;
260         RUN;

NOTE: PROCEDURE TTEST used (Total process time):
      real time           0.58 seconds
      user cpu time       0.18 seconds
      system cpu time     0.10 seconds
      memory              10069.62k
      OS Memory           44252.00k
      Timestamp           12/07/2022 04:19:39 AM
      Step Count                        39  Switch Count  45
      Page Faults                       0
      Page Reclaims                     25702
      Page Swaps                        0
      Voluntary Context Switches        1024
```

```
Involuntary Context Switches      1
Block Input Operations            0
Block Output Operations           1272


261
262
263
264         /* Question 10: Equal Variance Test */
265         /* Hypotheses
266         H0: σ^2Steel=σ^2Wood
267         H1: σ^2Steel!=σ^2Wood
268         Test Statistic: F=1.35
269         P-Value: 0.3650
270         Decision: Do not reject H0
271         Conclusion: There is not enough evidence that the variances are different.
272         Variances are equal.
273         */
274
275
276         /* Question 11: Mean Testing */
277         /*Hypotheses
278         H0: muSteel - muWood = -825;
279         H1: muSteel - muWood < -825;
280         Test Statistic: t=-2.02
281         P-Value: 0.9775
282         Decision: Do not reject H0
283         Conclusion: There is not enough evidence that the mean Distance_Traveled for steel materials minus
284         the mean Distance_Traveled for wood materials is less than -825.
285         */
286
287
288
289
290
291
292         ************************************************
293         ******** Task 4: REGRESSION ********************
294         ************************************************;
295         TITLE 'Task4 Q12: Multiple Linear Regression';
296         /* CODE */
297         PROC REG DATA=Rides1 ALPHA=0.012 ;
298         MODEL Ride_Length_Time=Distance_Traveled Type;
299         RUN;

300
301
302
303         /*
304         Part a - Check model assumptions
305         Linearity
306         Graph / results looked at: Residual by Regressors for Ride_Length_Time
307         Is the linearity condition met or not?
308         Linearity is met because there is no patterns.
309
310         Normality
311         Graph / results looked at: Fit Diagnostics: Residual vs Quantile and Percent vs Residual
312         Is the normality of residuals condition met or not?
313
314         Normality is not met because on the Residual vs Quantile we can see that there are
315         dots in the right top corner that are too far away from the line.
316         Also, on the Percent vs Residual graph, we can see that the histogram is somewhat bell
317         shaped but not perfectly
318
319         Equal Variance
320         Graph / results looked at: Residual vs Predicted Value
321         Is the equal variance of residuals condition met or not?
322         Condition is met because there is no pattern.
323
324
325
326         Part b - Give the equation of the Multiple Linear Regression line
327
328         Ride_Length_Time=44.60286+0.02367*Distance_Traveled+14.09045×Type
329
330
331         Part c - Does the model in total explain variability in Ride_Length_Time?
332         Hypotheses
333         H0: Beta_Distance_Traveled = Beta_Type = 0
334         H1: at leats one Beta != 0
335         Test Statistic: F=146.47
336         P-Value: <.0001
337         Decision: Reject H0
338         Conclusion: There is enough evidence that there is at least one variable explaining
339         the variability in Ride_Length_Time.
340
341
342
343
```

```
344         Part d (If needed. If not needed, state why.)
345
346         Testing Individual Variables (Variable 1 = Distance_Traveled)
347         Hypotheses
348         H0: Beta_Distance_Traveled = 0
349         H1: Beta_Distance_Traveled != 0
350         Test Statistic: 16.90
351         P-Value: <.0001
352         Decision: Reject H0
353         Conclusion: There is enough evidence that Distance_Traveled is important in explaining
354                 some of the variability in Ride_Length_Time.
355
356
357         Testing Individual Variables (Variable 2 = Type)
358         Hypotheses
359         H0: Beta_Type = 0
360         H1: Beta_Type != 0
361         Test Statistic: 2.29
362         P-Value: 0.0238
363         Decision: Do not reject H0
364         Conclusion: There is enough evidence that the Type variable is not important in explaining
365         some of the variability in Ride_Length_Time.
366
367
368
369
370         Part e - Value of R^2 and interpretation
371         R^2: 0.6861
372         Interpretation: 68.61% of the variability in Ride_Length_Time is explained
373         by Distance_Traveled and Type.
374
375
376         */
377
378
379
380
381
382
383
384         ************************************************
385         ******** Task 5: 1-way ANOVA ******************
386         ************************************************;
387         TITLE 'Task5 Q13: 1-Way ANOVA';
388
389         TITLE2 'Part a: Mean Duration for each Group';
390         /* CODE */

NOTE: PROCEDURE REG used (Total process time):
      real time           0.59 seconds
      user cpu time       0.18 seconds
      system cpu time     0.04 seconds
      memory              11532.46k
      OS Memory           45808.00k
      Timestamp           12/07/2022 04:19:40 AM
      Step Count                        40  Switch Count  24
      Page Faults                       0
      Page Reclaims                     12332
      Page Swaps                        0
      Voluntary Context Switches        702
      Involuntary Context Switches      2
      Block Input Operations            0
      Block Output Operations           936


391         PROC MEANS DATA = Rides1; CLASS SpeedGroup;
392         VAR Ride_Length_Time;
393         RUN;

NOTE: There were 200 observations read from the data set WORK.RIDES1.
NOTE: PROCEDURE MEANS used (Total process time):
      real time           0.02 seconds
      user cpu time       0.02 seconds
      system cpu time     0.00 seconds
      memory              8909.21k
      OS Memory           46280.00k
      Timestamp           12/07/2022 04:19:40 AM
      Step Count                        41  Switch Count  1
      Page Faults                       0
      Page Reclaims                     1930
      Page Swaps                        0
      Voluntary Context Switches        15
      Involuntary Context Switches      0
      Block Input Operations            0
      Block Output Operations           0


394
395
```

```
396         /* Detail any difference by group.
397          There are three groups. Fast has the highest number of observations(non-missing) which is 94 and slow has the lowest
398          number of non-missing observations which is 13 (which is <30), for the middle, it is 30,
399          which is equal to 30. As for means, the lowest mean has Slow which is (85.0769231) and the
400          highest has Fast(137.1170213). Means are decreasing from Fast to Slow. Standard deviation for
401          Slow and Middle are kind of close and the STD for Fast is bigger than STD for Slow and Middle.
402
403
404         */
405         TITLE2 'Part b: Side by Side Boxpots';
406         /* CODE */
407         PROC SGPLOT DATA=Rides1;
408         HBOX Ride_Length_Time / Category=SpeedGroup;
409         RUN;

NOTE: PROCEDURE SGPLOT used (Total process time):
      real time           0.12 seconds
      user cpu time       0.04 seconds
      system cpu time     0.01 seconds
      memory              2065.71k
      OS Memory           38972.00k
      Timestamp           12/07/2022 04:19:40 AM
      Step Count                        42  Switch Count  1
      Page Faults                       0
      Page Reclaims                     299
      Page Swaps                        0
      Voluntary Context Switches        330
      Involuntary Context Switches      0
      Block Input Operations            0
      Block Output Operations           440

NOTE: There were 200 observations read from the data set WORK.RIDES1.

410
411
412         /* Detail any difference by group.
413         All three means are different and the mean/median increases by going from Low to Fast.
414         Slow Group has Outliers but Middle and Fast do not have any.
415
416            How many groups are there?
417            There are 3 groups.
418
419
420            Are the sample sizes large (>30) in each group?
421            Yes, the Fast Group has the biggest sample size and the Middle and Low has smaller
422            sample sizes. */
423
424         TITLE2 'Part c: Run a 1-way ANOVA model';
425
426         PROC GLM DATA=Rides1 ALPHA=0.03;
427         CLASS SpeedGroup;
428         MODEL Ride_Length_Time = SpeedGroup;
429         MEANS SpeedGroup / BON TUKEY CLDIFF HOVTEST = LEVENE;
430         OUTPUT OUT = ANOVA221 r = residual;
431         RUN;

432
433
434
435         TITLE2 'Part d: Normality Test';
436         /* Will you test the normality assumption using the overall dataset, or for each group
437         individually?
438         No, because there is only one sample size for Fast equals >30, for the Middle it is equals
439         to 30 and for the Low it is <30. */
440
441
442         /* CODE, if needed */

NOTE: The data set WORK.ANOVA221 has 200 observations and 12 variables.
NOTE: PROCEDURE GLM used (Total process time):
      real time           0.28 seconds
      user cpu time       0.17 seconds
      system cpu time     0.01 seconds
      memory              4218.56k
      OS Memory           40012.00k
      Timestamp           12/07/2022 04:19:41 AM
      Step Count                        43  Switch Count  5
      Page Faults                       0
      Page Reclaims                     967
      Page Swaps                        0
      Voluntary Context Switches        674
      Involuntary Context Switches      0
      Block Input Operations            0
      Block Output Operations           1048


443         PROC UNIVARIATE NORMAL PLOT DATA = ANOVA221 ALPHA=0.03;
444         VAR residual;
445         RUN;
```

```
NOTE: PROCEDURE UNIVARIATE used (Total process time):
      real time           0.19 seconds
      user cpu time       0.12 seconds
      system cpu time     0.00 seconds
      memory              3400.28k
      OS Memory           39528.00k
      Timestamp           12/07/2022 04:19:41 AM
      Step Count                        44  Switch Count  0
      Page Faults                       0
      Page Reclaims                     476
      Page Swaps                        0
      Voluntary Context Switches        223
      Involuntary Context Switches      0
      Block Input Operations            0
      Block Output Operations           456


446
447         /* Conclusion(s):
448         Normality check is met because Shapiro-Wilk has p-value of 0.0329, which is a little bigger
449         than significance level of 0.03. Thus, the normality check for overall model was passed.
450         */
451
452
453         TITLE2 'Part e: Equal Variance Assumption Check';
454         /* Conclusion:
455         Equal Variance Check is not met. Based on the Levene Test, there is a p-value of 0.0021, thus,
456         it means that 0.0021 is smaller than the significance level of 0.03.
457         */
458
459
460
461
462         TITLE2 'Part f: Is there a significant evidence of an effect?';
463         /*Hypotheses
464         H0: mu_Slow = mu_Middle = mu_Fast = 0
465         H1: at least one mu != 0
466         Test Statistic: F=15.98
467         P-Value: <.0001
468         Decision: Reject H0
469         Conclusion: There is enough evidence to say that there is significant evidence of an effect.
470         */
471
472
473
474
475         TITLE2 'Part g: Bonerroni or Tukey';
476         /* Are you providing Bonferroni or Tukey Intervals?
477         Bonferroni Intervals
478         */
479
480
481         /* Provide confidence intervals for each difference
482         (make sure to indicate the difference you are writing a confidence interval for):
483         Fast - Middle (14.632, 59.202)
484         Fast - Slow(20.594, 83.487)
485         Middle - Fast (-59.202,-14.632)
486         Middle - Slow (-20.164, 50.410)
487         Slow - Fast(-83.487, -20.594)
488         Slow - Middle (-50.410, 20.16)
489         */
490
491
492         /* For each pair, state whether the difference is significant or not
493         Fast - Middle: difference is significant;
494         Fast - Slow: difference is significant;
495         Middle - Fast: difference is significant;
496         Middle - Slow: difference is not significant;
497         Slow - Fast: difference is significant;
498         Slow - Middle: difference is not significant.
499         */
500
501
502
503
504
505         TITLE;
506         TITLE2;
507
508         OPTIONS NONOTES NOSTIMER NOSOURCE NOSYNTAXCHECK;
518
```