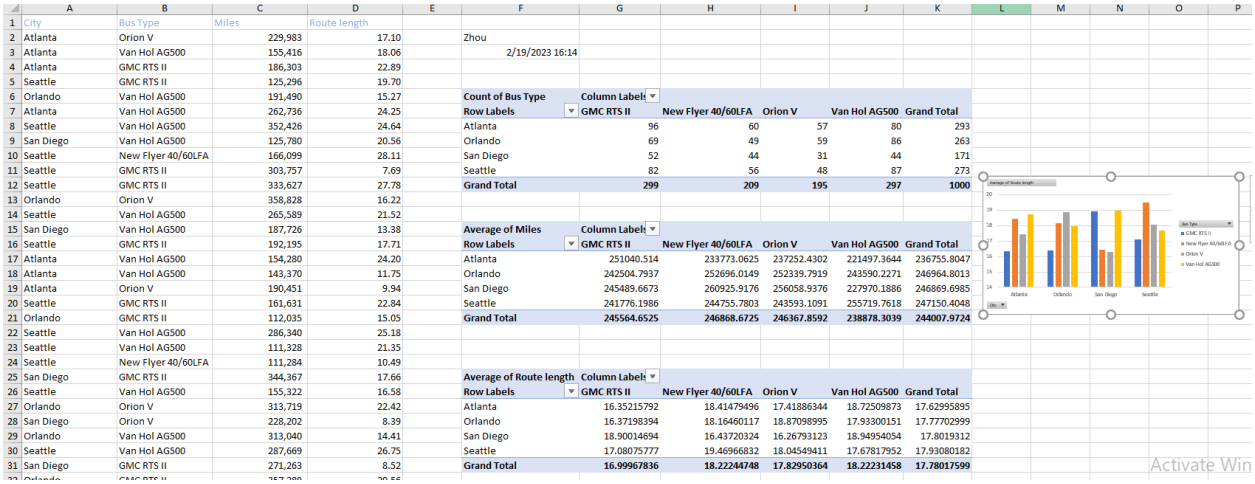
CEE 3804 Homework 5 Solution

Problem 1

Figure 1 shows a sample pivot table presentation of the data.



City	Bus Type	Miles	Route length
Atlanta	Orion V	229,983	17.10
Atlanta	Van Hol AG500	155,416	18.06
Atlanta	GMC RTS II	186,303	22.89
Seattle	GMC RTS II	125,296	19.70
Orlando	Van Hol AG500	191,490	15.27
Atlanta	Van Hol AG500	262,736	24.25
Seattle	Van Hol AG500	352,426	24.64
San Diego	Van Hol AG500	125,780	20.56
Seattle	New Flyer 40/60LFA	166,099	28.11
Seattle	GMC RTS II	303,757	7.69
Seattle	GMC RTS II	333,627	27.78
Orlando	Orion V	358,828	16.22
Seattle	Van Hol AG500	265,589	21.52
San Diego	Van Hol AG500	187,726	13.38
Seattle	GMC RTS II	192,195	17.71
Atlanta	Van Hol AG500	154,280	24.20
Atlanta	Van Hol AG500	143,370	11.75
Atlanta	Orion V	190,451	9.94
Seattle	GMC RTS II	161,631	22.84
Orlando	GMC RTS II	112,035	15.05
Seattle	Van Hol AG500	286,340	25.18
Seattle	Van Hol AG500	111,328	21.35
Seattle	New Flyer 40/60LFA	111,284	10.49
San Diego	GMC RTS II	344,367	17.66
Seattle	Van Hol AG500	155,322	16.58
Orlando	Orion V	313,719	22.42
San Diego	Orion V	228,202	8.39
Orlando	Van Hol AG500	313,040	14.41
Seattle	Van Hol AG500	287,669	26.75
San Diego	GMC RTS II	271,263	8.52

Zhou

2/19/2023 16:14

Count of Bus Type	Column Labels				
Row Labels	GMC RTS II	New Flyer 40/60LFA	Orion V	Van Hol AG500	Grand Total
Atlanta	96	60	57	80	293
Orlando	69	49	59	86	263
San Diego	52	44	31	44	171
Seattle	82	56	48	87	273
Grand Total	299	209	195	297	1000

Average of Miles	Column Labels				
Row Labels	GMC RTS II	New Flyer 40/60LFA	Orion V	Van Hol AG500	Grand Total
Atlanta	251040.514	233773.0625	237252.4302	221497.3644	236755.8047
Orlando	242504.7937	252696.0149	252339.7919	243590.2271	246964.8013
San Diego	245489.6673	260925.9176	256058.9376	227970.1886	246869.6985
Seattle	241776.1986	244755.7803	243593.1091	255719.7618	247150.4048
Grand Total	245564.6525	246868.6725	246367.8592	238878.3039	244007.9724

Average of Route length	Column Labels				
Row Labels	GMC RTS II	New Flyer 40/60LFA	Orion V	Van Hol AG500	Grand Total
Atlanta	16.35215792	18.41479496	17.41886344	18.72509873	17.62995895
Orlando	16.37198394	18.16460117	18.87098995	17.93300151	17.77702999
San Diego	18.90014694	16.43720324	16.26793123	18.94954054	17.8019312
Seattle	17.08075777	19.46966832	18.04549411	17.67817952	17.93080182
Grand Total	16.99967836	18.22244748	17.82950364	18.22231458	17.78017599

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Figure 1. Pivot Table for Bus Asset Problem.

Count of Bus Type	Column Labels				
Row Labels	GMC RTS II	New Flyer 40/60LFA	Orion V	Van Hol AG500	Grand Total
Atlanta	96	60	57	80	293
Orlando	69	49	59	86	263
San Diego	52	44	31	44	171
Seattle	82	56	48	87	273
Grand Total	**299**	**209**	**195**	**297**	**1000**

Average of Miles	Column Labels				
Row Labels	GMC RTS II	New Flyer 40/60LFA	Orion V	Van Hol AG500	Grand Total
Atlanta	251,041	233,773	237,252	221,497	236,756
Orlando	242,505	252,696	252,340	243,590	246,965
San Diego	245,490	260,926	256,059	227,970	246,870
Seattle	241,776	244,756	243,593	255,720	247,150
Grand Total	**245,565**	**246,869**	**246,368**	**238,878**	**244,008**

Vertical (Value) Axis

Average of Route length	Column Labels				
Row Labels	GMC RTS II	New Flyer 40/60LFA	Orion V	Van Hol AG500	Grand Total
Atlanta	16.4	18.4	17.4	18.7	17.6
Orlando	16.4	18.2	18.9	17.9	17.8
San Diego	18.9	16.4	16.3	18.9	17.8
Seattle	17.1	19.5	18.0	17.7	17.9
Grand Total	**17.0**	**18.2**	**17.8**	**18.2**	**17.8**

Figure 2. Summary Pivot Tables of Bus Asset Problem.

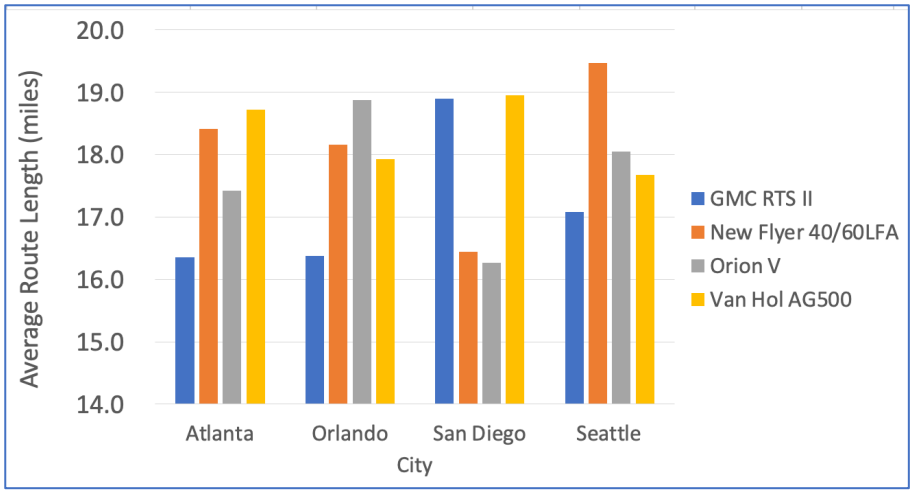

Figure 3. Average Route Length for Various Cities.

```
Sub Macro1()
'
' Macro1 Macro
'

'
    Range("F2").Select
    ActiveCell.FormulaR1C1 = "Zhou"
    Range("F3").Select
    ActiveCell.FormulaR1C1 = "2/19/2023 16:14"
    Range("A1:D1").Select
    With Selection.Font
        .ThemeColor = xlThemeColorAccent1
        .TintAndShade = 0.399975585192419
    End With
    Application.CutCopyMode = False
    Cells.FormatConditions.Delete
    Range("C2:C1001").Select
    Range("A1").Activate
    Selection.FormatConditions.AddTop10
    Selection.FormatConditions(Selection.FormatConditions.Count).SetFirstPriority
    With Selection.FormatConditions(1)
        .TopBottom = xlTop10Top
        .Rank = 1
        .Percent = False
    End With
```

Figure 4. Macro Generated by Excel to Create Summaries of Bus Assets.

Problem 2

Application of the Excel Macro developed in Problem 1 yields the following results.

b) The average route length for buses New Flyer 40/60LFA operated in Los Angeles is 23.74

c) There are 57 buses of type Van Hol AG500 are operated in San Francisco

d) The average number of miles of Orion V operated in Boston 223,444.

e) The average route length of GMC RTS II buses operated in Denver is 18.4.

f) The city with the highest route length (average route length) is New York

Problem 3

Code for parts 1 through 5.

Answer of second question is 6.19 lbs/ton

Type of Train	Aerodynamic Coefficient (dim)		Step List		Speed List	
Regular trains	0.07		1		10	
Container trains	0.0935		5		20	
Truck trailers	0.16		10		30	
		Index of step list	1		40	
					50	
Type of Train	Container trains	Select Step	Select Speed		60	
Step	1	1			70	
Speed	70		70		7	Index of speed list
n	4					
w	18					
				Calculate		
Speed (mph)	Train Resistance (lbs/ton)					
0	1.711111069					
1	1.722409725					
2	1.736305594					
3	1.752798557					
4	1.771888852					

Figure 5. Train Resistance Calculation Spreadsheet.

B8=INDEX(D2:D4,D5)

B9=INDEX(F2:F8,F9)

```
Option Explicit

Dim R_total As Single
Dim w As Single
Dim n As Single
Dim V As Single
Dim Typeoftrain As String
Dim Maxspeed As Single
Dim Speedstep As Single
Dim speed As Single
Dim K As Single
Dim count As Integer
Dim rowToStartTable As Integer

Sub Resistance()

' Subroutine to estimate train resistance (R_total)
'
' R_total = train resistance (lbs/ton)
' Typeoftrain = type of train (flat cars, etc.)
' Maxspeed = speed in miles per hour
' speedstep = invcrement of speed to estimate a t
' w = weight of car per axle (tons)

' R_total = 0.6+20/w+0.01V+KV^2/(wn)

' Select the type of train
' This has an influence in theaerodynamic coeffici

Range("B7").Select
Typeoftrain = ActiveCell.Value

' Select the step size for speed
Range("B8").Select
Speedstep = ActiveCell.Value
```

Figure 6. VBA Code for Train Resistance Calculations.

```
' Select the step size for speed
Range("B8").Select
Speedstep = ActiveCell.Value

' Select the maximumtrain speed
Range("B9").Select
Maxspeed = ActiveCell.Value

' Select the number of axles per car
Range("B10").Select
n = ActiveCell.Value

' Select the weight per axle (ton)
Range("B11").Select
w = ActiveCell.Value

' Estimate the aerodynamic coefficient given the
```

```
' Estimate the aerodynamic coefficient given the ty
If Typeoftrain = "Regular trains" Then
    K = 0.07
ElseIf Typeoftrain = "Container trains" Then
    K = 0.0935
ElseIf Typeoftrain = "Truck trailers" Then
    K = 0.16
End If

' Clear the range to generate a table
Range("A15:B100").Clear
count = 0
rowToStartTable = 15
```

Figure 7. VBA Code for Train Resistance Calculations.

```
' Start a loop to perform multiple resistance calculationsgiven Max
For speed = 0 To Maxspeed Step Speedstep

    '15 is the first row to write values in the table'

    Range("A" & count + rowToStartTable).Select
    ActiveCell.Value = speed

    R_total = 0.6 + 20 / w + 0.01 * speed + K * speed ^ 2 / (w * n)
    Range("B" & count + rowToStartTable).Select
    ActiveCell.Value = R_total

    count = count + 1

Next speed
```

Figure 8. VBA Code for Train Resistance Calculations.

Problem 4

	A	B	C
1	M_pendulum	6	kilograms
2	m_bullet	0.0088	kilograms
3	h	0.071	meters
4	g	9.8	m/s^2
5	v_bullet	805.494	m/s
6	K	2854.81	

```
Sub Vbullet()

Sheets("Sheet1").Select
Range("B1").Select
M_pendulum = ActiveCell.Value

Range("B2").Select
m_bullet = ActiveCell.Value

Range("B3").Select
h = ActiveCell.Value

Range("B4").Select
g = ActiveCell.Value

v_bullet = (M_pendulum + m_bullet) / m_bullet * Sqr(2 * g * h)

Call Kinetic(m_bullet, v_bullet, K)

Range("B5").Select
ActiveCell.Value = v_bullet

Range("B6").Select
ActiveCell.Value = K

End Sub
```

```
Sub Kinetic(m_bullet, v_bullet, K)

K = 0.5 * m_bullet * v_bullet ^ 2

End Sub
```