Problem 1

1) Add a cell in Excel to place the lower bound (i.e., lowest value) of the applied load. Read the value in the cell and use it in VBA to start the loop.

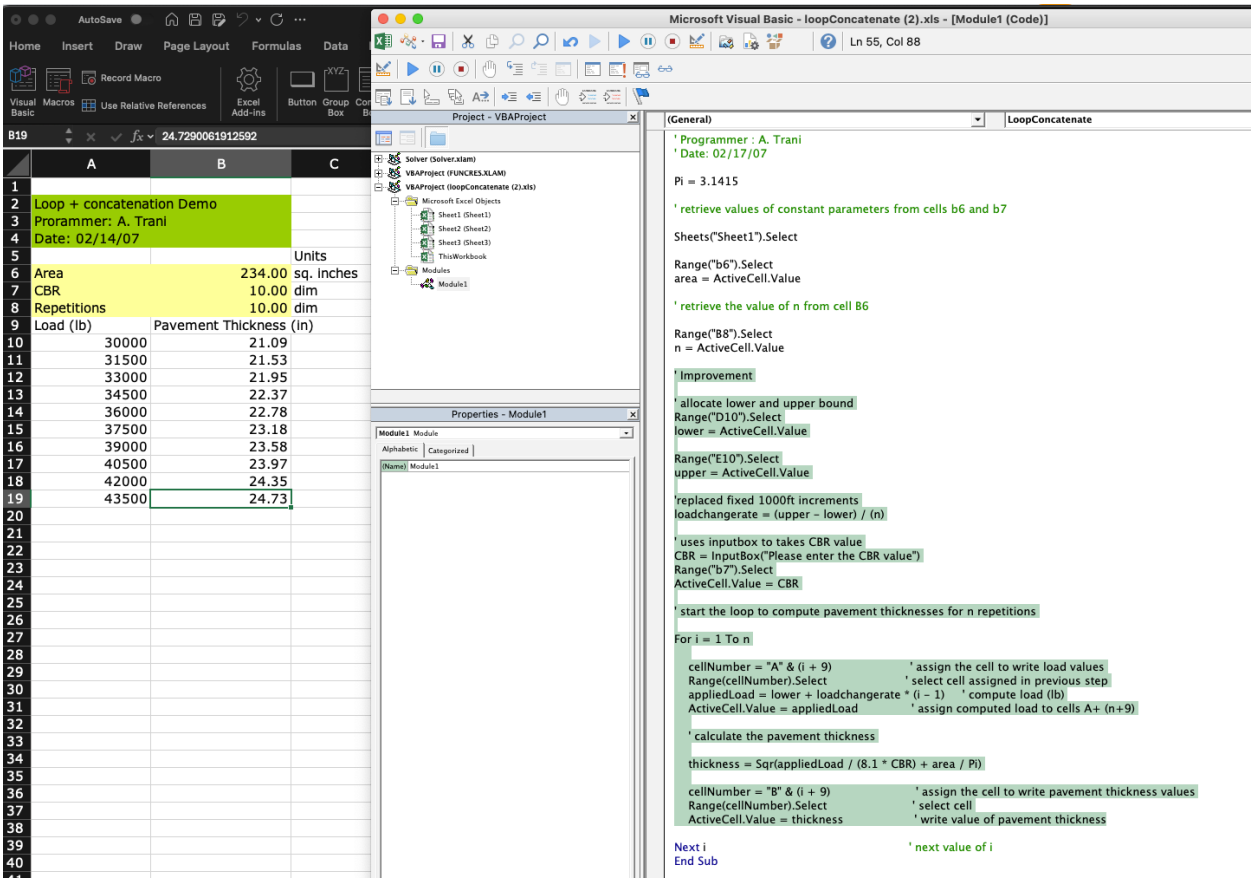
2) Add a cell in Excel to place the upper bound (i.e., highest value) of the applied load. Read the value in the cell and use it in VBA to end the loop.

The lower/upper bounds are shown below.

Lower Bound	Upper Bound
30000	45000

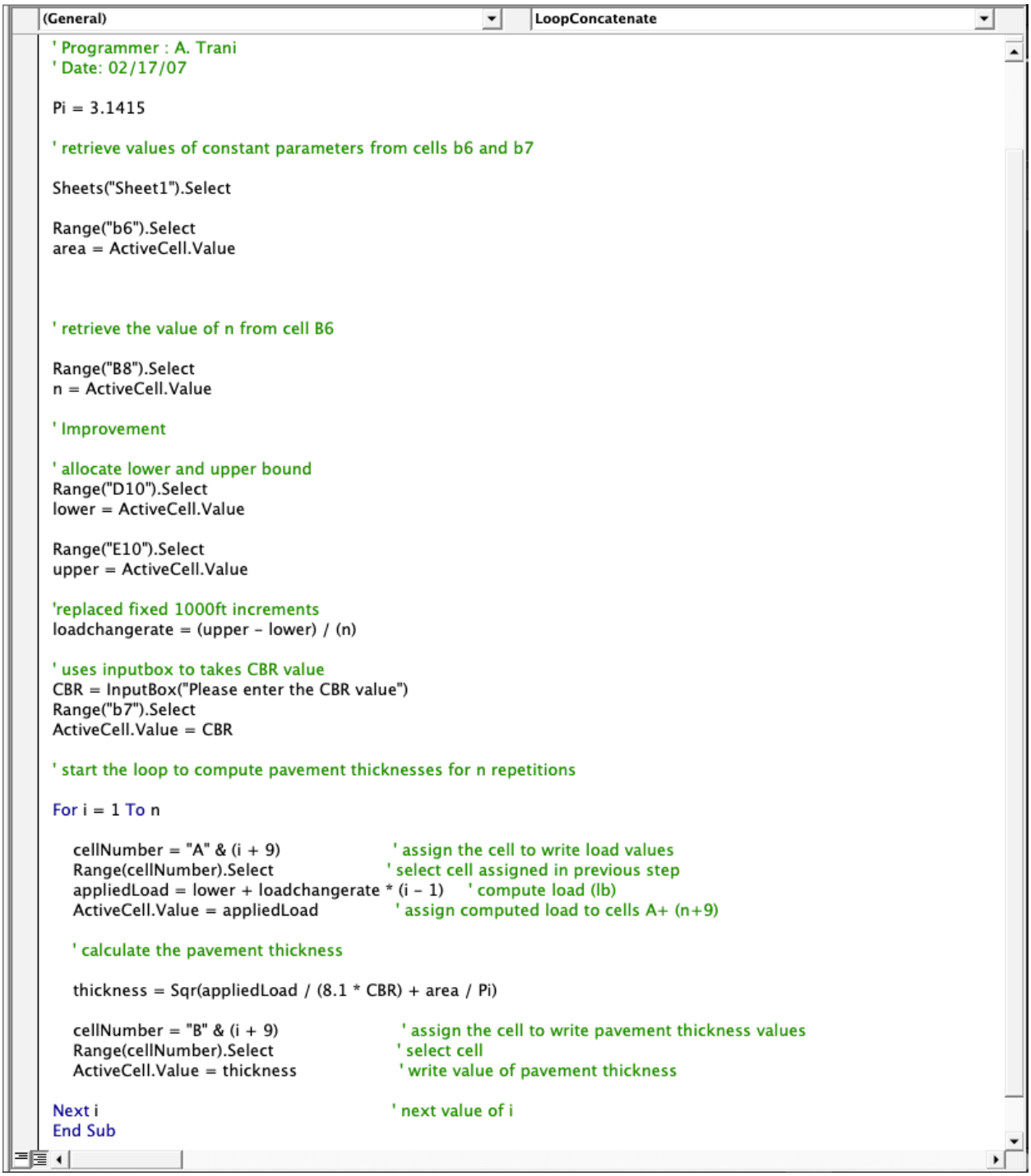
3) Add VBA code to calculate the applied load change needed consistent with the number of repetitions.

The improvement code is shown below. A major improvement is that 1) it takes the lower/upper bound, 2) uses these values as the starting/ending point, and replaces fixed 1000 lbs increments to dynamical increments based on bounds and repetitions.



	A	B	C
1			
2	Loop + concatenation Demo		
3	Prorammer: A. Trani		
4	Date: 02/14/07		
5			Units
6	Area	234.00	sq. inches
7	CBR	10.00	dim
8	Repetitions	10.00	dim
9	Load (lb)	Pavement Thickness (in)	
10	30000	21.09	
11	31500	21.53	
12	33000	21.95	
13	34500	22.37	
14	36000	22.78	
15	37500	23.18	
16	39000	23.58	
17	40500	23.97	
18	42000	24.35	
19	43500	24.73	

```
' Programmer : A. Trani
' Date: 02/17/07

Pi = 3.1415

' retrieve values of constant parameters from cells b6 and b7

Sheets("Sheet1").Select

Range("b6").Select
area = ActiveCell.Value

' retrieve the value of n from cell B6

Range("B8").Select
n = ActiveCell.Value

' Improvement

' allocate lower and upper bound
Range("D10").Select
lower = ActiveCell.Value

Range("E10").Select
upper = ActiveCell.Value

'replaced fixed 1000ft increments
loadchangerate = (upper - lower) / (n)

' uses inputbox to takes CBR value
CBR = InputBox("Please enter the CBR value")
Range("b7").Select
ActiveCell.Value = CBR

' start the loop to compute pavement thicknesses for n repetitions

For i = 1 To n

   cellNumber = "A" & (i + 9)                ' assign the cell to write load values
   Range(cellNumber).Select                  ' select cell assigned in previous step
   appliedLoad = lower + loadchangerate * (i - 1)    ' compute load (lb)
   ActiveCell.Value = appliedLoad            ' assign computed load to cells A+ (n+9)

   ' calculate the pavement thickness

   thickness = Sqr(appliedLoad / (8.1 * CBR) + area / Pi)

   cellNumber = "B" & (i + 9)                ' assign the cell to write pavement thickness values
   Range(cellNumber).Select                  ' select cell
   ActiveCell.Value = thickness              ' write value of pavement thickness

Next i                                       ' next value of i
End Sub
```



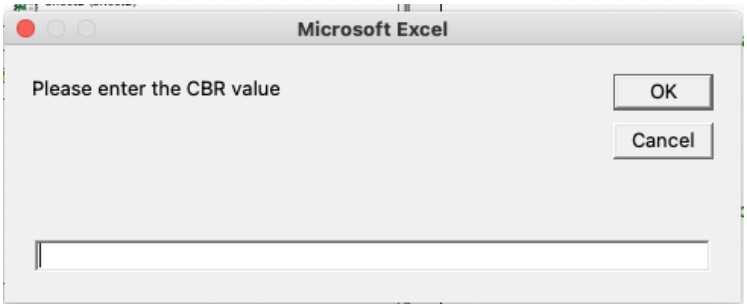

```
' Programmer : A. Trani
' Date: 02/17/07

Pi = 3.1415

' retrieve values of constant parameters from cells b6 and b7

Sheets("Sheet1").Select

Range("b6").Select
area = ActiveCell.Value



' retrieve the value of n from cell B6

Range("B8").Select
n = ActiveCell.Value

' Improvement

' allocate lower and upper bound
Range("D10").Select
lower = ActiveCell.Value

Range("E10").Select
upper = ActiveCell.Value

'replaced fixed 1000ft increments
loadchangerate = (upper - lower) / (n)

' uses inputbox to takes CBR value
CBR = InputBox("Please enter the CBR value")
Range("b7").Select
ActiveCell.Value = CBR

' start the loop to compute pavement thicknesses for n repetitions

For i = 1 To n

   cellNumber = "A" & (i + 9)                  ' assign the cell to write load values
   Range(cellNumber).Select                    ' select cell assigned in previous step
   appliedLoad = lower + loadchangerate * (i - 1)     ' compute load (lb)
   ActiveCell.Value = appliedLoad              ' assign computed load to cells A+ (n+9)

   ' calculate the pavement thickness

   thickness = Sqr(appliedLoad / (8.1 * CBR) + area / Pi)

   cellNumber = "B" & (i + 9)                   ' assign the cell to write pavement thickness values
   Range(cellNumber).Select                    ' select cell
   ActiveCell.Value = thickness                ' write value of pavement thickness

Next i                                         ' next value of i
End Sub
```

```
' Improvement

' allocate lower and upper bound
Range("D10").Select
lower = ActiveCell.Value

Range("E10").Select
upper = ActiveCell.Value

'replaced fixed 1000ft increments
loadchangerate = (upper - lower) / (n)

' uses inputbox to takes CBR value
CBR = InputBox("Please enter the CBR value")
Range("b7").Select
ActiveCell.Value = CBR

' start the loop to compute pavement thicknesses for n repetitions

For i = 1 To n

   cellNumber = "A" & (i + 9)                  ' assign the cell to write load values
   Range(cellNumber).Select                    ' select cell assigned in previous step
   appliedLoad = lower + loadchangerate * (i - 1)     ' compute load (lb)
   ActiveCell.Value = appliedLoad              ' assign computed load to cells A+ (n+9)

   ' calculate the pavement thickness

   thickness = Sqr(appliedLoad / (8.1 * CBR) + area / Pi)

   cellNumber = "B" & (i + 9)                  ' assign the cell to write pavement thickness values
   Range(cellNumber).Select                    ' select cell
   ActiveCell.Value = thickness                ' write value of pavement thickness
```

4) Add VBA code to query the value of CBR using an input box.

The input box is shown below.

```
' uses inputbox to takes CBR value
CBR = InputBox("Please enter the CBR value")
Range("b7").Select
ActiveCell.Value = CBR
```



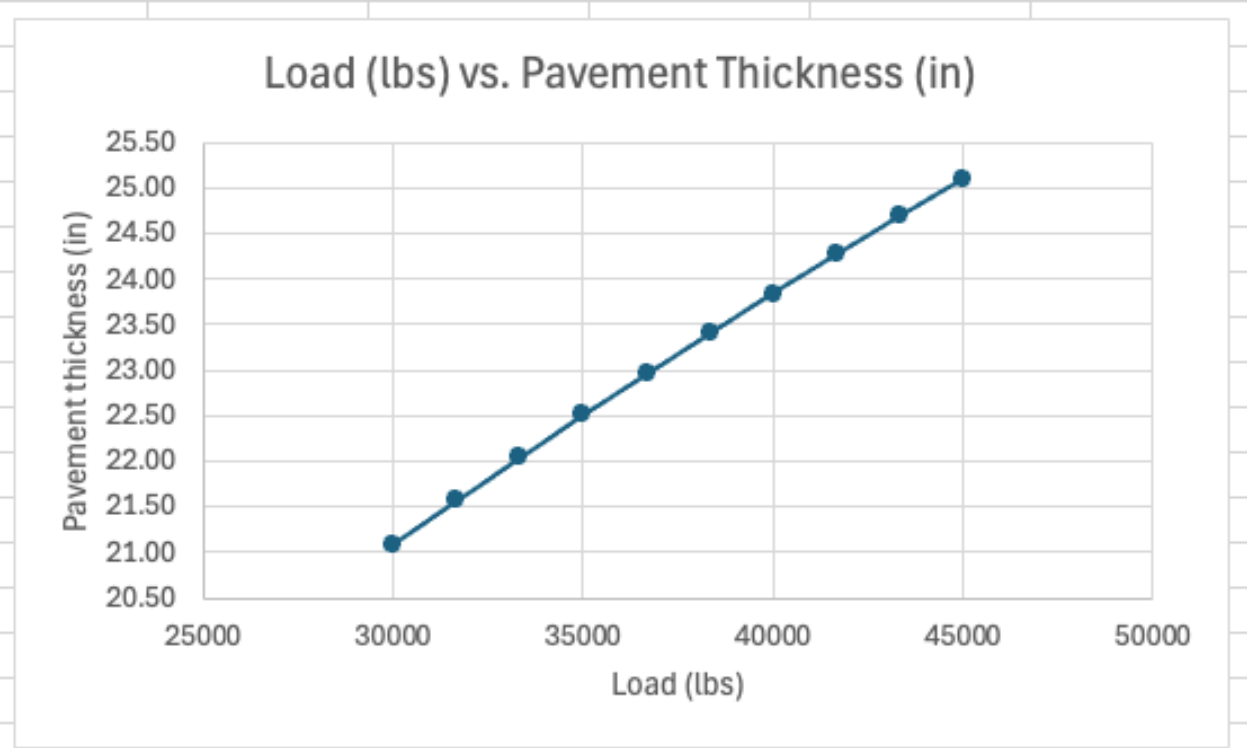
5) Test the changes in parts (A-D) and show me the answers in Excel and your new VBA code. Test the improved program with 10 load repetitions and a starting applied load of 30,000 lbs. and ending at 45,000 lbs.

Since our repetitions (n) are 10, now the increment is 1666.66667 lbs (45000-30000)/(n-1) per repetition. Then why n-1? Because we need to start calculating thickness from 30000 lbs, so that our appliedLoad = lower + loadchangerate * (i - 1).

	A	B	C
1			
2	Loop + concatenation Demo		
3	Prorammer: A. Trani		
4	Date: 02/14/07		
5			Units
6	Area	234.00	sq. inches
7	CBR	10.00	dim
8	Repetitions	10.00	dim
9	Load (lb)	Pavement Thickness	(in)
10	30000	21.09	
11	31666.66667	21.57	
12	33333.33333	22.05	
13	35000	22.51	
14	36666.66667	22.96	
15	38333.33333	23.40	
16	40000	23.84	
17	41666.66667	24.27	
18	43333.33333	24.69	
19	45000	25.10	
20			

6) Use the answers generated in columns A and B to make a plot (do that in Excel for now).

The example of a plot of load versus pavement thickness is shown below.



Problem 2

1) **Create an Excel/VBA program (Subroutine or Sub)** to estimate the value of temperature at a city selected by the user in Excel for a given year. The Excel interface should allow the user to select a city (by name) in the Excel interface using a **Data Validation** List as demonstrated in class for the pavement design example (see VBA notes). The Excel interface also provides a cell to **select the year of the prediction**. The values of the coefficients shown in Table 1 can be contained in the VBA code directly and must be selected via an **IF-ELSEIF-END** statement. The Excel interface must include a "**Calculation**" button to link the execution of the VBA program.

Note: Be aware when using the **Year**, since **Year** is the name of a built-in function of Excel. For example, Range("C7").Select **Year** = ActiveCell.Value will generate an error. So, we must modify the name of the variable likes CurrentYear or SelectYear, or whatever you want, except for Year

There are four tasks that we should do.

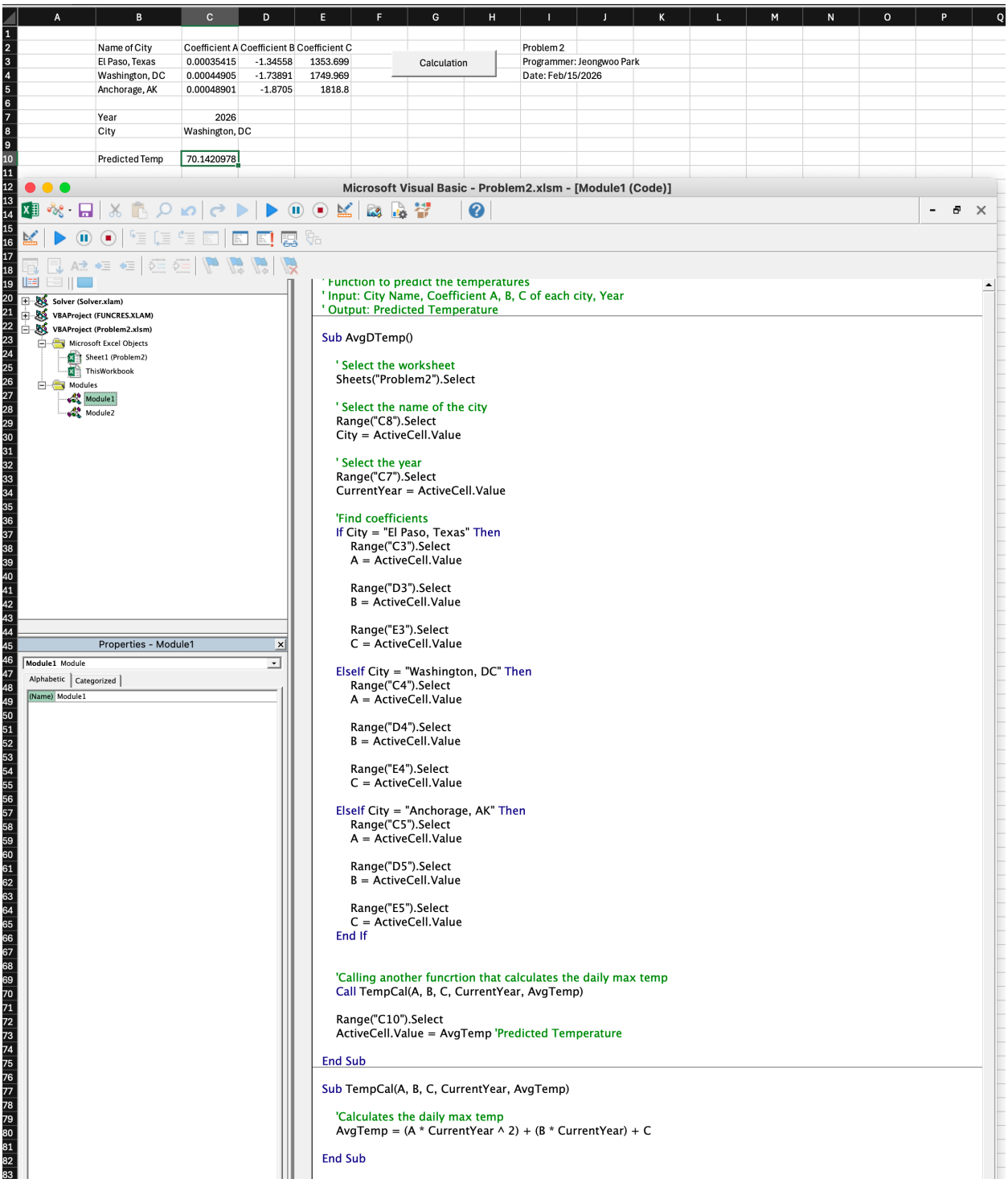
1. Create Sub

2. Select the city using Data Validation

3. Cell to select the year of prediction (not necessarily uses the data validation because it is not explicity stated.)

4. The values of coefficients A, B, and C should be selected via an IF statement.

1. Create Sub and the numerical values of the coefficients A, B, and C coefficient are selected via an IF statement.



	Name of City	Coefficient A	Coefficient B	Coefficient C
	El Paso, Texas	0.00035415	-1.34558	1353.699
	Washington, DC	0.00044905	-1.73891	1749.969
	Anchorage, AK	0.00048901	-1.8705	1818.8
	Year	2026		
	City	Washington, DC		
	Predicted Temp	70.1420978		

Calculation

Problem 2
Programmer: Jeongwoo Park
Date: Feb/15/2026

Microsoft Visual Basic - Problem2.xlsm - [Module1 (Code)]

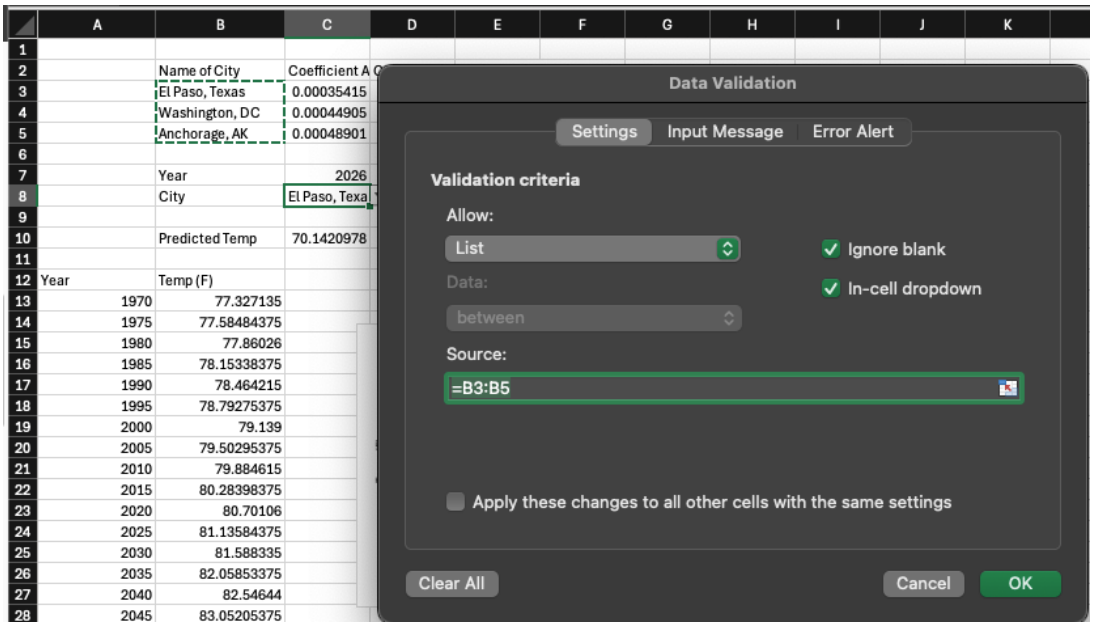
Solver (Solver.xlam)
VBAProject (FUNCRES.XLAM)
VBAProject (Problem2.xlsm)
Microsoft Excel Objects
Sheet1 (Problem2)
ThisWorkbook
Modules
Module1
Module2

Properties - Module1
Module1 Module
Alphabetic | Categorized
(Name) Module1

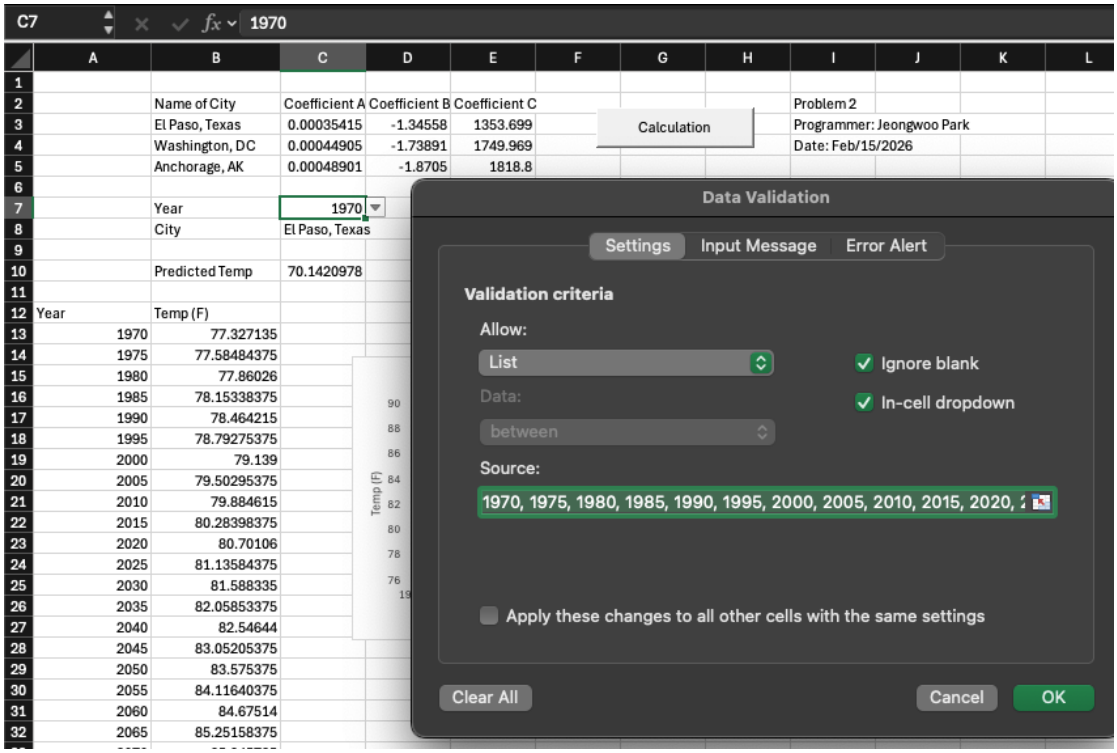
```
' Function to predict the temperatures
' Input: City Name, Coefficient A, B, C of each city, Year
' Output: Predicted Temperature

Sub AvgDTemp()

    ' Select the worksheet
    Sheets("Problem2").Select

    ' Select the name of the city
    Range("C8").Select
    City = ActiveCell.Value

    ' Select the year
    Range("C7").Select
    CurrentYear = ActiveCell.Value

    'Find coefficients
    If City = "El Paso, Texas" Then
        Range("C3").Select
        A = ActiveCell.Value

        Range("D3").Select
        B = ActiveCell.Value

        Range("E3").Select
        C = ActiveCell.Value

    ElseIf City = "Washington, DC" Then
        Range("C4").Select
        A = ActiveCell.Value

        Range("D4").Select
        B = ActiveCell.Value

        Range("E4").Select
        C = ActiveCell.Value

    ElseIf City = "Anchorage, AK" Then
        Range("C5").Select
        A = ActiveCell.Value

        Range("D5").Select
        B = ActiveCell.Value

        Range("E5").Select
        C = ActiveCell.Value
    End If


    'Calling another funcrtion that calculates the daily max temp
    Call TempCal(A, B, C, CurrentYear, AvgTemp)

    Range("C10").Select
    ActiveCell.Value = AvgTemp 'Predicted Temperature

End Sub

Sub TempCal(A, B, C, CurrentYear, AvgTemp)

    'Calculates the daily max temp
    AvgTemp = (A * CurrentYear ^ 2) + (B * CurrentYear) + C

End Sub
```

```
' Function to predict the temperatures
' Input: City Name, Coefficient A, B, C of each city, Year
' Output: Predicted Temperature

Sub AvgDTemp()

    ' Select the worksheet
    Sheets("Problem2").Select

    ' Select the name of the city
    Range("C8").Select
    City = ActiveCell.Value

    ' Select the year
    Range("C7").Select
    CurrentYear = ActiveCell.Value

    'Find coefficients
    If City = "El Paso, Texas" Then
        Range("C3").Select
        A = ActiveCell.Value

        Range("D3").Select
        B = ActiveCell.Value

        Range("E3").Select
        C = ActiveCell.Value

    ElseIf City = "Washington, DC" Then
        Range("C4").Select
        A = ActiveCell.Value

        Range("D4").Select
        B = ActiveCell.Value

        Range("E4").Select
        C = ActiveCell.Value

    ElseIf City = "Anchorage, AK" Then
        Range("C5").Select
        A = ActiveCell.Value

        Range("D5").Select
        B = ActiveCell.Value

        Range("E5").Select
        C = ActiveCell.Value
    End If


    'Calling another funcrtion that calculates the daily max temp
    Call TempCal(A, B, C, CurrentYear, AvgTemp)

    Range("C10").Select
    ActiveCell.Value = AvgTemp 'Predicted Temperature

End Sub

Sub TempCal(A, B, C, CurrentYear, AvgTemp)

    'Calculates the daily max temp
    AvgTemp = (A * CurrentYear ^ 2) + (B * CurrentYear) + C

End Sub
```

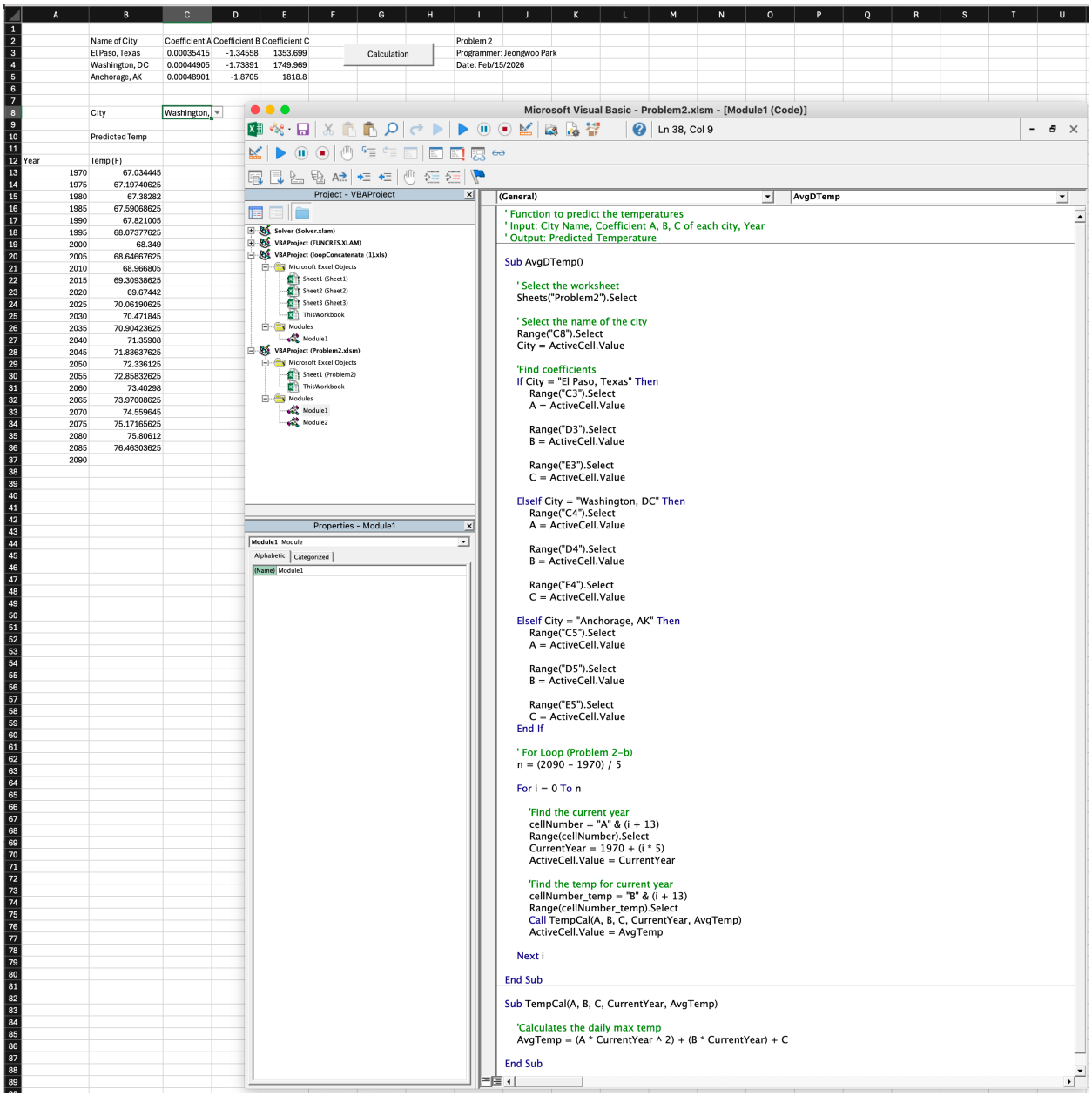
2. Select the city using Data Validation



3. We can use a cell in Excel to select the year of prediction (not necessarily uses the data validation because it is not explicity stated.)



2) Improve the program in part (a) by adding a loop in VBA to calculate the temperatures of the city selected from 1970 to the year 2090 (at steps of five years).



```
(General)                                   AvgDTemp

' Function to predict the temperatures
' Input: City Name, Coefficient A, B, C of each city, Year
' Output: Predicted Temperature

Sub AvgDTemp()

    ' Select the worksheet
    Sheets("Problem2").Select

    ' Select the name of the city
    Range("C8").Select
    City = ActiveCell.Value

    'Find coefficients
    If City = "El Paso, Texas" Then
        Range("C3").Select
        A = ActiveCell.Value

        Range("D3").Select
        B = ActiveCell.Value

        Range("E3").Select
        C = ActiveCell.Value

    ElseIf City = "Washington, DC" Then
        Range("C4").Select
        A = ActiveCell.Value

        Range("D4").Select
        B = ActiveCell.Value

        Range("E4").Select
        C = ActiveCell.Value

    ElseIf City = "Anchorage, AK" Then
        Range("C5").Select
        A = ActiveCell.Value

        Range("D5").Select
        B = ActiveCell.Value

        Range("E5").Select
        C = ActiveCell.Value
    End If

    ' For Loop (Problem 2-b)
    n = (2090 - 1970) / 5

    For i = 0 To n

        'Find the current year
        cellNumber = "A" & (i + 13)
        Range(cellNumber).Select
        CurrentYear = 1970 + (i * 5)
        ActiveCell.Value = CurrentYear

        'Find the temp for current year
        cellNumber_temp = "B" & (i + 13)
        Range(cellNumber_temp).Select
        Call TempCal(A, B, C, CurrentYear, AvgTemp)
        ActiveCell.Value = AvgTemp

    Next i

End Sub

Sub TempCal(A, B, C, CurrentYear, AvgTemp)

    'Calculates the daily max temp
    AvgTemp = (A * CurrentYear ^ 2) + (B * CurrentYear) + C

End Sub
```

```
    ' For Loop (Problem 2-b)
    n = (2090 - 1970) / 5

    For i = 0 To n

        'Find the current year
        cellNumber = "A" & (i + 13)
        Range(cellNumber).Select
        CurrentYear = 1970 + (i * 5)
        ActiveCell.Value = CurrentYear

        'Find the temp for current year
        cellNumber_temp = "B" & (i + 13)
        Range(cellNumber_temp).Select
        Call TempCal(A, B, C, CurrentYear, AvgTemp)
        ActiveCell.Value = AvgTemp

    Next i

End Sub
```

```
Sub TempCal(A, B, C, CurrentYear, AvgTemp)

    'Calculates the daily max temp
    AvgTemp = (A * CurrentYear ^ 2) + (B * CurrentYear) + C

End Sub
```

The predicted temperatures for each city are shown below. Your answer should always control the number of decimals (probably one or two suffice).

El Paso, Texas

	City	El Paso, Texas
	Predicted Temp	
Year	Temp (F)	
1970	77.327135	
1975	77.58484375	
1980	77.86026	
1985	78.15338375	
1990	78.464215	
1995	78.79275375	
2000	79.139	
2005	79.50295375	
2010	79.884615	
2015	80.28398375	
2020	80.70106	
2025	81.13584375	
2030	81.588335	
2035	82.05853375	
2040	82.54644	
2045	83.05205375	
2050	83.575375	
2055	84.11640375	
2060	84.67514	
2065	85.25158375	
2070	85.845735	
2075	86.45759375	
2080	87.08716	
2085	87.73443375	
2090	88.399415	

Washington, DC

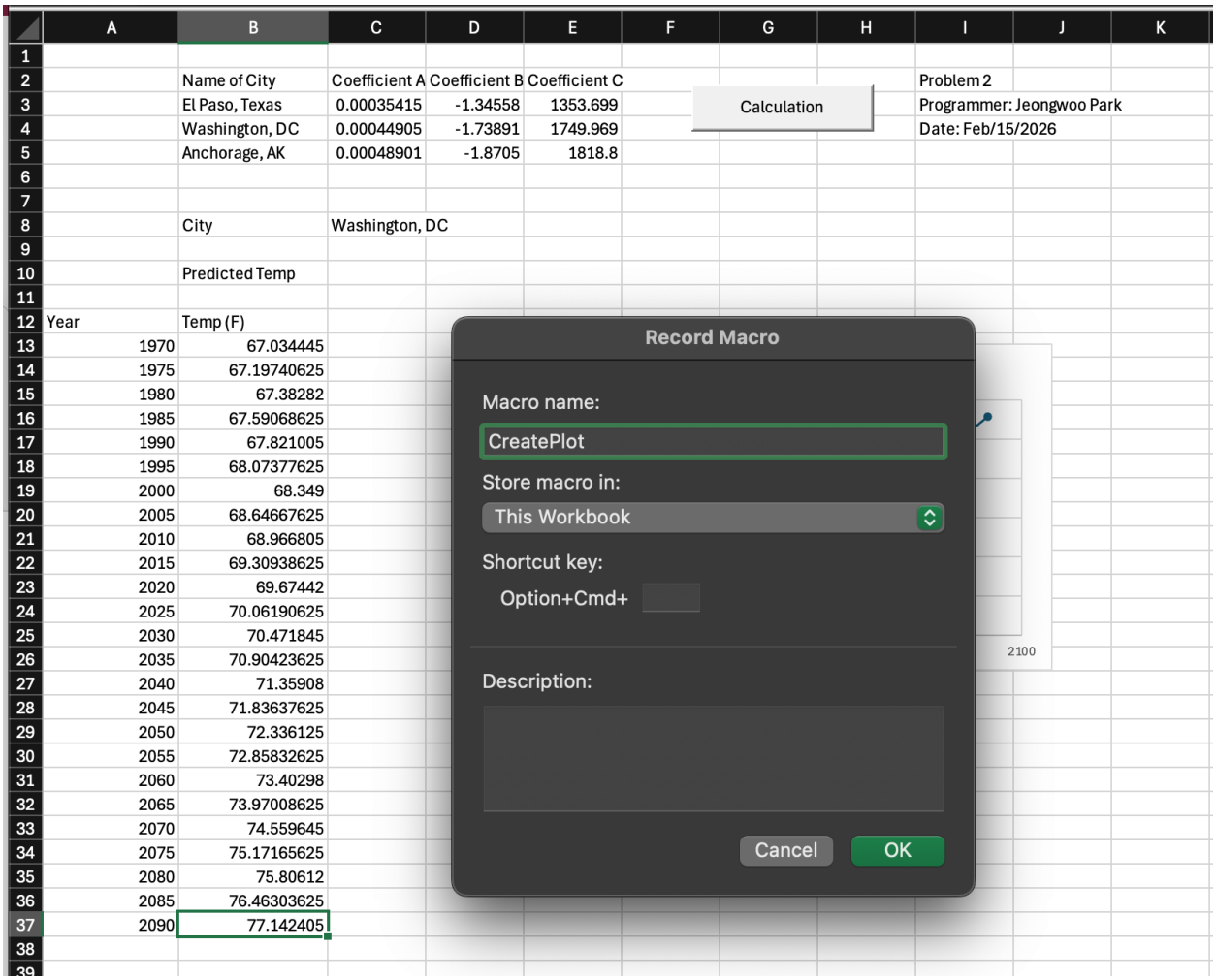
	City	Washington,
	Predicted Temp	
Year	Temp (F)	
1970	67.034445	
1975	67.19740625	
1980	67.38282	
1985	67.59068625	
1990	67.821005	
1995	68.07377625	
2000	68.349	
2005	68.64667625	
2010	68.966805	
2015	69.30938625	
2020	69.67442	
2025	70.06190625	
2030	70.471845	
2035	70.90423625	
2040	71.35908	
2045	71.83637625	
2050	72.336125	
2055	72.85832625	
2060	73.40298	
2065	73.97008625	
2070	74.559645	
2075	75.17165625	
2080	75.80612	
2085	76.46303625	
2090	77.142405	

Anchorage, AK

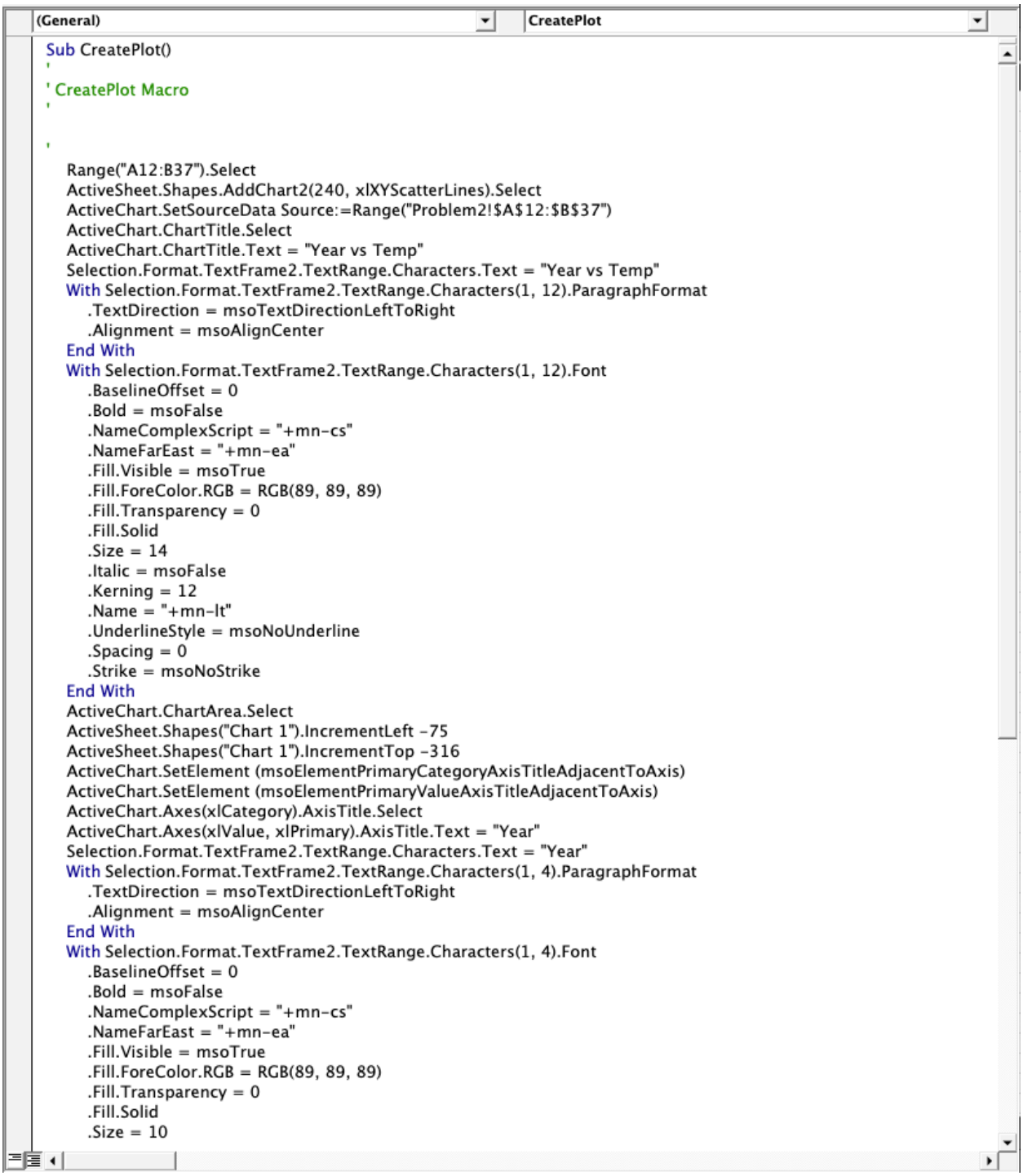
	City	Anchorage, AK
	Predicted Temp	
Year	Temp (F)	
1970	31.713909	
1975	32.00713125	
1980	32.324804	
1985	32.66692725	
1990	33.033501	
1995	33.42452525	
2000	33.84	
2005	34.27992525	
2010	34.744301	
2015	35.23312725	
2020	35.746404	
2025	36.28413125	
2030	36.846309	
2035	37.43293725	
2040	38.044016	
2045	38.67954525	
2050	39.339525	
2055	40.02395525	
2060	40.732836	
2065	41.46616725	
2070	42.223949	
2075	43.00618125	
2080	43.812864	
2085	44.64399725	
2090	45.499581	

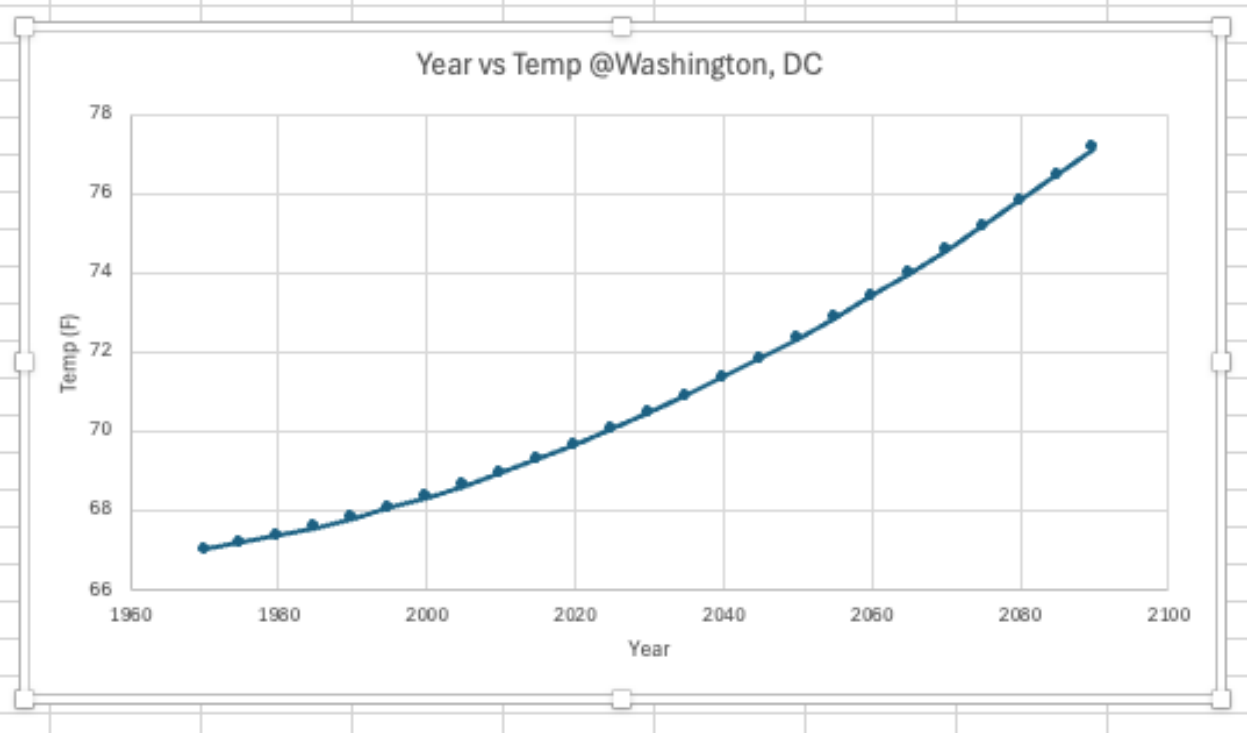
3) Use Excel to enhance your program and make a plot (in Excel not VBA) of the temperature profile over time.

You can use Macros -> Record Macro -> Make a Plot



	A	B	C	D	E	F	G	H	I	J	K
1											
2		Name of City	Coefficient A	Coefficient B	Coefficient C				Problem 2		
3		El Paso, Texas	0.00035415	-1.34558	1353.699		Calculation		Programmer: Jeongwoo Park		
4		Washington, DC	0.00044905	-1.73891	1749.969				Date: Feb/15/2026		
5		Anchorage, AK	0.00048901	-1.8705	1818.8						
6											
7											
8		City	Washington, DC								
9											
10		Predicted Temp									
11											
12	Year	Temp (F)									
13	1970	67.034445									
14	1975	67.19740625									
15	1980	67.38282									
16	1985	67.59068625									
17	1990	67.821005									
18	1995	68.07377625									
19	2000	68.349									
20	2005	68.64667625									
21	2010	68.966805									
22	2015	69.30938625									
23	2020	69.67442									
24	2025	70.06190625									
25	2030	70.471845									
26	2035	70.90423625									
27	2040	71.35908									
28	2045	71.83637625									
29	2050	72.336125									
30	2055	72.85832625									
31	2060	73.40298									
32	2065	73.97008625									
33	2070	74.559645									
34	2075	75.17165625									
35	2080	75.80612									
36	2085	76.46303625									
37	2090	77.142405									
38											
39											

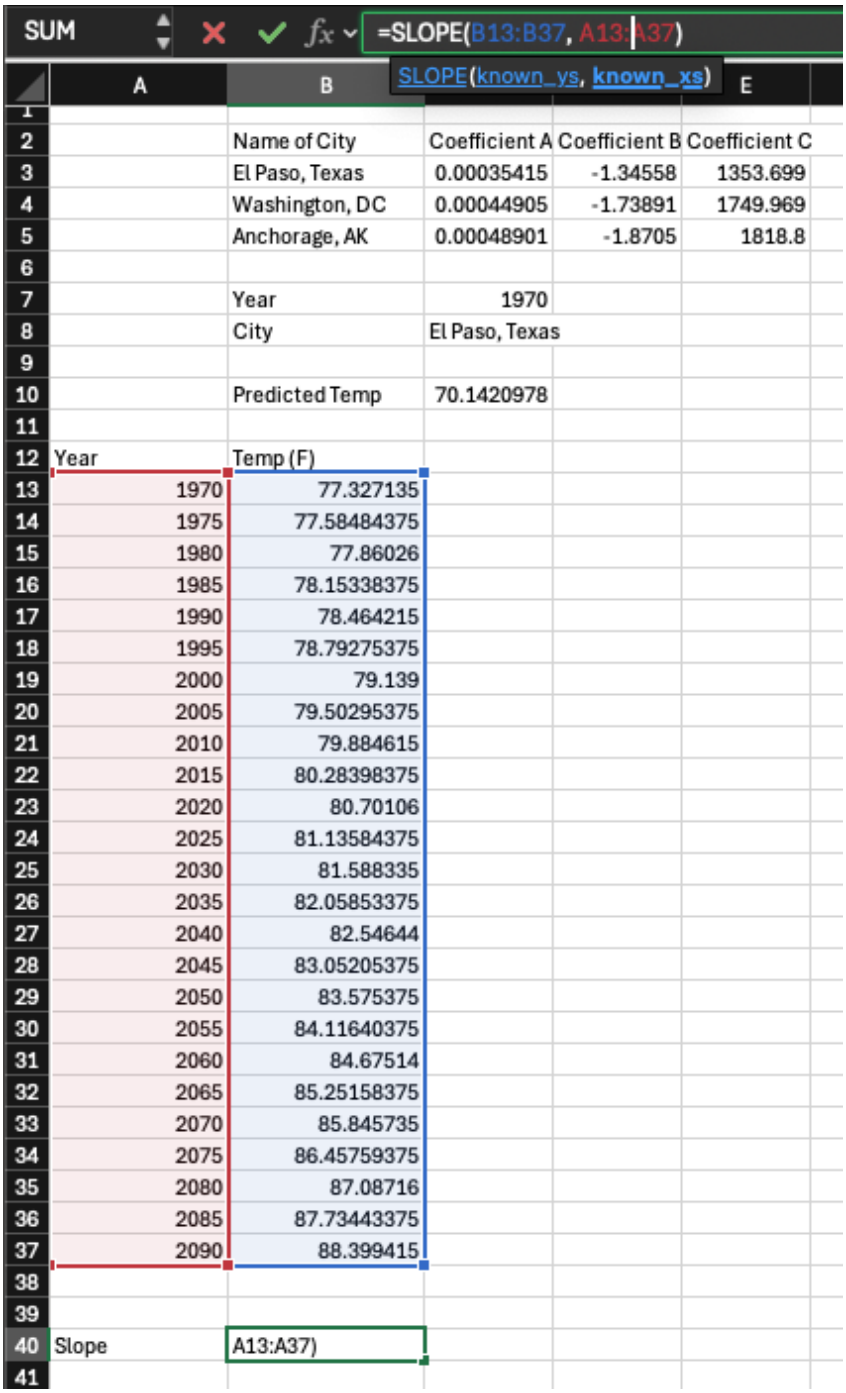

(General)
CreatePlot
Sub CreatePlot()
'
' CreatePlot Macro
'
'
Range("A12:B37").Select
ActiveSheet.Shapes.AddChart2(240, xlXYScatterLines).Select
ActiveChart.SetSourceData Source:=Range("Problem2!$A$12:$B$37")
ActiveChart.ChartTitle.Select
ActiveChart.ChartTitle.Text = "Year vs Temp"
Selection.Format.TextFrame2.TextRange.Characters.Text = "Year vs Temp"
With Selection.Format.TextFrame2.TextRange.Characters(1, 12).ParagraphFormat
.TextDirection = msoTextDirectionLeftToRight
.Alignment = msoAlignCenter
End With
With Selection.Format.TextFrame2.TextRange.Characters(1, 12).Font
.BaselineOffset = 0
.Bold = msoFalse
.NameComplexScript = "+mn-cs"
.NameFarEast = "+mn-ea"
.Fill.Visible = msoTrue
.Fill.ForeColor.RGB = RGB(89, 89, 89)
.Fill.Transparency = 0
.Fill.Solid
.Size = 14
.Italic = msoFalse
.Kerning = 12
.Name = "+mn-lt"
.UnderlineStyle = msoNoUnderline
.Spacing = 0
.Strike = msoNoStrike
End With
ActiveChart.ChartArea.Select
ActiveSheet.Shapes("Chart 1").IncrementLeft -75
ActiveSheet.Shapes("Chart 1").IncrementTop -316
ActiveChart.SetElement (msoElementPrimaryCategoryAxisTitleAdjacentToAxis)
ActiveChart.SetElement (msoElementPrimaryValueAxisTitleAdjacentToAxis)
ActiveChart.Axes(xlCategory).AxisTitle.Select
ActiveChart.Axes(xlValue, xlPrimary).AxisTitle.Text = "Year"
Selection.Format.TextFrame2.TextRange.Characters.Text = "Year"
With Selection.Format.TextFrame2.TextRange.Characters(1, 4).ParagraphFormat
.TextDirection = msoTextDirectionLeftToRight
.Alignment = msoAlignCenter
End With
With Selection.Format.TextFrame2.TextRange.Characters(1, 4).Font
.BaselineOffset = 0
.Bold = msoFalse
.NameComplexScript = "+mn-cs"
.NameFarEast = "+mn-ea"
.Fill.Visible = msoTrue
.Fill.ForeColor.RGB = RGB(89, 89, 89)
.Fill.Transparency = 0
.Fill.Solid
.Size = 10



4) What city in the US may be more affected by rising temperatures in the future?

The predicted temperature is increasing each year. We can calculate the average rate of change in temperature using the **SLOPE** function. According to the average change rate, Anchorage, AK, is more affected by rising temperatures in the future. However, the predicted temperature in Anchorage is very low. Therefore, El Paso, TX, is also affected by rising temperatures in the US.

City	Average Change Rate (°F/year)
El Paso, TX	0.09
Washington, DC	0.08
Anchorage, AK	0.11



	A	B	C	D	E
2		Name of City	Coefficient A	Coefficient B	Coefficient C
3		El Paso, Texas	0.00035415	-1.34558	1353.699
4		Washington, DC	0.00044905	-1.73891	1749.969
5		Anchorage, AK	0.00048901	-1.8705	1818.8
6					
7		Year	1970		
8		City	El Paso, Texas		
9					
10		Predicted Temp	70.1420978		
11					
12	Year	Temp (F)			
13	1970	77.327135			
14	1975	77.58484375			
15	1980	77.86026			
16	1985	78.15338375			
17	1990	78.464215			
18	1995	78.79275375			
19	2000	79.139			
20	2005	79.50295375			
21	2010	79.884615			
22	2015	80.28398375			
23	2020	80.70106			
24	2025	81.13584375			
25	2030	81.588335			
26	2035	82.05853375			
27	2040	82.54644			
28	2045	83.05205375			
29	2050	83.575375			
30	2055	84.11640375			
31	2060	84.67514			
32	2065	85.25158375			
33	2070	85.845735			
34	2075	86.45759375			
35	2080	87.08716			
36	2085	87.73443375			
37	2090	88.399415			
38					
39					
40	Slope	A13:A37)			
41					

5) Give an example of a civil engineering infrastructure that may be affected by rising temperatures.

Airports will require more runway distance due to rising temperatures. Because air density decreases with rising temperature.

Transportation pavements may deteriorate faster due to higher temperatures.

Bridge structures may also deteriorate faster due to additional temperature change cycles.

Problem 3

1) **Create an Excel/VBA program (Sub)** to calculate the value of SSD given three inputs: V, a, t. The program **reads the three inputs** using Excel as a simple interface and produces one output (SSD). The Excel interface allows the **user to select the type of pavement condition in the form of a data validation** list and then **selects the appropriate deceleration rate in the calculation of SSD in VBA**. Your program should the **user to specify the value of design speed and reaction time in the Excel interface**. Include the units of each parameter in Excel.

There are four tasks that we should do.

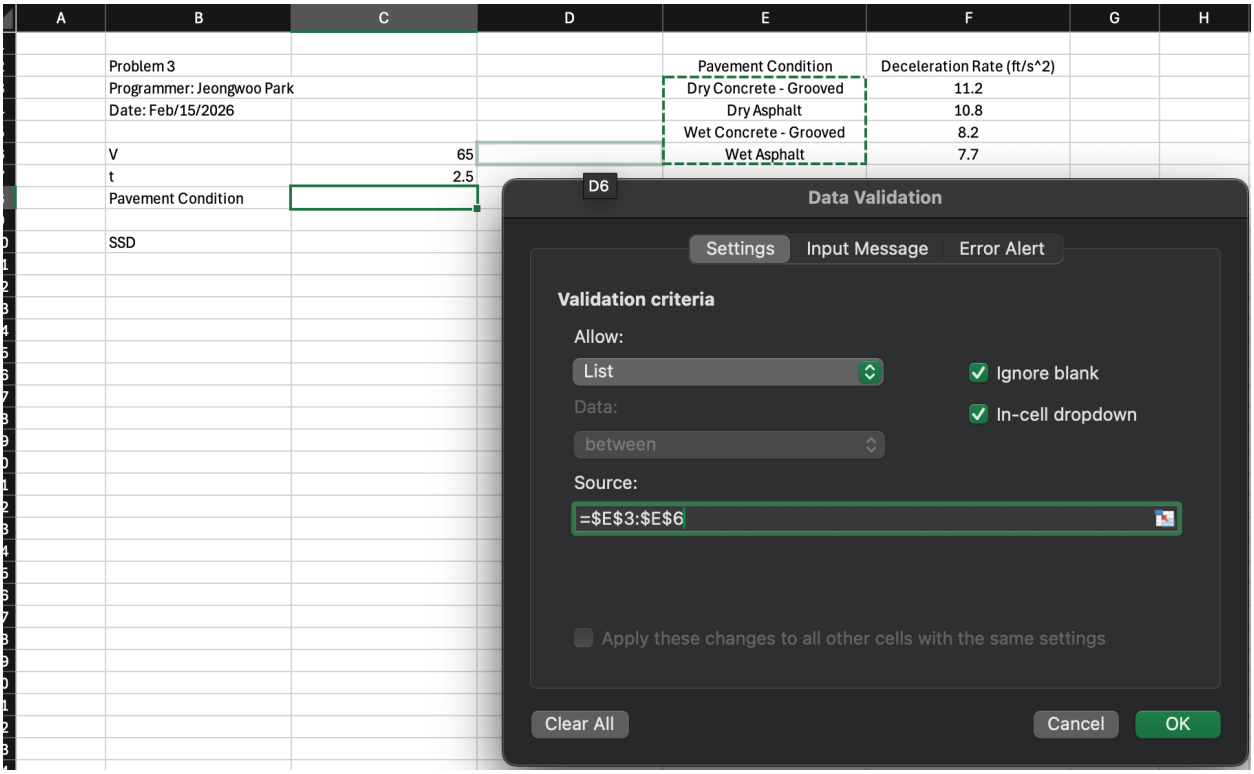
1. Create the Sub

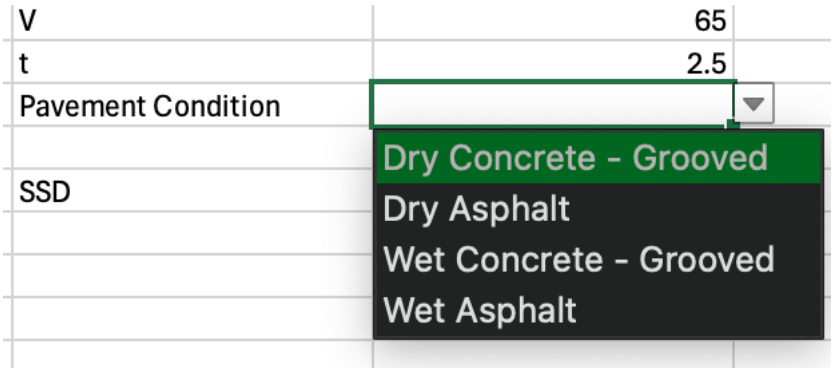
2. Select the pavement condition using Data Validation

3. The SSD values should be chosen via an IF statement.

4. User to specify the value of design speed and reaction time in the Excel interface.

2. Select the pavement condition using Data Validation





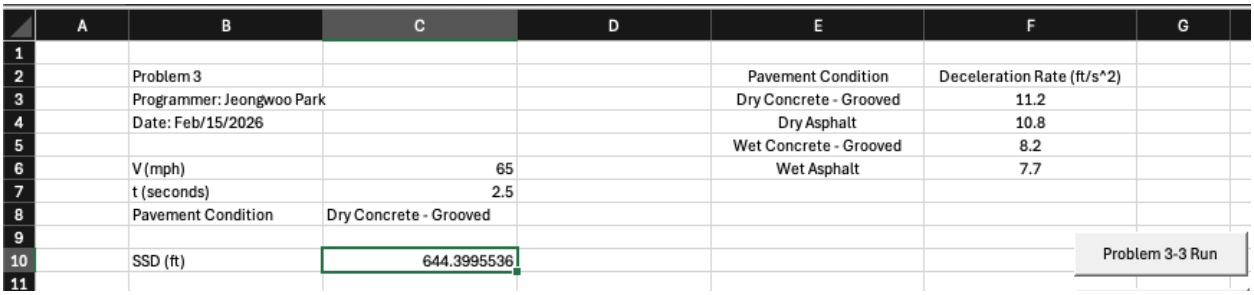
1. Create Sub. The SSD values should be slected via an IF statement. The user can specify the value of design speed and reaction time in the Excel interface.

	A	B	C	D	E	F	G
1							
2		Problem 3			Pavement Condition	Deceleration Rate (ft/s^2)	
3		Programmer: Jeongwoo Park			Dry Concrete - Grooved	11.2	
4		Date: Feb/15/2026			Dry Asphalt	10.8	
5					Wet Concrete - Grooved	8.2	
6		V (mph)	65		Wet Asphalt	7.7	
7		t (seconds)	2.5				
8		Pavement Condition	Wet Concrete - Grooved			Run	
9							
10		SSD (ft)	792.7621951				

```
(General)                                   SSDCalculation

' Input
' V highway design speed (mph)
' t breaking reaction time (sec)
' a vehicle design deceleration rate (ft/s^2)

' Output
' SSD stopping sight distance (feet)

Sub SSDCalculation()
    Sheets("Sheet1").Select

    ' Select the pavement type
    Range("C8").Select
    Pavement = ActiveCell.Value

    ' Assign the vehicle design deceleration rate based on selection
    If Pavement = "Dry Concrete - Grooved" Then

        Range("F3").Select
        a = ActiveCell.Value

    ElseIf Pavement = "Dry Asphalt" Then
        Range("F4").Select
        a = ActiveCell.Value

    ElseIf Pavement = "Wet Concrete - Grooved" Then
        Range("F5").Select
        a = ActiveCell.Value

    ElseIf Pavement = "Wet Asphalt" Then
        Range("F6").Select
        a = ActiveCell.Value

    End If

    ' Select Speed
    Range("C6").Select
    V = ActiveCell.Value

   ' Select deceleration rate
    Range("C7").Select
    t = ActiveCell.Value

    ' Calculate and assign SSD values
    Call SSD(V, t, a, SSD_Value)

    Range("C10").Select
    ActiveCell.Value = SSD_Value

End Sub

'Function that calculates SSD
Sub SSD(V, t, a, SSD_Value)
    SSD_Value = 1.47 * V * t + 1.075 * V ^ 2 / a
End Sub
```

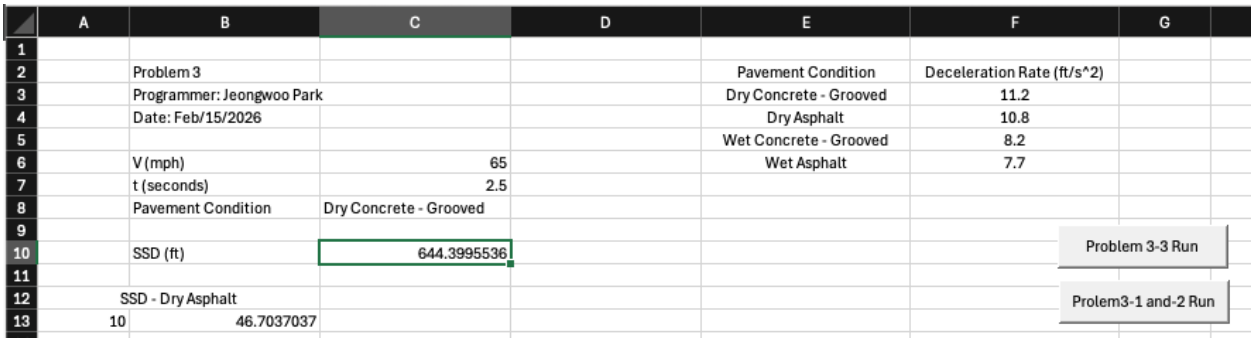
2) Test the program created in part (a) to estimate the stopping sight distance (SSD) for a vehicle traveling at 65 miles per hour on dry (grooved) concrete pavement. Repeat for wet concrete (grooved). Use a 2.5 second breaking reaction time in your calculations. Compare the two solutions and comment on the additional stopping distance needed when the concrete pavement is wet.

SSD Dry (grooved) Pavement: 644.39 ft



	A	B	C	D	E	F	G
1							
2		Problem 3			Pavement Condition	Deceleration Rate (ft/s^2)	
3		Programmer: Jeongwoo Park			Dry Concrete - Grooved	11.2	
4		Date: Feb/15/2026			Dry Asphalt	10.8	
5					Wet Concrete - Grooved	8.2	
6		V (mph)	65		Wet Asphalt	7.7	
7		t (seconds)	2.5				
8		Pavement Condition	Dry Concrete - Grooved				
9							
10		SSD (ft)	644.3995536				
11							

SSD wet (grooved) Pavement: 792.76 ft

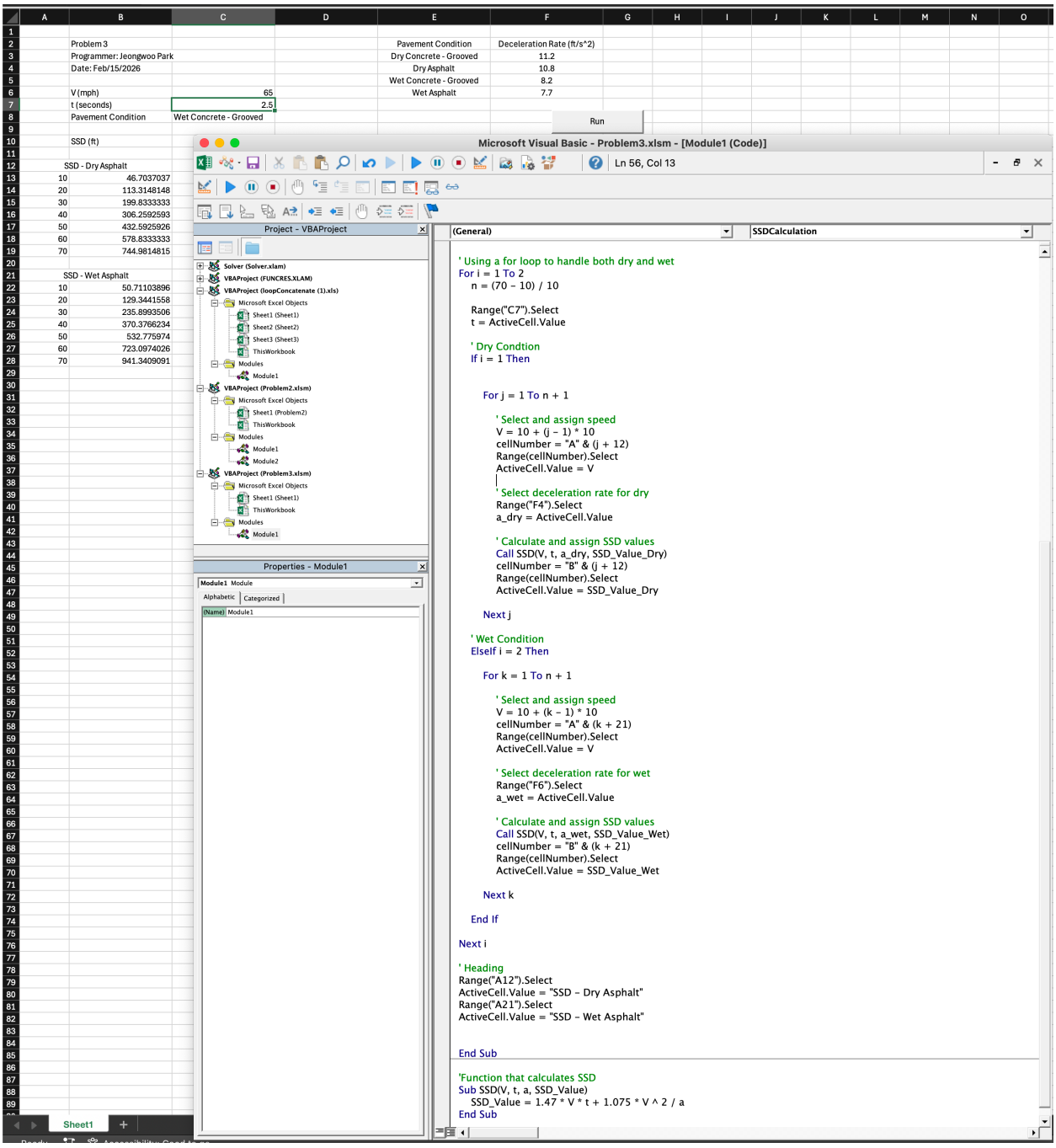


	A	B	C	D	E	F	G
1							
2		Problem 3			Pavement Condition	Deceleration Rate (ft/s^2)	
3		Programmer: Jeongwoo Park			Dry Concrete - Grooved	11.2	
4		Date: Feb/15/2026			Dry Asphalt	10.8	
5					Wet Concrete - Grooved	8.2	
6		V (mph)	65		Wet Asphalt	7.7	
7		t (seconds)	2.5				
8		Pavement Condition	Dry Concrete - Grooved				
9							
10		SSD (ft)	644.3995536				
11							
12		SSD - Dry Asphalt					
13	10	46.7037037					

3) Add more code to the program in part (a) creating a table to estimate the values of SSD for speeds 10 to 70 mph at intervals of 10 mph. The table is created in another section of the Excel spreadsheet. Create a table with design speed in column A and SSD in column B. Label your table appropriately. In your solution, show two tables with your solution: 1) SSD for dry asphalt and 2) SSD for wet asphalt.

To do this, you can run the SSD for dry asphalt first, then rerun the code for SSD for wet asphalt. If you want to create two tables simultaneously, you can use a for loop and an IF statement. The solution below included the VBA code that creates two tables simultaneously.

12	SSD - Dry Asphalt	
13	10	46.7037037
14	20	113.3148148
15	30	199.8333333
16	40	306.2592593
17	50	432.5925926
18	60	578.8333333
19	70	744.9814815
20		
21	SSD - Wet Asphalt	
22	10	50.71103896
23	20	129.3441558
24	30	235.8993506
25	40	370.3766234
26	50	532.775974
27	60	723.0974026
28	70	941.3409091



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1															
2		Problem 3			Pavement Condition	Deceleration Rate (ft/s^2)									
3		Programmer: Jeongwoo Park			Dry Concrete - Grooved	11.2									
4		Date: Feb/15/2026			Dry Asphalt	10.8									
5					Wet Concrete - Grooved	8.2									
6		V (mph)	65		Wet Asphalt	7.7									
7		t (seconds)	2.5												
8		Pavement Condition	Wet Concrete - Grooved												
9															
10		SSD (ft)													
11															
12		SSD - Dry Asphalt													
13		10	46.7037037												
14		20	113.3148148												
15		30	199.8333333												
16		40	306.2592593												
17		50	432.5925926												
18		60	578.8333333												
19		70	744.9814815												
20															
21		SSD - Wet Asphalt													
22		10	50.71103896												
23		20	129.3441558												
24		30	235.8993506												
25		40	370.3766234												
26		50	532.775974												
27		60	723.0974026												
28		70	941.3409091												
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Run

Microsoft Visual Basic - Problem3.xlsm - [Module1 (Code)]

Ln 56, Col 13

Project - VBAProject

- Solver (Solver.xlam)
- VBAProject (FUNCRES.XLAM)
- VBAProject (loopConcatenate (1).xls)
  - Microsoft Excel Objects
    - Sheet1 (Sheet1)
    - Sheet2 (Sheet2)
    - Sheet3 (Sheet3)
    - ThisWorkbook
  - Modules
    - Module1
- VBAProject (Problem2.xlsm)
  - Microsoft Excel Objects
    - Sheet1 (Problem2)
    - ThisWorkbook
  - Modules
    - Module1
    - Module2
- VBAProject (Problem3.xlsm)
  - Microsoft Excel Objects
    - Sheet1 (Sheet1)
    - ThisWorkbook
  - Modules
    - Module1

Properties - Module1

Module1 Module

Alphabetic | Categorized

(Name) Module1

(General) | SSDCalculation

```
' Using a for loop to handle both dry and wet
For i = 1 To 2
    n = (70 - 10) / 10

    Range("C7").Select
    t = ActiveCell.Value

    ' Dry Condtion
    If i = 1 Then


        For j = 1 To n + 1

            ' Select and assign speed
            V = 10 + (j - 1) * 10
            cellNumber = "A" & (j + 12)
            Range(cellNumber).Select
            ActiveCell.Value = V

            ' Select deceleration rate for dry
            Range("F4").Select
            a_dry = ActiveCell.Value

            ' Calculate and assign SSD values
            Call SSD(V, t, a_dry, SSD_Value_Dry)
            cellNumber = "B" & (j + 12)
            Range(cellNumber).Select
            ActiveCell.Value = SSD_Value_Dry

        Next j

    ' Wet Condition
    ElseIf i = 2 Then

        For k = 1 To n + 1

            ' Select and assign speed
            V = 10 + (k - 1) * 10
            cellNumber = "A" & (k + 21)
            Range(cellNumber).Select
            ActiveCell.Value = V

            ' Select deceleration rate for wet
            Range("F6").Select
            a_wet = ActiveCell.Value

            ' Calculate and assign SSD values
            Call SSD(V, t, a_wet, SSD_Value_Wet)
            cellNumber = "B" & (k + 21)
            Range(cellNumber).Select
            ActiveCell.Value = SSD_Value_Wet

        Next k

    End If

Next i

' Heading
Range("A12").Select
ActiveCell.Value = "SSD - Dry Asphalt"
Range("A21").Select
ActiveCell.Value = "SSD - Wet Asphalt"


End Sub

'Function that calculates SSD
Sub SSD(V, t, a, SSD_Value)
    SSD_Value = 1.47 * V * t + 1.075 * V ^ 2 / a
End Sub
```

(General) SSDCalculation

```
' Using a for loop to handle both dry and wet
For i = 1 To 2
    n = (70 - 10) / 10

    Range("C7").Select
    t = ActiveCell.Value

    ' Dry Condtion
    If i = 1 Then


        For j = 1 To n + 1

            ' Select and assign speed
            V = 10 + (j - 1) * 10
            cellNumber = "A" & (j + 12)
            Range(cellNumber).Select
            ActiveCell.Value = V

            ' Select deceleration rate for dry
            Range("F4").Select
            a_dry = ActiveCell.Value

            ' Calculate and assign SSD values
            Call SSD(V, t, a_dry, SSD_Value_Dry)
            cellNumber = "B" & (j + 12)
            Range(cellNumber).Select
            ActiveCell.Value = SSD_Value_Dry

        Next j

    ' Wet Condition
    ElseIf i = 2 Then

        For k = 1 To n + 1

            ' Select and assign speed
            V = 10 + (k - 1) * 10
            cellNumber = "A" & (k + 21)
            Range(cellNumber).Select
            ActiveCell.Value = V

            ' Select deceleration rate for wet
            Range("F6").Select
            a_wet = ActiveCell.Value

            ' Calculate and assign SSD values
            Call SSD(V, t, a_wet, SSD_Value_Wet)
            cellNumber = "B" & (k + 21)
            Range(cellNumber).Select
            ActiveCell.Value = SSD_Value_Wet

        Next k

    End If

Next i

' Heading
Range("A12").Select
ActiveCell.Value = "SSD - Dry Asphalt"
Range("A21").Select
ActiveCell.Value = "SSD - Wet Asphalt"


End Sub

'Function that calculates SSD
Sub SSD(V, t, a, SSD_Value)
    SSD_Value = 1.47 * V * t + 1.075 * V ^ 2 / a
End Sub
```