Assignment 5 Solution (CEE 3804)

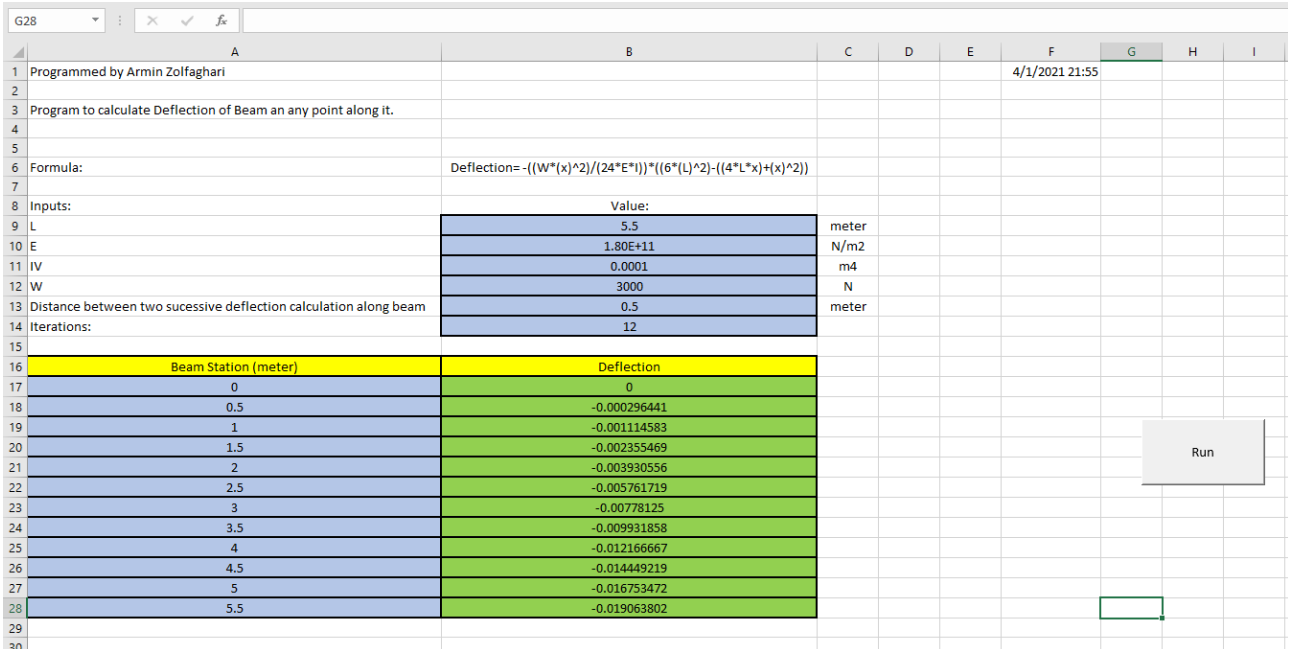
Problem 1:

Task a:

ormat Debug Run Tools Add-Ins Window Help

(General) routine1

```
Dim ValL As Double
Dim ValE As Double
Dim ValIV As Double
Dim ValW As Double
Dim Valx As Double
Dim Valbeamstation As Double
Dim Valdeflection As Double
Sub routine1()
' Programmed by Armin Zolfaghari
'Date: 02/24/2021
'A program to calculater the deflection along a beam every 50 centimetrs

' Define the spreadsheat we are working on
Sheets("Problem1").Select

'Read necessary inputs from Excel to calculate deflection
Range("B9").Select
L = ActiveCell.Value

Range("B10").Select
E = ActiveCell.Value

Range("B11").Select
IV = ActiveCell.Value

Range("B12").Select
W = ActiveCell.Value

'Distance between two sucessive deflection calculation along beam in meter
Range("B13").Select
x = ActiveCell.Value


'Calculate number of iteration
CellNumber = "B" & (14)
Range(CellNumber).Select
Iterations = Int((L / x) + 1)
ActiveCell.Value = Iterations

' Loop to calculate the deflection along beam every x meter
For i = 1 To Iterations

  'Function that calculates the desired posion for deflection calculation every 0.5 meter on beam
  CellNumber = "A" & (i + 16)
  Range(CellNumber).Select
  beamstation = x * (i - 1)
  ActiveCell.Value = beamstation

  'Function to calculate the deflection
  CellNumber = "B" & (i + 16)
  Range(CellNumber).Select
  deflection = -((W * beamstation ^ 2) / (24 * E * IV)) * (6 * L ^ 2 - 4 * L * beamstation + beamstation ^ 2)
  ActiveCell.Value = deflection

Next i
End Sub
```



	A	B	C	F
1	Programmed by Armin Zolfaghari			4/1/2021 21:55
3	Program to calculate Deflection of Beam an any point along it.			
6	Formula:	Deflection= -((W*(x)^2)/(24*E*I))*((6*(L)^2)-((4*L*x)+(x)^2))		
8	Inputs:	Value:		
9	L	5.5	meter	
10	E	1.80E+11	N/m2	
11	IV	0.0001	m4	
12	W	3000	N	
13	Distance between two sucessive deflection calculation along beam	0.5	meter	
14	Iterations:	12		

Beam Station (meter)	Deflection
0	0
0.5	-0.000296441
1	-0.001114583
1.5	-0.002355469
2	-0.003930556
2.5	-0.005761719
3	-0.00778125
3.5	-0.009931858
4	-0.012166667
4.5	-0.014449219
5	-0.016753472
5.5	-0.019063802

Run

```
Dim ValIV As Double
Dim ValW As Double
Dim Valx As Double
Dim Valbeamstation As Double
Dim Valdeflection As Double

Sub routine2()
'Programmed by Armin Zolfaghari
'Date: 02/24/2021
'A program to calculater the deflection along a beam every 50 centimetrs
'Define the spreadsheat we are working on
Sheets("Problem2").Select
'Read necessary inputs from Excel to calculate deflection
Range("B9").Select
L = ActiveCell.Value
Range("B10").Select
material = ActiveCell.Value
'Use conditional statements to assign E to the desired material
If material = "Structural Steel" Then
E = 200000000000#
ElseIf material = "Stainless Steel" Then
E = 180000000000#
ElseIf material = "Titanium" Then
E = 120000000000#
ElseIf material = "Aluminum" Then
E = 70000000000#
ElseIf material = "High Strength Concrete" Then
E = 30000000000#
End If

Range("B11").Select
IV = ActiveCell.Value
Range("B12").Select
W = ActiveCell.Value
'Distance between two sucessive deflection calculation along beam in meter
Range("B13").Select
x = ActiveCell.Value
'Calculate number of iteration
CellNumber = "B" & (14)
Range(CellNumber).Select
Iterations = Int((L / x) + 1)
ActiveCell.Value = Iterations
' Loop to calculate the deflection along beam every 50 centimetrs
For i = 1 To Iterations
  'Function that calculates the desired posion for deflection calculation every 0.5 meter on beam
  CellNumber = "A" & (i + 16)
  Range(CellNumber).Select
  beamstation = 0.5 * (i - 1)
  ActiveCell.Value = beamstation
  'Function to calculate the deflection
  CellNumber = "B" & (i + 16)
  Range(CellNumber).Select
  deflection = -((W * beamstation ^ 2) / (24 * E * IV)) * (6 * L ^ 2 - 4 * L * beamstation + beamstation ^ 2)
  ActiveCell.Value = deflection
Next i
End Sub
```

Task b)

```
(General)                                                routine

Dim ValE As Double
Dim ValIV As Double
Dim ValW As Double
Dim Valx As Double
Dim Valbeamstation As Double
Dim Valdeflection As Double
Sub routine4()
'Programmed by Armin Zolfaghari
'Date: 02/24/2021
'A program to calculater the deflection along a beam every 50 centimetrs
'Define the spreadsheat we are working on
Sheets("GUI (Problem 2)").Select
'Read necessary inputs from Excel to calculate deflection
'Clear the work space
Range("A15", "B2000").Clear
Range("E6").Select
L = ActiveCell.Value
Range("E7").Select
material = ActiveCell.Value
'Use conditional statements to assign E to the desired material
If material = "Structural Steel" Then
E = 200000000000#
ElseIf material = "Stainless Steel" Then
E = 180000000000#
ElseIf material = "Titanium" Then
E = 120000000000#
ElseIf material = "Aluminum" Then
E = 70000000000#
ElseIf material = "High Strength Concrete" Then
E = 30000000000#
End If
Range("E8").Select
IV = ActiveCell.Value
Range("E9").Select
W = ActiveCell.Value
'Distance between two sucessive deflection calculation along beam in meter
Range("E10").Select
x = ActiveCell.Value
'Calculate number of iteration
CellNumber = "B" & (11)
Range(CellNumber).Select
Iterations = Int((L / x) + 1)
ActiveCell.Value = Iterations
' Loop to calculate the deflection along beam every 50 centimetrs
For i = 1 To Iterations
  'Function that calculates the desired posion for deflection calculation every 0.5 meter on beam
  CellNumber = "A" & (i + 14)
  Range(CellNumber).Select
  beamstation = x * (i - 1)
  ActiveCell.Value = beamstation
  'Function to calculate the deflection
  CellNumber = "B" & (i + 14)
  Range(CellNumber).Select
  deflection = -((W * beamstation ^ 2) / (24 * E * IV)) * (6 * L ^ 2 - 4 * L * beamstation + beamstation ^ 2)
  ActiveCell.Value = deflection
Next i
End Sub
```

Programmer: Armin Zolfaghari

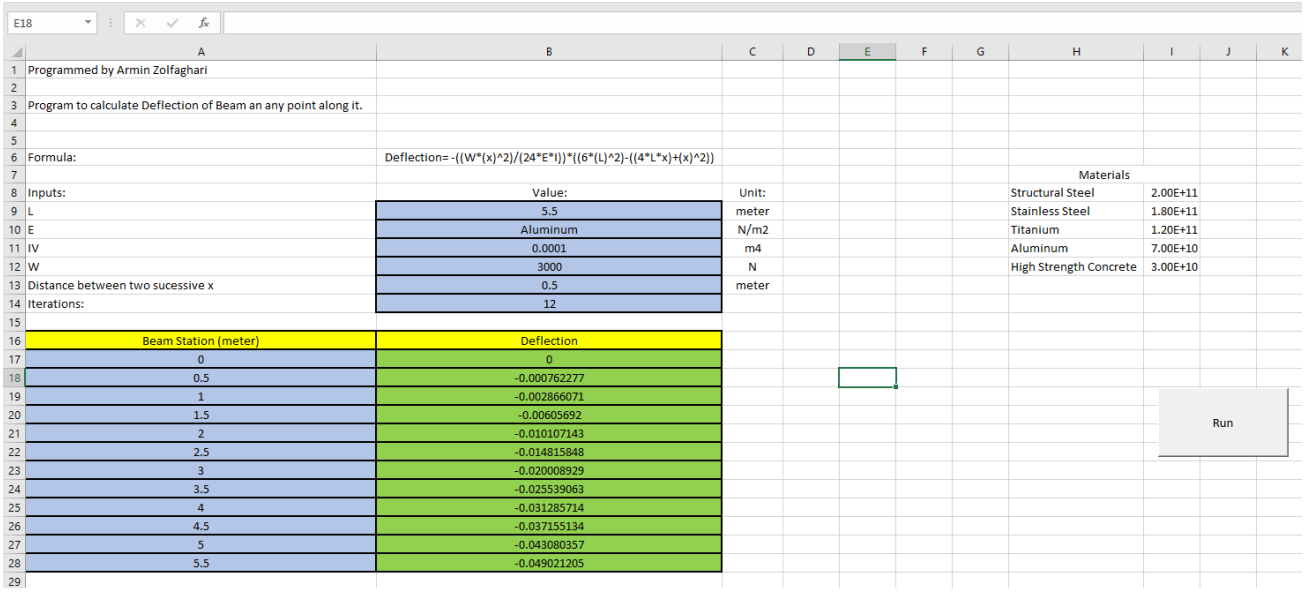
Program to calculate deflection along a beem **Date:** **4/1/2021 21:55**

Run

Inputs:		Value:	Unit:	Adjustments:
L		10	meter	
E		Stainless Steel	N/m2	
IV		0.0001	m4	
W		3000	N	
Distance between two sucessive x		0.25	meter	
Iterations:	41			

Beam Station	Deflection
0	0
0.25	-0.000256104
0.5	-0.001007378
0.75	-0.00222876
1	-0.003895833
1.25	-0.005984836
1.5	-0.008472656
1.75	-0.011336833
2	-0.014555556
2.25	-0.018107666
2.5	-0.021972656
2.75	-0.026130669
3	-0.0305625
3.25	-0.035249593
3.5	-0.040174045
3.75	-0.045318604
4	-0.050666667
4.25	-0.056202284
4.5	-0.061910156
4.75	-0.067775635
5	-0.073784722
5.25	-0.079924072
5.5	-0.08618099
5.75	-0.09254343

Task c)



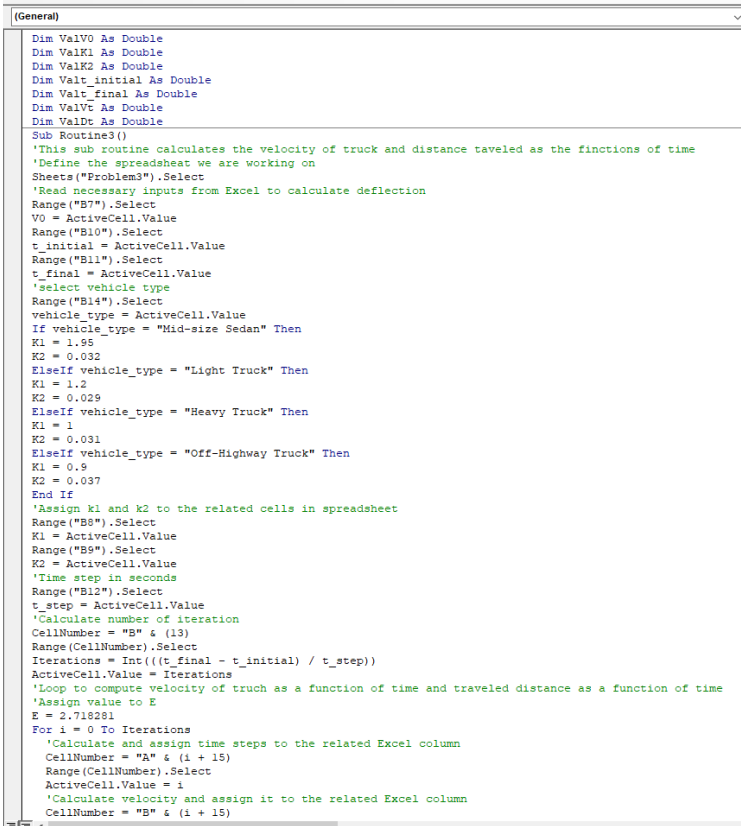
	A	B	C	H	I
1	Programmed by Armin Zolfaghari				
2					
3	Program to calculate Deflection of Beam an any point along it.				
4					
5					
6	Formula:	Deflection= -((W*(x)^2)/(24*E*I))*((6*(L)^2)-((4*L*x)+(x)^2))			
7				Materials	
8	Inputs:	Value:	Unit:	Structural Steel	2.00E+11
9	L	5.5	meter	Stainless Steel	1.80E+11
10	E	Aluminum	N/m2	Titanium	1.20E+11
11	IV	0.0001	m4	Aluminum	7.00E+10
12	W	3000	N	High Strength Concrete	3.00E+10
13	Distance between two sucessive x	0.5	meter		
14	Iterations:	12			
15					

Beam Station (meter)	Deflection
0	0
0.5	-0.000762277
1	-0.002866071
1.5	-0.00605692
2	-0.010107143
2.5	-0.014815848
3	-0.020008929
3.5	-0.025539063
4	-0.031285714
4.5	-0.037155134
5	-0.043080357
5.5	-0.049021205

Run

Problem 2

Background of problem 2)



```
(General)
Dim ValV0 As Double
Dim ValK1 As Double
Dim ValK2 As Double
Dim Valt_initial As Double
Dim Valt_final As Double
Dim ValVt As Double
Dim ValDt As Double
Sub Routine3()
'This sub routine calculates the velocity of truck and distance taveled as the finctions of time
'Define the spreadsheat we are working on
Sheets("Problem3").Select
'Read necessary inputs from Excel to calculate deflection
Range("B7").Select
V0 = ActiveCell.Value
Range("B10").Select
t_initial = ActiveCell.Value
Range("B11").Select
t_final = ActiveCell.Value
'select vehicle type
Range("B14").Select
vehicle_type = ActiveCell.Value
If vehicle_type = "Mid-size Sedan" Then
K1 = 1.95
K2 = 0.032
ElseIf vehicle_type = "Light Truck" Then
K1 = 1.2
K2 = 0.029
ElseIf vehicle_type = "Heavy Truck" Then
K1 = 1
K2 = 0.031
ElseIf vehicle_type = "Off-Highway Truck" Then
K1 = 0.9
K2 = 0.037
End If
'Assign k1 and k2 to the related cells in spreadsheet
Range("B8").Select
K1 = ActiveCell.Value
Range("B9").Select
K2 = ActiveCell.Value
'Time step in seconds
Range("B12").Select
t_step = ActiveCell.Value
'Calculate number of iteration
CellNumber = "B" & (13)
Range(CellNumber).Select
Iterations = Int(((t_final - t_initial) / t_step))
ActiveCell.Value = Iterations
'Loop to compute velocity of truch as a function of time and traveled distance as a function of time
'Assign value to E
E = 2.718281
For i = 0 To Iterations
  'Calculate and assign time steps to the related Excel column
  CellNumber = "A" & (i + 15)
  Range(CellNumber).Select
  ActiveCell.Value = i
  'Calculate velocity and assign it to the related Excel column
  CellNumber = "B" & (i + 15)
```

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(General)

```
'Read necessary inputs from Excel to calculate deflection
Range("B7").Select
V0 = ActiveCell.Value
Range("B10").Select
t_initial = ActiveCell.Value
Range("B11").Select
t_final = ActiveCell.Value
'select vehicle type
Range("B14").Select
vehicle_type = ActiveCell.Value
If vehicle_type = "Mid-size Sedan" Then
K1 = 1.95
K2 = 0.032
ElseIf vehicle_type = "Light Truck" Then
K1 = 1.2
K2 = 0.029
ElseIf vehicle_type = "Heavy Truck" Then
K1 = 1
K2 = 0.031
ElseIf vehicle_type = "Off-Highway Truck" Then
K1 = 0.9
K2 = 0.037
End If
'Assign k1 and k2 to the related cells in spreadsheet
Range("B8").Select
K1 = ActiveCell.Value
Range("B9").Select
K2 = ActiveCell.Value
'Time step in seconds
Range("B12").Select
t_step = ActiveCell.Value
'Calculate number of iteration
CellNumber = "B" & (13)
Range(CellNumber).Select
Iterations = Int(((t_final - t_initial) / t_step))
ActiveCell.Value = Iterations
'Loop to compute velocity of truch as a function of time and traveled distance as a function of time
'Assign value to E
E = 2.718281
For i = 0 To Iterations
  'Calculate and assign time steps to the related Excel column
  CellNumber = "A" & (i + 15)
  Range(CellNumber).Select
  ActiveCell.Value = i
  'Calculate velocity and assign it to the related Excel column
  CellNumber = "B" & (i + 15)
  Range(CellNumber).Select
  Vt = ((K1 * (1 - (E ^ (-K2 * i)))) / K2) + (V0 * (E ^ (-K2 * i)))
  ActiveCell.Value = Vt
  'Calculate travelled distance and assign it to the related Excel column
  CellNumber = "C" & (i + 15)
  Range(CellNumber).Select
  Dt = ((K1 / K2) * i) - ((K1 / (K2 ^ 2)) * (1 - (E ^ (-K2 * i)))) + ((V0 / K2) * (1 - (E ^ (-K2 * i))))
  ActiveCell.Value = Dt
Next i
End Sub
```

Format Debug Run Tools Add-Ins Window Help

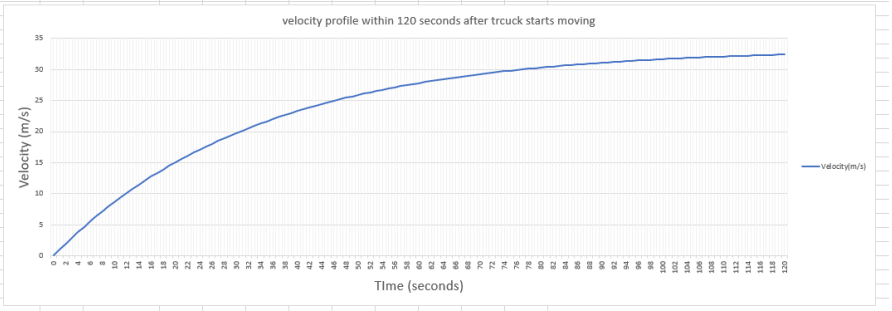
(General)

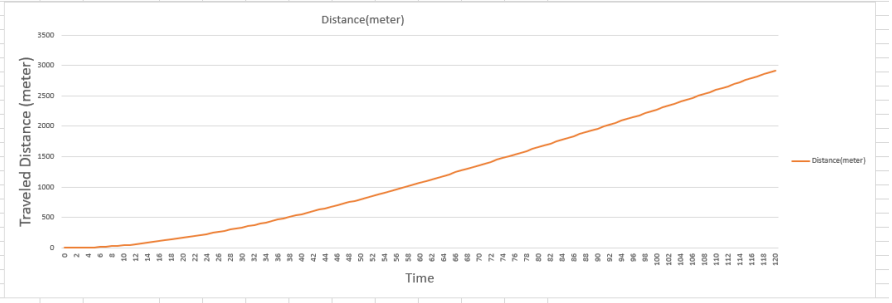
```
Dim ValV0 As Double
Dim ValK1 As Double
Dim ValK2 As Double
Dim Valt_initial As Double
Dim Valt_final As Double
Dim ValVt As Double
Dim ValDt As Double
Sub Routine5()
'Programmed by Armin Zolfaghari
'Date: 02/24/2021
'This sub routine calculates the velocity of truck and distance taveled as the finctions of time
'Define the spreadsheat we are working on
Sheets("GUI (Problem 3)").Select
'Clear the work space
Range("A17", "C5000").Clear
'Read necessary inputs from Excel to calculate deflection
Range("B7").Select
V0 = ActiveCell.Value
Range("B10").Select
t_initial = ActiveCell.Value
Range("B11").Select
t_final = ActiveCell.Value
'select vehicle type
Range("B14").Select
vehicle_type = ActiveCell.Value
If vehicle_type = "Mid-size Sedan" Then
K1 = 1.95
K2 = 0.032
ElseIf vehicle_type = "Light Truck" Then
K1 = 1.2
K2 = 0.029
ElseIf vehicle_type = "Heavy Truck" Then
K1 = 1
K2 = 0.031
ElseIf vehicle_type = "Off-Highway Truck" Then
K1 = 0.9
K2 = 0.037
End If
'Assign k1 and k2 to the related cells in spreadsheet
Range("B8").Select
K1 = ActiveCell.Value
Range("B9").Select
K2 = ActiveCell.Value
'Time step in seconds
Range("B12").Select
t_step = ActiveCell.Value
'Calculate number of iteration
CellNumber = "B" & (13)
Range(CellNumber).Select
Iterations = Int(((t_final - t_initial) / t_step))
ActiveCell.Value = Iterations
'Loop to compute velocity of truch as a function of time and traveled distance as a function of time
'Assign value to E
E = 2.718281
For i = 0 To Iterations Step t_step
 'Calculate and assign time steps to the related Excel column
  counter = 1
```

(General) | Routine5

```
K1 = 1
K2 = 0.031
ElseIf vehicle_type = "Off-Highway Truck" Then
K1 = 0.9
K2 = 0.037
End If
'Assign k1 and k2 to the related cells in spreadsheet
Range("B8").Select
K1 = ActiveCell.Value
Range("B9").Select
K2 = ActiveCell.Value
'Time step in seconds
Range("B12").Select
t_step = ActiveCell.Value
'Calculate number of iteration
CellNumber = "B" & (13)
Range(CellNumber).Select
Iterations = Int(((t_final - t_initial) / t_step))
ActiveCell.Value = Iterations
'Loop to compute velocity of truch as a function of time and traveled distance as a function of time
'Assign value to E
E = 2.718281
For i = 0 To Iterations Step t_step
 'Calculate and assign time steps to the related Excel column
  counter = 1
  CellNumber = "A" & (i + 17)
  Range(CellNumber).Select
  ActiveCell.Value = i
 'Calculate velocity and assign it to the related Excel column
  CellNumber = "B" & (i + 17)
  Range(CellNumber).Select
  Vt = ((K1 * (1 - (E ^ (-K2 * i)))) / K2) + (V0 * (E ^ (-K2 * i)))
  ActiveCell.Value = Vt

 'Calculate traveled distance and assign it to the related Excel column
  CellNumber = "C" & (i + 17)
  Range(CellNumber).Select
  Dt = ((K1 / K2) * i) - ((K1 / (K2 ^ 2)) * (1 - (E ^ (-K2 * i)))) + ((V0 / K2) * (1 - (E ^ (-K2 * i))))
  ActiveCell.Value = Dt

  'Calculate traveled distance in order to reach a specific speed called "speed to the highway".
  Range("B15").Select
  speedToHighway = ActiveCell.Value

  '1-First we need to calculate the time at which vehicle reaches the specific speed

  Range("D17").Select
  t_SpeedToHighway = -(Application.WorksheetFunction.Ln((speedToHighway * K2 - K1) / (V0 * K2 - K1))) / K2

  '2-Second, we need to calculate the teaveled distance when vehicle reaches "speed to the highway"
  D_t_SpeedToHighway = ((K1 / K2) * t_SpeedToHighway) - ((K1 / (K2 ^ 2)) * (1 - (E ^ (-K2 * t_SpeedToHighway)))) + ((V0 / K2) * (1 - (E ^ (-K2 * t_SpeedToHighway))))
  ActiveCell.Value = D_t_SpeedToHighway

Next i
End Sub
```

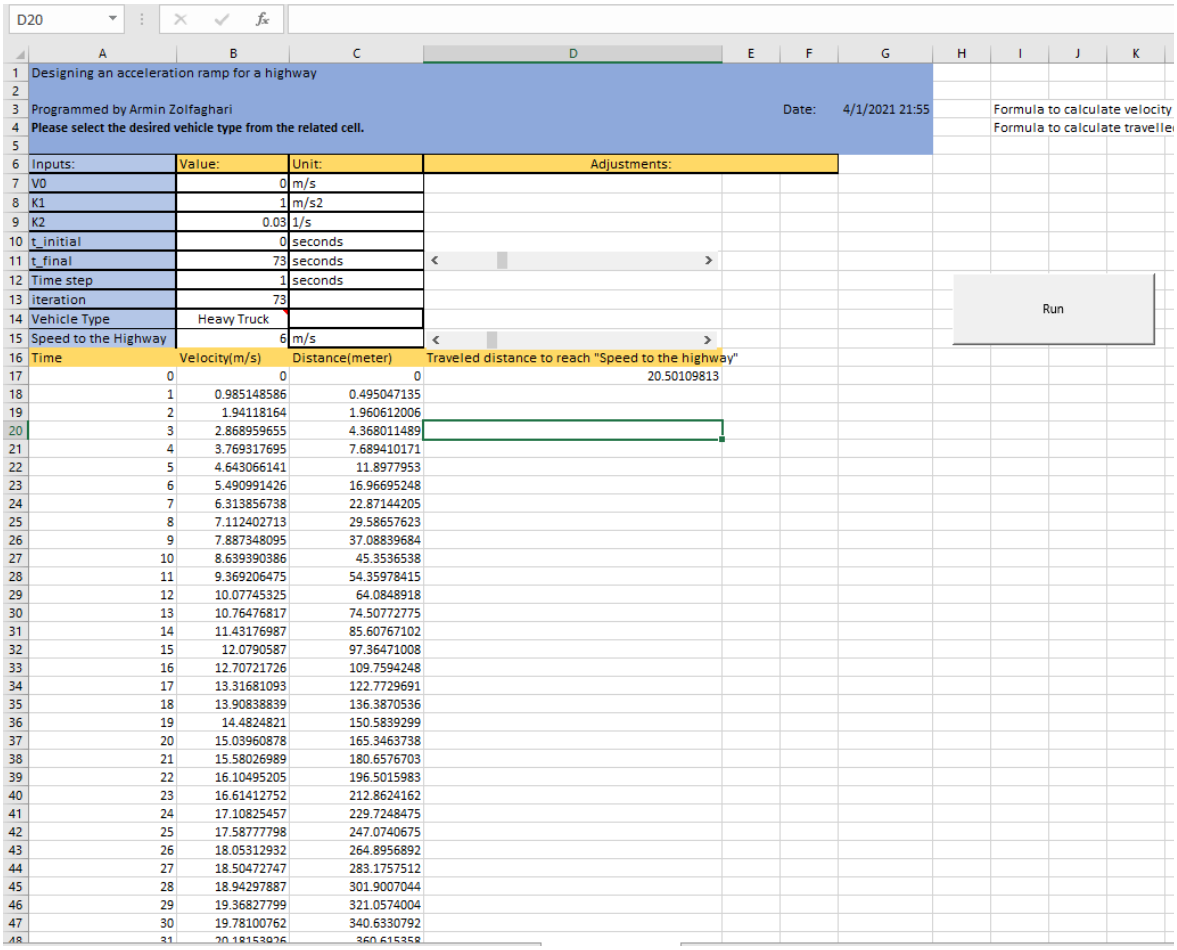
	A	B	C
18	3	2.868959655	4.368011489
19	4	3.769317695	7.689410171
20	5	4.643066141	11.8977953
21	6	5.490991426	16.96695248
22	7	6.313856738	22.87144205
23	8	7.112402713	29.58657623
24	9	7.887348095	37.08839684
25	10	8.639390386	45.3536538
26	11	9.369206475	54.35978415
27	12	10.07745325	64.0848918
28	13	10.76476817	74.50772775
29	14	11.43176987	85.60767102
30	15	12.0790587	97.36471008
31	16	12.70721726	109.7594248
32	17	13.31681093	122.7729691
33	18	13.90838839	136.3870536
34	19	14.4824821	150.5839299
35	20	15.03960878	165.3463738
36	21	15.58026989	180.6576703
37	22	16.10495205	196.5015983
38	23	16.61412752	212.8624162
39	24	17.10825457	229.7248475
40	25	17.58777798	247.0740675
41	26	18.05312932	264.8956892
42	27	18.50472747	283.1757512
43	28	18.94297887	301.9007044
44	29	19.36827799	321.0574004
45	30	19.78100762	340.6330792
46	31	20.18153926	360.615358
47	32	20.5702334	380.99222
48	33	20.9474399	401.7520035
49	34	21.31349826	422.8833914
50	35	21.66873796	444.3754012
51	36	22.01347875	466.2173749
52	37	22.34803091	488.3989695
53	38	22.67269557	510.9101477
54	39	22.98776494	533.7411688
55	40	23.2935226	556.8825801
56	41	23.59024376	580.3252081
57	42	23.87819549	604.0601505
58	43	24.15763696	628.0787681
59	44	24.42881969	652.3726771
60	45	24.69198776	676.9337415
61	46	24.94737804	701.7540654
62	47	25.1952204	726.8259867





	A	B	C	D	E	F
77	62	28.1442427	1128.525243			
78	63	28.2976035	1156.746551			
79	64	28.4464317	1185.118942			
80	65	28.5908615	1213.637951			
81	66	28.7310226	1242.299245			
82	67	28.8670414	1271.098619			
83	68	28.9990403	1300.031991	**Part d answer**		
84	69	29.127138	1329.095401			
85	70	29.2514498	1358.285007			
86	71	29.3720876	1387.597079			
87	72	29.4891601	1417.027997			
88	73	29.6027726	1446.574248			
89	74	29.7130273	1476.232425			
90	75	29.8200234	1505.999219			
91	76	29.9238574	1535.87142			
92	77	30.0246226	1565.845313			
93	78	30.1224098	1595.919674			
94	79	30.2173069	1626.089771			
95	80	30.3093993	1656.353355			
96	81	30.3987701	1686.707664			
97	82	30.4854995	1717.150017			
98	83	30.5696657	1747.677811			
99	84	30.6513444	1778.288521			
100	85	30.7306091	1808.979696			
101	86	30.8075312	1839.74896			
102	87	30.8821799	1870.594003			
103	88	30.9546224	1901.512586			
104	89	31.0249239	1932.502536			
105	90	31.0931477	1963.561742			
106	91	31.1593552	1994.68816			
107	92	31.2236059	2025.879802			
108	93	31.2859578	2057.13474			
109	94	31.3464669	2088.451104			
110	95	31.4051876	2119.827079			
111	96	31.4621729	2151.260902			
112	97	31.5174741	2182.750865			
113	98	31.5711408	2214.295307			
114	99	31.6232214	2245.892619			
115	100	31.6737629	2277.541238			
116	101	31.7228106	2309.239647			
117	102	31.7704087	2340.986377			
118	103	31.8166001	2372.779997			
119	104	31.8614263	2404.619123			
120	105	31.9049277	2436.502409			
121	106	31.9471435	2468.42855			
122	107	31.9881116	2500.396281			
123	108	32.0278689	2532.404371			
124	109	32.0664512	2564.451628			
125	110	32.1038932	2596.536894			
126	111	32.1402286	2628.659046			
127	112	32.1754902	2660.816994			
128	113	32.2097096	2693.00968			
129	114	32.2429177	2725.236077			
130	115	32.2751443	2757.495189			
131	116	32.3064185	2789.786049			
132	117	32.3367685	2822.107718			
133	118	32.3662214	2854.459287			
134	119	32.3948039	2886.839871			
135	120	32.4225416	2919.248614			

Task a, b, and c)



	A	B	C	D	E	F	G	H	I	J	K
1	Designing an acceleration ramp for a highway										
2											
3	Programmed by Armin Zolfaghari					Date:	4/1/2021 21:55		Formula to calculate velocity		
4	**Please select the desired vehicle type from the related cell.**								Formula to calculate travelle		
5											
6	Inputs:	Value:	Unit:	Adjustments:							
7	V0	0	m/s								
8	K1	1	m/s2								
9	K2	0.03	1/s								
10	t_initial	0	seconds								
11	t_final	73	seconds								
12	Time step	1	seconds								
13	iteration	73									
14	Vehicle Type	Heavy Truck									
15	Speed to the Highway	6	m/s								
16	Time	Velocity(m/s)	Distance(meter)	Traveled distance to reach "Speed to the highway"							
17	0	0	0	20.50109813							
18	1	0.985148586	0.495047135								
19	2	1.94118164	1.960612006								
20	3	2.868959655	4.368011489								
21	4	3.769317695	7.689410171								
22	5	4.643066141	11.8977953								
23	6	5.490991426	16.96695248								
24	7	6.313856738	22.87144205								
25	8	7.112402713	29.58657623								
26	9	7.887348095	37.08839684								
27	10	8.639390386	45.3536538								
28	11	9.369206475	54.35978415								
29	12	10.07745325	64.0848918								
30	13	10.76476817	74.50772775								
31	14	11.43176987	85.60767102								
32	15	12.0790587	97.36471008								
33	16	12.70721726	109.7594248								
34	17	13.31681093	122.7729691								
35	18	13.90838839	136.3870536								
36	19	14.4824821	150.5839299								
37	20	15.03960878	165.3463738								
38	21	15.58026989	180.6576703								
39	22	16.10495205	196.5015983								
40	23	16.61412752	212.8624162								
41	24	17.10825457	229.7248475								
42	25	17.58777798	247.0740675								
43	26	18.05312932	264.8956892								
44	27	18.50472747	283.1757512								
45	28	18.94297887	301.9007044								
46	29	19.36827799	321.0574004								
47	30	19.78100762	340.6330792								

Run

Problem 3

Task a)

Assignment5_Problem3.m

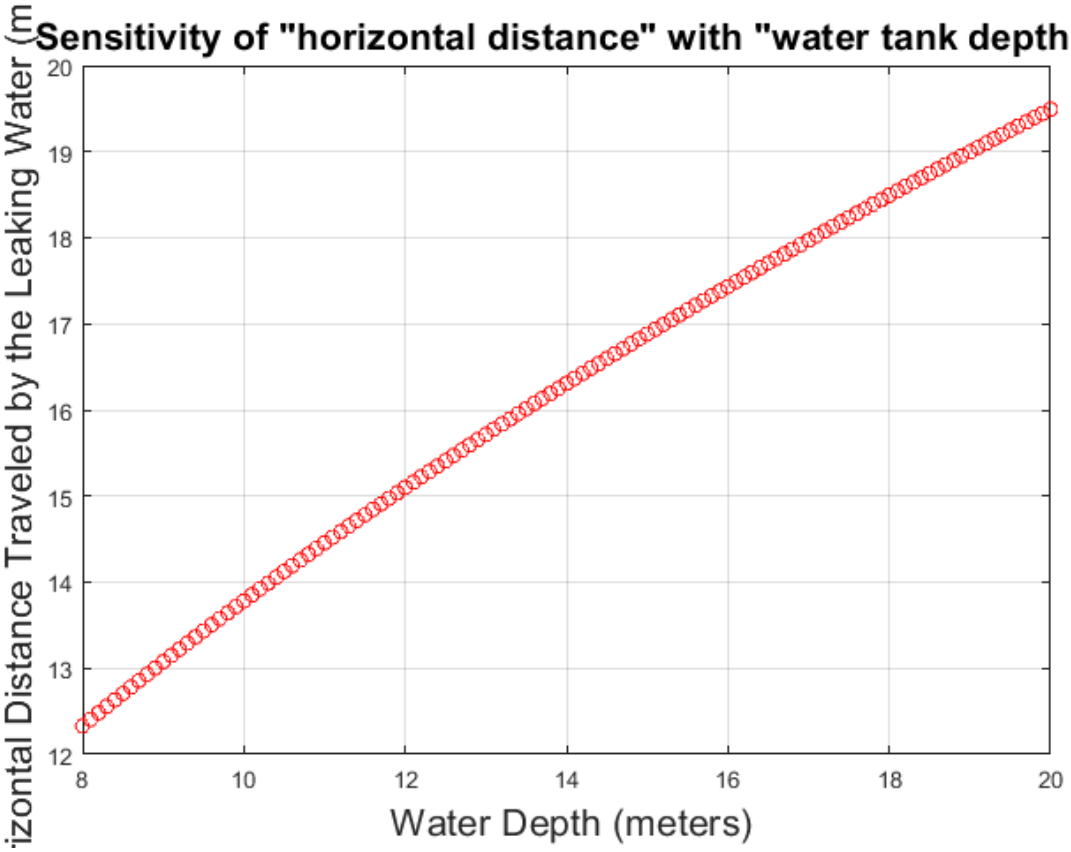
```
%Program to  to determine the reaction force (F) generated by a leaking tank
%Programmer: Armin Zolfaghari
%Date: 03/10/2021
close all
clc
clear
%%%Define parameters and necessary inputs:
g= 9.81; %gravity constant
h1= input('Enter water depth to the leaking point (meters):');
h2= input ('Enter distance from the bottom of the tank to the leaking point (meters):');
A= input ('Enter area of the leaking orifice (m2):');
contraction_coefficient= input( 'Select either "thin" or "thick":','s');
if contraction_coefficient== "thin"
   m= 0.62;
elseif contraction_coefficient== "thick"
    m= 0.97;
else disp('Check your input for contraction_coefficient')
end
 equivalent_friction= 0.97;
 specific_weight_water= 1000;
 %Calculate velocity of the leaking water flow (m/s)
 velocity= equivalent_friction*sqrt(2*g*h1);
 % Calculate horizontal distance traveled by the leaking water (meters)
 horizontal_distance= 2*sqrt(h1*h2);
 %Calculate volumetric flow rate (m3/s)
volumetric_flow_rate= equivalent_friction*m*A*sqrt(2*g*h1);
%Calculate reaction force acting on the tank (Newtons)
reaction_force= 2*specific_weight_water*g*A*h1;

%Display calculated values in command line

disp(['Calculated velocity of the leaking water flow is',' ',num2str(velocity),' ','(m/s)'])
disp(['Calculated horizontal distance traveled by the leaking water is',' ',num2str(horizontal_distance),' ','(meters)'])
disp(['Calculated volumetric flow rate is',' ',num2str(volumetric_flow_rate),' ', '(m3/s)'])
disp(['Calculated reaction force acting on the tank is',' ' ,num2str(reaction_force),' ','(Newtons)'])
%Plot
figure
plot(h1, horizontal_distance,'or')
xlabel(' Water Depth (meters)','fontsize',16)
ylabel(' Horizontal Distance Traveled by the Leaking Water (meters)','fontsize',16)
title('Sensitivity of "horizontal distance" with "water tank depth".','fontsize',16)
grid
```

Task b)

Command Window

```
Enter water depth to the leaking point (meters):8:0.1:20
Enter distance from the bottom of the tank to the leaking point (meters):4.75
Enter area of the leaking orifice (m2):0.05
Select either "thin" or "thick":thin
Calculated velocity of the leaking water flow is 12.1525      12.2282      12.3035      12.3783      12.4526      12.5265      12.
Calculated horizontal distance traveled by the leaking water is 12.3288      12.4056      12.482      12.5579      12.6333      12.7
Calculated volumetric flow rate is 0.37673     0.37908     0.38141     0.38373     0.38603     0.38832      0.3906     0.39286     0.
Calculated reaction force acting on the tank is 7848          7946.1          8044.2          8142.3          8240.4          8338.5
>>
```

Task c)


Sensitivity of "horizontal distance" with "water tank depth
izontal Distance Traveled by the Leaking Water (m
20
19
18
17
16
15
14
13
12
8
10
12
14
16
18
20
Water Depth (meters)