# Assignment 5: VBA Programming

# Solution

Date Due: March 5, 2015

## Problem 1

a) VBA Program & Excel interface

Sub TransportRate() This subrutine estimates the transport rate of sediment for beaches exposed 'to waves. ' Programmer: Moises Bobadilla ' Date: March/03/2015 ' 'Inputs: 'K = coastal coefficient [dim] 'gamma = wave height to water depth at breaking ratio [dim] 'g = gravity constant [m/s^2] 'Hb = significant wave height [m] 'alpha = angle between waves and beach [degrees]	'Data validation ' A message box is output if the K value the user inputs is either below '0.03 or greater than 0.32. Also, another if-statements check wheter the 'variable alpha is out of range (0 - 90 degrees). If (K < 0.03) Then MsgBox ("K value out of range. Valid K range [0.03-0.32]") Q = "Out of Range" Range("C17").Select ActiveCell.Value = Q
ap = ratio of solid to total vol. of sediment [dim]	Elself (K $> 0.32$ ) Then
' 'Output:	MsgBox ("K value out of range. Valid K range [0.03-0.32]")
'Q = longshore transport rate [m^3/s]	Q = "Out of Range"
Sheets("Problem 1").Select	Range("C17").Select ActiveCell.Value = Q
'Variable Assignment	Elself (alphaDeg < 0) Then MsgBox ("Alpha value out of range. Valid alpha range [0-90 degrees]")
Range("C7").Select g = ActiveCell.Value	Q = "Out of Range"
	Range("C17").Select
Range("C8").Select gamma = ActiveCell.Value	ActiveCell.Value = Q
Range("C9").Select	Elself (alphaDeg > 90) Then
Hb = ActiveCell.Value	MsgBox ("Alpha value out of range. Valid alpha range [0-90 degrees]")
Range("I10").Select	Q = "Out of Range" Range("C17").Select
alpha = ActiveCell.Value	ActiveCell.Value = Q
Range("C10").Select	'If none of the data ranges were violated, then the following calculation is made
alphaDeg = ActiveCell.Value	' and the output is shown in the selected cell.
Range("C11").Select	Else
s = ActiveCell.Value	$Q = K * (g / gamma) \land 0.5 * (((Hb) \land 2.5) * (Sin(2 * alpha))) / (16 * (s - 1) * ap)$
Range("C12").Select	Range("C17").Select ActiveCell.Value = 0
ap = ActiveCell.Value	End If
Range("C13").Select	
K = ActiveCell.Value	
	End Sub

	С	D	E	F	G	Н		J
6	Inputs							
7	9.81	[m/s^2]	<u>к (</u>	Coastal Coeff) S	elector	Execute		
8	0.9	[unitless]		0.1 🛟		Execute		
9	3	[meters]				L		
10	45	[degrees]	A	pha (angle) Sel	lector	alpha	0.7854	[radians]
11	2.6	[dim]						
12	0.6	[dim]		-				
13	0.1	[dim]	0°	45°	90°			
14								
15				$\left[ q H \right]^{2.5}$	$\sin 2\alpha$			
16	Output		Q	$k = K \sqrt{\frac{g}{\gamma}} \frac{H_b^{2.5}}{16*(s)}$	$(s-1)a^*$			
17	0.335062	m^3/s		1,10.(	5 - 1 /4			

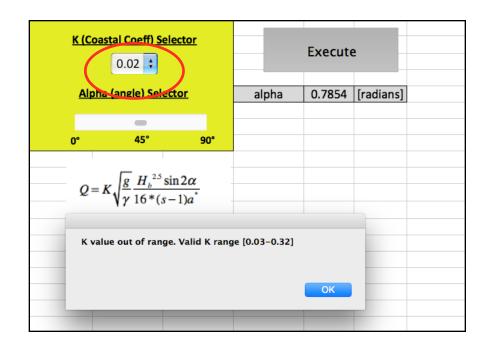
Instructor: Trani

### b) Data Validation

_	
1	A message box is output if the K value the user inputs is either below 0.03 or greater than 0.32. Also, another if-statements check wheter the variable alpha is out of range (0 – 90 degrees). f (K < 0.03) Then MsgBox ("K value out of range. Valid K range [0.03-0.32]")
	Q = "Out of Range" Range("C17").Select ActiveCell.Value = Q
E	Elself (K > 0.32) Then MsgBox ("K value out of range. Valid K range [0.03-0.32]") Q = "Out of Range" Range("C17").Select ActiveCell.Value = Q
E	ilself (alphaDeg < 0) Then MsgBox ("Alpha value out of range. Valid alpha range [0-90 degrees]") Q = "Out of Range" Range("C17").Select ActiveCell.Value = Q
E	ilself (alphaDeg > 90) Then MsgBox ("Alpha value out of range. Valid alpha range [0-90 degrees]") Q = "Out of Range" Range("C17").Select ActiveCell.Value = Q
	If none of the data ranges were violated, then the following calculation is made and the output is shown in the selected cell. Ise
	Q = K * (g / gamma) ^ 0.5 * (((Hb) ^ 2.5) * (Sin(2 * alpha))) / (16 * (s - 1) * ap) Range("C17").Select ActiveCell.Value = Q End If

This part of the code checks for both alpha and K, and warns the user in case the established valid range of values is violated.

Note: Can also use the Data Validation built in in Excel



## Problem 2

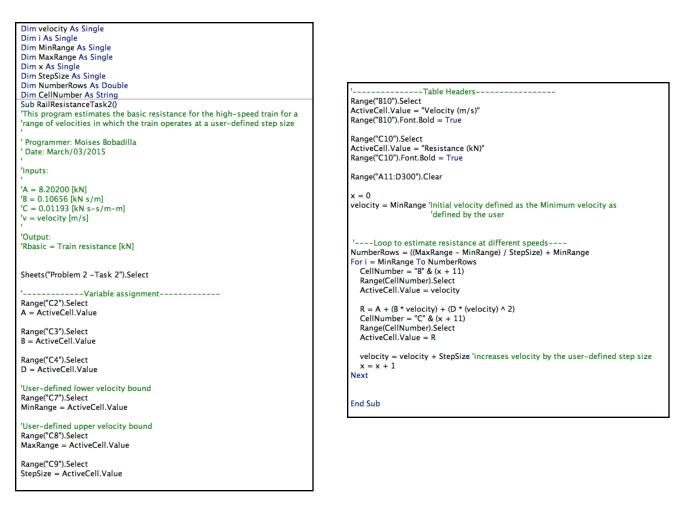
a) VBA Code & Interface

Image("C10").Select A a Single Dim As Single Dim CellNumber As String Sub RaiResistance0 This program estimates the basic resistance for the high-speed train for a 'range of velocities in which the train operates ' ' Pogrammer: Moises Bobadilla ' Date: March/03/2015 ' a - 8.20200 [kN] ''s = 0.10556 [kN s/m] 'C = 0.01193 [kN s-s/m-m] 'v = velocity [m/s] 'Output: 'Bobis (kN s/m] 'Culturi: 'Bobis (kN s/m] 'Culturi: 'Sheets('Problem 2'').Select 'Opens spreadsheet to read/write 'Variable assignmentRange('C2'').Select A = A.ttiveCell.Value Range('C4'').Select ActiveCell.Value Range('C4'').Select ActiveCell.Value Range('C4'').Select Dim Velocity and the train operates ' 'Pogrammer: Moises Bobadilla 'Date: March/03/2015 'Loop to estimate resistance at different speeds velocity = 0 For i = 0 To 85 CellNumber - String CellNumber - String 'Loop to estimate resistance at different speeds velocity = 0 For i = 0 To 85 CellNumber).Select ActiveCell.Value Range('C4'').Select B - ActiveCell.Value Range('C4'').Select B - ActiveCell.Value Range('C4'').Select D - ActiveCell.Value <pr< th=""><th></th><th></th></pr<>		
Dim A As Single Dim A As Single Dim As Single Dim As Single Dim Valotity Imvisity ' 'noputs: ' 'noputs: <td></td> <td></td>		
Dim B As Single Dim R As Single Dim K As Single Dim K As Single 		'Table Headers
Dim DAS Single         Dim As Single         Dintis Single <t< td=""><td></td><td></td></t<>		
Dim values as Single         Dim values as Single         Dim values as Single         Dim values as Single         Dim dellumber As Single         Dim dellumber As Single         Dim values as Single         Sub RailResistance0         This program estimates the basic resistance for the high-speed train for a 'range of values' may be assigned to the train operates ''         ' Programmer: Moises Bobadilla         'Date: March/03/2015         'Inputs:         'A = 8.20200 [kN]         'Sub Solution (m/s)         'Loop to estimate resistance at different speeds         'velocity [m/s]         'uLoop to estimate resistance at different speeds         'velocity [m/s]         'u - velocity [m/s]         's Sheets("Problem 2").Select 'Opens spreadsheet to read/write         'a - ActiveCell.Value         'a - ActiveCell.Value	Dim D As Single	
Dim i As Single         Programmer: Moises Bobadilla         'Date: March/03/2015         'Inputs:         '         '         'A = 8.20200 [kN]         'B = 0.10656 [kN s/m]         'C = 0.01193 [kN s-s/m-m]         'v = velocity [m/s]         '         'Output:         'Range("C1").Select 'Opens spreadsheet to read/write         '		
Dim CellNumber As StringSub RailResistance0This program estimates the basic resistance for the high-speed train for a 'range of velocities in which the train operates'Programmer: Moises Bobadilla 'Date: March/03/2015'' <t< td=""><td></td><td>Range("B10").Font.Bold = True</td></t<>		Range("B10").Font.Bold = True
Sub RailResistance0       Inside ("C10"). Jetted: "Range (kN)"         This program estimates the basic resistance for the high-speed train for a 'range of velocities in which the train operates ''       Active Cell. Value = "Range (kN)"         '' Programmer: Moises Bobadilla       ''         'Date: March/03/2015       ''         ''nuts:       ''         ''nuts:       ''         '' No Cost (kN)       ''         ''B = 0.10656 [kN s/m]       ''         'C = 0.01193 [kN s-s/m-m]       ''         '' v = velocity [m/s]       ''         '' Output:       ''         ''Rabasic = Train resistance [kN]       CellNumber = "B" & (i + 11)         Sheets("Problem 2").Select 'Opens spreadsheet to read/write       Range("C2").Select         ''		
This program estimates the basic resistance for the high-speed train for a 'range of velocities in which the train operates       ActiveCell.Value = Range (KN)'         '' Programmer: Moises Bobadilla      Loop to estimate resistance at different speeds         '' A = 8.20200 [kN]       'Loop to estimate resistance at different speeds         'A = 8.20200 [kN]       'Loop to estimate resistance at different speeds         'A = 8.20200 [kN]       'Loop to estimate resistance at different speeds         'A = 8.20200 [kN]       'Loop to estimate resistance at different speeds         'A = 8.20200 [kN]       'Loop to estimate resistance at different speeds         'A = 8.20200 [kN]       'Loop to estimate resistance at different speeds         'Y = velocity [m/s]       'Loop to estimate resistance at different speeds         'Output:       'Range(CellNumber).Select       ActiveCell.Value = i         ''Output:       Re A + (B * velocity) + (D * (velocity) ^ 2)       velocity = velocity = velocity = 1         'Sheets("Problem 2").Select 'Opens spreadsheet to read/write       ''		Range("C10").Select
'range of velocities in which the train operates         'range of velocities in which the train operates         'Programmer: Moises Bobadilla         'Date: March/03/2015         'Inputs:         ''Inputs:         ''A = 8.20200 [kN]         'B = 0.10656 [kN s/m]         'C = 0.01193 [kN s-s/m-m]         'v = velocity [m/s]         'Output:         ''Rabsic = Train resistance [kN]         'Sheets("Problem 2").Select 'Opens spreadsheet to read/write         ''Variable assignmentRange("C2").Select         A = ActiveCell.Value         B = ActiveCell.Value         B = ActiveCell.Value         Range("C3").Select         B = ActiveCell.Value         B = ActiveCell.Value         B = ActiveCell.Value         B = ActiveCell.Value         Range("C4").Select		
<ul> <li><sup>1</sup> Programmer: Moises Bobadilla</li> <li><sup>1</sup> Date: March/03/2015</li> <li><sup>1</sup> Inputs:</li> <li><sup>1</sup> A = 8.20200 [kN]</li> <li><sup>1</sup> A = 8.2020 [kN]</li> <li><sup>1</sup> A = 8.2020 [kN]<td></td><td>Range("C10").Font.Bold = True</td></li></ul>		Range("C10").Font.Bold = True
<ul> <li>'Date: March/03/2015</li> <li>'Inputs:</li> <li>'Inputs:</li> <li>'A = 8.20200 [kN]</li> <li>'B = 0.10656 [kN s/m]</li> <li>'C = 0.01193 [kN s-s/m-m]</li> <li>'v = velocity [m/s]</li> <li>'Output:</li> <li>'Rbasic = Train resistance [kN]</li> <li>Sheets("Problem 2").Select 'Opens spreadsheet to read/write</li> <li>'</li></ul>	i	
<ul> <li>'Date: March/03/2015</li> <li>'Inputs:</li> <li>'Inputs:</li> <li>'A = 8.20200 [kN]</li> <li>'B = 0.10656 [kN s/m]</li> <li>'C = 0.01193 [kN s-s/m-m]</li> <li>'v = velocity [m/s]</li> <li>'Output:</li> <li>'Rbasic = Train resistance [kN]</li> <li>Sheets("Problem 2").Select 'Opens spreadsheet to read/write</li> <li>'</li></ul>	' Programmer: Moises Bobadilla	
<pre>velocity = 0 Velocity = 0 For i = 0 To 85 CellNumber = "B" &amp; (i + 11) Range(CellNumber).Select ActiveCell.Value = i R = A + (B * velocity) + (D * (velocity) ^ 2) velocity = velocity = 1 CellNumber = "C" &amp; (i + 11) Range(CellNumber).Select ActiveCell.Value Range("C2").Select A = ActiveCell.Value Range("C3").Select Range("C3").Select B = ActiveCell.Value Range("C4").Select </pre>		
<pre>velocity = 0 Velocity = 0 For i = 0 To 85 CellNumber = "B" &amp; (i + 11) Range(CellNumber).Select ActiveCell.Value = i R = A + (B * velocity) + (D * (velocity) ^ 2) velocity = velocity + 1 CellNumber = "C" &amp; (i + 11) Range(CellNumber).Select ActiveCell.Value Range("C2").Select A = ActiveCell.Value Range("C3").Select Range("C3").Select B = ActiveCell.Value Range("C4").Select </pre>	'	' oon to estimate resistance at different speeds
<pre>'A = 8.20200 [kN] 'B = 0.10656 [kN s/m] 'C = 0.01193 [kN s-s/m-m] 'Y = velocity [m/s] ' 'Output: 'Rbasic = Train resistance [kN] ' Sheets("Problem 2").Select 'Opens spreadsheet to read/write 'Variable assignment Range("C2").Select A = ActiveCell.Value Range("C3").Select B = ActiveCell.Value Range("C4").Select</pre>	'Inputs:	
'B = 0.10656 [kN s/m]         'C = 0.01193 [kN s-s/m-m]         'V = velocity [m/s]         'Output:         'Rbasic = Train resistance [kN]         'Sheets("Problem 2").Select 'Opens spreadsheet to read/write         'Variable assignment         Range("C2").Select         A = ActiveCell.Value         Range("C2").Select         B = ActiveCell.Value         Range("C3").Select         B = ActiveCell.Value         Range("C4").Select         B = ActiveCell.Value         Range("C4").Select		
'C = 0.01193 [kN s-s/m-m]       Range(CellNumber).Select         'v = velocity [m/s]       Range(CellNumber).Select         'Output:       R = A + (B * velocity) + (D * (velocity) ^ 2)         'Range("CellNumber 2").Select 'Opens spreadsheet to read/write       R = A + (B * velocity + 1         'sheets("Problem 2").Select 'Opens spreadsheet to read/write       CellNumber = "C" & (i + 11)         'sheets("Problem 2").Select 'Opens spreadsheet to read/write       Range('C2").Select         'sheets("Problem 2").Select       Next         Range("C3").Select       Next         Range("C4").Select       End Sub		
'v = velocity [m/s]       Range(CellNumber).Select         'Output:       ActiveCell.Value = i         ''Rbasic = Train resistance [kN]       R = A + (B * velocity) + (D * (velocity) ^ 2)         Sheets("Problem 2").Select 'Opens spreadsheet to read/write       R = A + (B * velocity) + (D * (velocity) ^ 2)         ''Variable assignment       Range("C2").Select         A = ActiveCell.Value       Range("C2").Select         B = ActiveCell.Value       Next         Range("C3").Select       End Sub		
'Output:       'ActiveCell.Value = i         'Output:       'Rest (% velocity) + (D * (velocity) ^ 2)         'Rbasic = Train resistance [kN]       Rest (% velocity) + (D * (velocity) ^ 2)         'Sheets("Problem 2").Select 'Opens spreadsheet to read/write       Rest (% velocity) + (D * (velocity) ^ 2)         'Variable assignmentRange("C2").Select       Rest (% velocity) + (D * (velocity) ^ 2)         'A = A + (B * velocity) + (D * (velocity) ^ 2)       velocity = velocity + 1         CellNumber = "C" & (i + 11)       Range(CellNumber).Select         'A = ActiveCell.Value       Next         Range("C3").Select       Next         B = ActiveCell.Value       End Sub		
'Rbasic = Train resistance [kN]       R = A + (B * velocity) + (D * (velocity) ^ 2)         Sheets("Problem 2").Select 'Opens spreadsheet to read/write       velocity = velocity + 1         'Variable assignment       CellNumber = "C" & (i + 11)         Range("C2").Select       A = ActiveCell.Value         Range("C3").Select       Next         Range("C4").Select       End Sub		ActiveCell.Value = i
Sheets("Problem 2").Select 'Opens spreadsheet to read/write       Image: Cellocity + 1         Sheets("Problem 2").Select 'Opens spreadsheet to read/write       Image: CellNumber = "C" & (i + 11)         Range("C2").Select       Range("C2").Select         A = ActiveCell.Value       Next         Range("C3").Select       Next         B = ActiveCell.Value       End Sub	'Output:	
Sheets("Problem 2").Select 'Opens spreadsheet to read/write       CellNumber = "C" & (i + 11)         'Variable assignment       Range('C2").Select         A = ActiveCell.Value       Next         Range("C3").Select       Next         B = ActiveCell.Value       End Sub	'Rbasic = Train resistance [kN]	$R = A + (B * velocity) + (D * (velocity) \land 2)$
Sheets("Problem 2").Select 'Opens spreadsheet to read/write       CellNumber = "C" & (i + 11)         'Variable assignment       Range('C2").Select         A = ActiveCell.Value       Next         Range("C3").Select       Next         B = ActiveCell.Value       End Sub		velocity = velocity + 1
Sneets( Problem 2 ).select Opens spreadsneet to read/write     Range(CellNumber).Select       'Variable assignmentRange("C2").Select     ActiveCell.Value = R       A = ActiveCell.Value     Next       Range("C3").Select     End Sub		
'Variable assignment     ActiveCell.Value = R       Range("C2").Select     Next       Range("C3").Select     End Sub	Sheets("Problem 2").Select 'Opens spreadsheet to read/write	
Range("C2").Select     Next       Range("C3").Select     End Sub	Variable assignment	
A = ActiveCell.Value     Next       Range("C3").Select     End Sub       Range("C4").Select     End Sub		Activecen.value = K
Range("C3").Select     End Sub       B = ActiveCell.Value     End Sub		Maria
B = ActiveCell.Value Range("C4").Select End Sub		Next
Range("C4").Select End Sub		
Range("C4").Select	B = ActiveCell.Value	
		End Sub
D = Activecent value		
	D = ActiveCen.value	

	В	C	D	E	F
1		Inputs			
2	Α	8.20200	[kN]		
3	В	0.10656	[kN s/m]		
4	С	0.01193	[kN s-s/m-m]		
5					
6	Train I	Resistance pro	ogram		
7	Program	mer: Moises I	Bobadilla		
8	Date	e: March/03/2	2015		
9					
10	Velocity (m/s	Range (kN)			
11	0	8.20199966			
12	1	8.32048988		Run	
13	2	8.46284008			
14	3	8.6290493			
15	4	8.81911945			
16	5	9.03304958			
17	6	9.27083969			
18	7	9.53248978			
19	8	9.81799984			
20	9	10.1273699			

b) Improved program with sliders, user-defined lower and upper bound for velocity and speed step size selector

#### 1. VBA Code



#### 2. Interface

	В	С	D	E	F	G	Н		J	K	L	M	N
1		Inputs											
2	A	9	[kN]										
3	В	0.12	[kN s/m]	<b>—</b>					A - Coefficient	Selector			Dummy
4	С	0.010	[kN s-s/m-m]							-			
5								6 kN			10 kN		
6	Velocity I	Range & Step	Selector						B - Coefficient	Selector			3
7	Min	40	m/s						-				2
8	Max	55	m/s					.10 s/m			.14 s/m		
9	Step	1.5	m/s						C - Coefficient	Selector			1
10	Velocity (m/s)							-					0
11		33.0400009				$\rightarrow$		.010			.013		
12		34.6884995						(s-s/m-m)			(s-s/m-m)		
13		36.3909988											
14		38.1474991							Run				
15		39.9580002							Kull				
16		41.8224983											
17		43.7410011											
18	50.5	45.713501											
19		47.7400017											
20		49.8204994											
21	55	51.9550018											
22													

## a.3. Sliders

There are many ways to do this. Because sliders only take integers, I linked the slider to a "Dummy" number and then used a formula to link this number to the the input area where it would use the correct value. Shown below:

		К	L	м	N	0	Format Control
	J	K	-	141	N	0	
							Size Protection Properties Control
	A - Coefficient	t Selector			Dummy		Current value: 3
6 kN		-	10 kN				
0	B - Coefficient	t Selector			3		Minimum value: 1
.10 s/m			.14 s/m		2		Maximum value: 5
	C - Coefficient	t Selector					Incremental change: 1
-				C			Page change: 10
.010 (s-s/m-m)			.0 (s-s/	fx =N6-	1	-	
(5 57)							Cell link: \$N\$6
	Run						

	В	С		$fx = (N7^*)$	0.01) + 0.1	G	Н	1	J	K	L	М	
1		Inputs											
2	А	9											
3	В	0.12	[kN s/m]	<u> </u>					A - Coefficien	t Selector			D
4	С	0.010	[kN s-s/n	n-m]						-			
5								6 kN			10 kN		
6	Velocity	Range & Ste							B - Coefficien	t Selector			
7	Min	40	fx fx	=(N10*0	.001)+0.01				-				
8	Max	55						.10 s/m			.14 s/m		
9	Step	1.5	m/s						C - Coefficien	t Selector			
10	Velocity (m/s)	Resistance (	(N)					-					
11	40	33.0400009				$\rightarrow$		.010			.013		
12	41.5	34.6884995						(s-s/m-m)			(s-s/m-m)		
13	43	36.3909988											
1.4	44.5	20 1474004											

- c) Test for various Shinkansen train sets
  - a. Shinkasen 200

b. Shinkasen 300

A B

Inputs									
A	9.21	[kN]							
В	0.12	[kN s/m]							
С	0.012	[kN s-s/m-m]							
Velocity Range & Step Selector									
Velocity	Range & Step	Selector							
Velocity Min	Range & Step 20	Selector m/s							
Min	20	m/s							
Min Max	20 21 1	m/s m/s m/s							

c. Shinkasen 500

Inputs									
A	8.10	[kN]							
В	0.11	[kN s/m]							
С	0.011	[kN s-s/m-m]							
Velocity	Range & Step	Selector							
Min	20	m/s							
Max	21	m/s							
Step	1	m/s							
Velocity (m/s) Resistance (kN)									
20	14.6000004								

Velocity Range & Step Selector								
Min	20	m/s						
Max	21	m/s						
Step	1	m/s						
Velocity (m/s)	Resistance (	(N)						
20	15.1199999							

Inputs 8.20

0.11

0.012

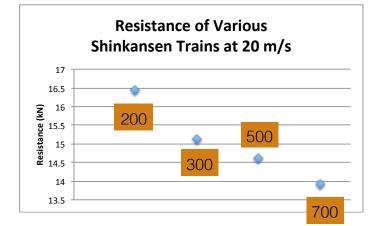
[kN]

[kN s/m]

[kN s-s/m-m]

c. Shinkasen 700

Inputs									
A	7.92	[kN]							
В	0.10	[kN s/m]							
С	0.010	[kN s-s/m-m]							
Velocity	Range & Step	Selector							
Min	20	m/s							
Max	21	m/s							
Step	1	m/s							
Velocity (m/s) Resistance (kN)									
20	13.9200001								



As it can be seen above, the train which shows the least resistance at a speed of 20 m/s is **Shinkansen 700**. From this information, it can be inferred that this train is also the fastest from the four in question. This information is confirmed in the Wikipedia article (Under 'Speed Records').

### Problem 3

a) (Tasks 1 & 2) VBA Code & Interface

Sub WaterTank()	'ComboBox linked to 18. IF thank is thin, this cell gets a value
This subrutine estimates the reaction force generated by a leaking tank	of 1, if thick it gets a value of 2. Later used in if-statement.
Programmer: Moises Bobadilla	Range("18").Select
Date: March/03/2015	ThinThick = ActiveCell.Value
'Inputs:	'Assignment of mu value
'h1 = water depth to the leaking point [meters]	If ThinThick = 1 Then
'h2 = distance from the bottom of the tank to the leaking point [meters]	mu = 0.62
'A = Area of leaking orifice [m^2] 'phi = equivalent friction paramter [dim]	Range("C12").Select
'gamma = Specific Weight of water, (1000 kg/m^3) [kg/m^3]	ActiveCell.Value = mu
mu = contraction coefficient [dim]	Elself ThinThick = 2 Then
'Outputs:	mu = 0.97
'v = velocity of leaking water flow [m/s]	Range("C12").Select
'd = horizontal distance traveled by the leaking water [meters]	ActiveCell.Value = mu
$'Q = volumetric flow rate [m^3/s]$	
'F = friction force acting on tank [N]	End If
	'Calculations
Sheets("Problem 3").Select	
	v = phi * ((2 * g * h1) ^ 0.5) Range("C16").Select
'Variable assignment	ActiveCell.Value = $v$
g = 9.81	ActiveCell.Value = V
Range("C7").Select	$D = 2 * ((h1 * h2) \land 0.5)$
h1 = ActiveCell.Value	Range("C17").Select
	ActiveCell.Value = D
Range("C8").Select	
h2 = ActiveCell.Value	$Q = phi * (mu * A * (2 * g * h1) ^ 0.5)$
	Range("C18").Select
Range("C9").Select	ActiveCell.Value = Q
A = ActiveCell.Value	5 2 + + - + A + h 1
	F = 2 * gamma * g * A * h1 Range("C19").Select
Range("C10").Select	ActiveCell.Value = $F$
phi = ActiveCell.Value	Activecen.value = r
Range("C11").Select	End Sub
gamma = ActiveCell.Value	End Sub

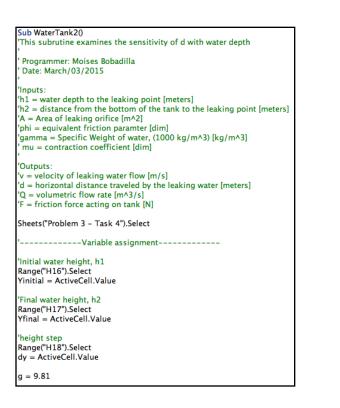
Type of tank			
Thin			
	Inputs		
h1	18	[meters]	
h2	1	[meters]	
A	0.1	[m^2]	
phi (Φ)	0.97	[dim]	
gamma (y)	1000	[kg/m^3]	
mu (μ)	0.62	[dim]	
Πα (μ)	0.02	[unit]	
	Outputs		
		[m/c]	
V		[m/s]	
d		[meters]	
Q		m^3/s	
F	35316	[N]	

b) (Task 3) Test program with following input: h1 = 18, h2 = 1.0, A=0.10, phi=0.97, gamma = 1000

Type of tank		
Thin	÷	
	Inputs	
h1		[meters]
h2		[meters]
A		[m^2]
phi (Φ)		[dim]
gamma (y)	1000	[kg/m^3]
mu (μ)	0.62	[dim]
	Outputs	
v 18.2287752		[m/s]
d		[meters]
Q	1.13018406	m^3/s
F	35316	[N]

c) (Task 4) Examine sensitivity of d with water tank depth

a. VBA Code





## b. Interface

	Α	B	C	D	E	F	G	Н		J
1										
2		Type of tank								
3		Thick								
4										
5										
6			Inputs							
7		h1	18	[meters]						
8		h2	1	[meters]				Du	n	
9		A	0.1	[m^2]				Run		
10		phi (Φ)	0.97	[dim]						
11		gamma (γ)	1000	[kg/m^3]						
12		mu (μ)	0.97	[dim]						
13										
14										
15		Outputs								
16		Height (m) Horiz. D (m)				Initial Depth			m	
17		5	4.47213595			Final Depth		18		
18		5.1	4.51663592			Height Increment		0.1	m	
19		5.2	4.5607017							
20		5.3								
21		5.4								
22		5.5	4.69041576							
23		5.6								
24		5.7								
25		5.8								
26		5.9								
27		6	4.89897949							
28		6.1								
29		6.2	4.97995984							

As it can be seen above, d is directly proportional to the height.