Building an Digital Clock in Excel ***– part #2 – a full digital clock model using the “digit” sprites*** *by George Lungu*

- In this tutorial we will learn how to use the digit sprites created before. This is very important since a lot of the models used in this blog are based on animation in general and on sprites in particular.

- We will start by building a 2-D scatter chart and showing how we can replace each individual point with a sprite. Combined with a little “count-up” macro we will prove animation functionality on the chart.

- In the second stage we will insert a new spreadsheet and write a macro which updates the value of cell A29 with the current time and the value of the cell A30 with the current date.

- After that we’ll extract the hours, minutes and seconds using special spreadsheet functions and use the numbers as reference to six tables, each containing information to run the six “digit” sprites groups on a common chart, hence finalizing the clock model.

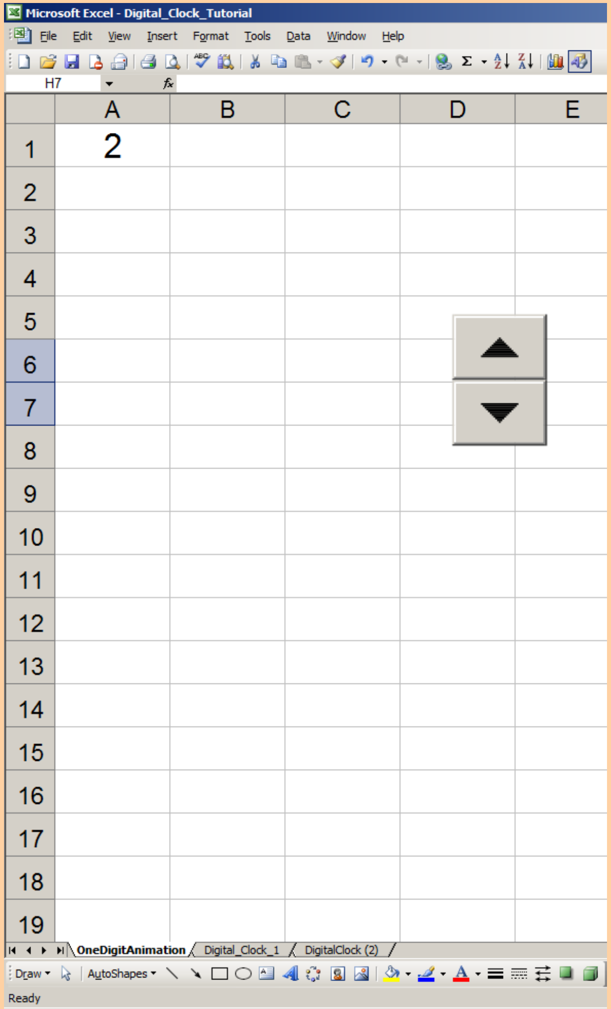
A basic sprite animation for a single digit display:

- Rename the “Sheet1” of the workbook “OneDigitAnimation”
- In the VBA editor section corresponding to “Sheet1” write the following macro:

```
Sub RunPause_Change()
    If RunPause > 9 Then RunPause = 0
    If RunPause < 0 Then RunPause = 9
    Range("A1") = RunPause.Value
End Sub
```

-This macro will run the integer number in cell A1 from 0 to 9 and it will “roll over” after reading 9 or 0.

- Create a spin-button with the range -1 to 10 and associate it to this macro.
- Verify the functionality of the button-macro pair.



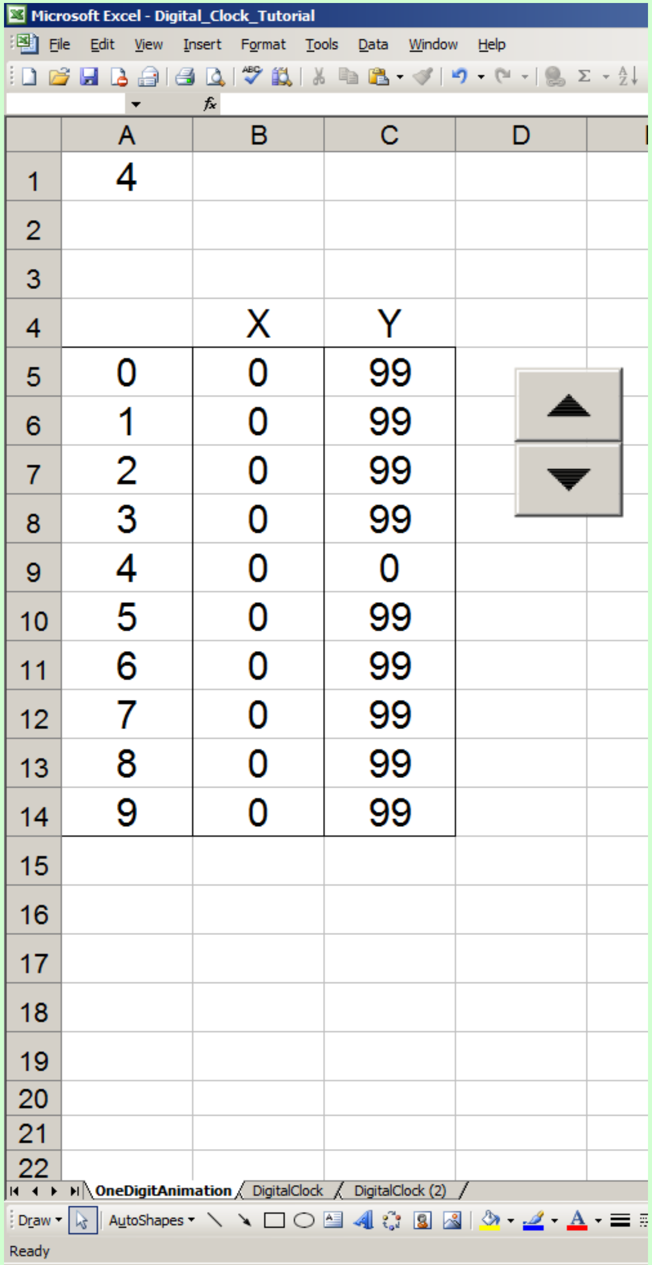
The “sprite” driver:

- Create a increasing series from 0 to 9 in the range: “A5:A14”

  -> A5: “=1”, A6: “=A5+1”, copy A6 down to A14
- Pad the range “B5:B14” with zeroes
- Insert the following formula in cell C5: “=IF(A$1=A5,0,99)”
- Copy down C5 to C14

- Keep clicking on the button and you can see that only one number on the Y column is zero at any time (the rest are 99). That number’s position is defined by the value in cell “A1”. This is an extremely important setup for sprite animation and it will be used a lot from now on.

- If we plot the X-Y information on a 2D scatter chart and attach a different sprite to each of the 10 points we could see how we can keep all the sprites except one out of view (coordinate 99 is arbitrarily chosen well beyond the scatter chart axis range). Of course, during the run, the handle (cell A1) can be changed many times which produces the effect of animation.



	A	B	C	D
1	4			
2				
3				
4		X	Y	
5	0	0	99	
6	1	0	99	
7	2	0	99	
8	3	0	99	
9	4	0	0	
10	5	0	99	
11	6	0	99	
12	7	0	99	
13	8	0	99	
14	9	0	99	
15				
16				
17				
18				
19				
20				
21				
22				

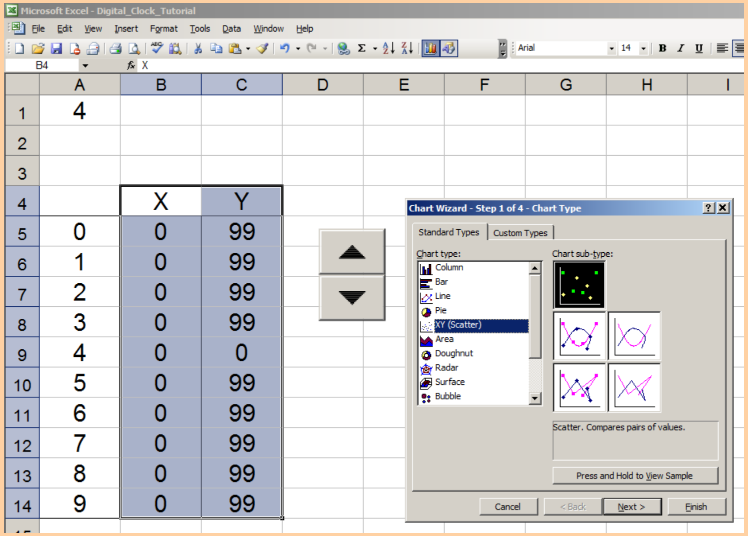
- Select range “B4:C14” and insert a scatter chart
- Adjust both axes to ranges between -5 and +5
- Delete gridlines, delete both axes and axes titles and shape the chart to a rough square
- Double click the plot area rectangle and change the color to a dark green or something dark that you like
- Copy the “digit” sprites you created from the previous tutorial and paste all ten of them in the worksheet

- Select sprite “0” -> Shift -> Edit -> Copy Picture - > As Shown On Screen -> OK

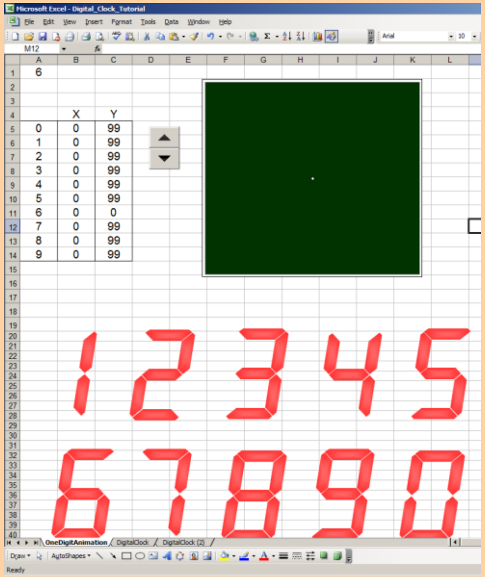
- Click the spin button until cell A1 = 0

- Click on the data point on the screen then wait 1-2 seconds then click again until the cursor looks like a cross

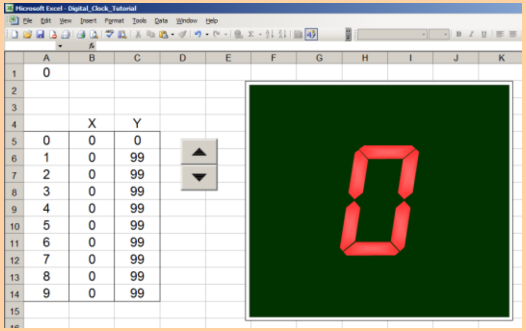
- Paste. After that we can see a “0” on the chart


Microsoft Excel - Digital_Clock_Tutorial
File Edit View Insert Format Tools Data Window Help
Arial 14
B4 fx X
Chart Wizard - Step 1 of 4 - Chart Type
Standard Types
Custom Types
Chart type:
Column
Bar
Line
Pie
XY (Scatter)
Area
Doughnut
Radar
Surface
Bubble
Chart sub-type:
Scatter. Compares pairs of values.
Press and Hold to View Sample
Cancel
< Back
Next >
Finish

	A	B	C
1	4		
2			
3			
4		X	Y
5	0	0	99
6	1	0	99
7	2	0	99
8	3	0	99
9	4	0	0
10	5	0	99
11	6	0	99
12	7	0	99
13	8	0	99
14	9	0	99

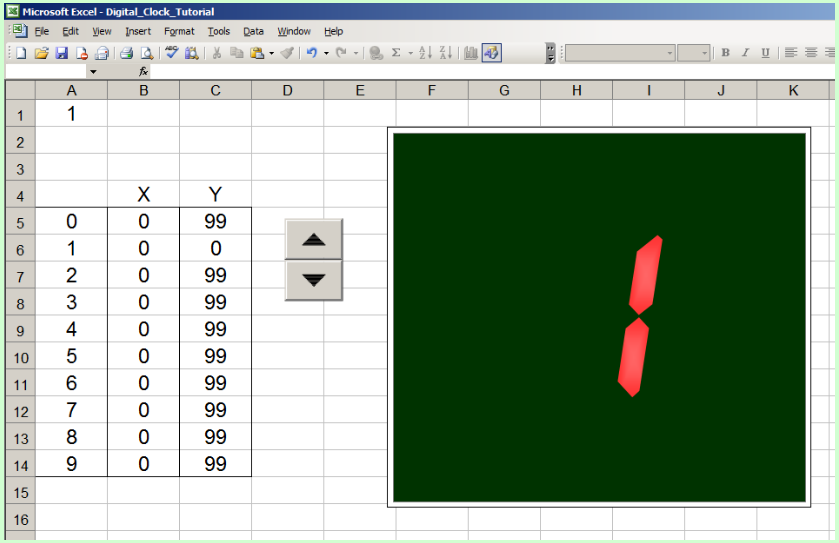


	A	B	C
1	6		
2			
3			
4		X	Y
5	0	0	99
6	1	0	99
7	2	0	99
8	3	0	99
9	4	0	99
10	5	0	99
11	6	0	0
12	7	0	99
13	8	0	99
14	9	0	99



	A	B	C
1	0		
2			
3			
4		X	Y
5	0	0	0
6	1	0	99
7	2	0	99
8	3	0	99
9	4	0	99
10	5	0	99
11	6	0	99
12	7	0	99
13	8	0	99
14	9	0	99

- Select sprite “1” -> Shift -> Edit -> Copy Picture
- > As Shown On Screen -> OK
- Click the spin button until cell A1 = 1
- Click on the data point on the screen then wait 1-2 seconds then click again until the cursor looks like a cross
- Paste. After that we can see a “1” on the chart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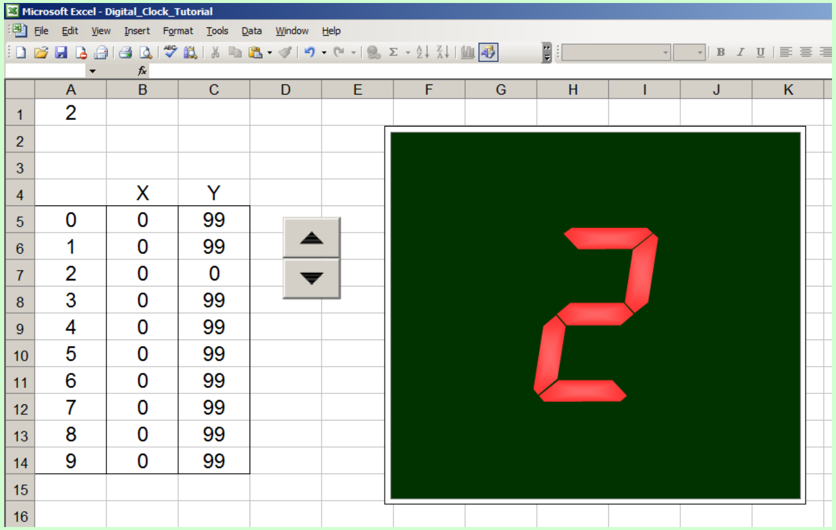
File Edit View Insert Format Tools Data Window Help
fx

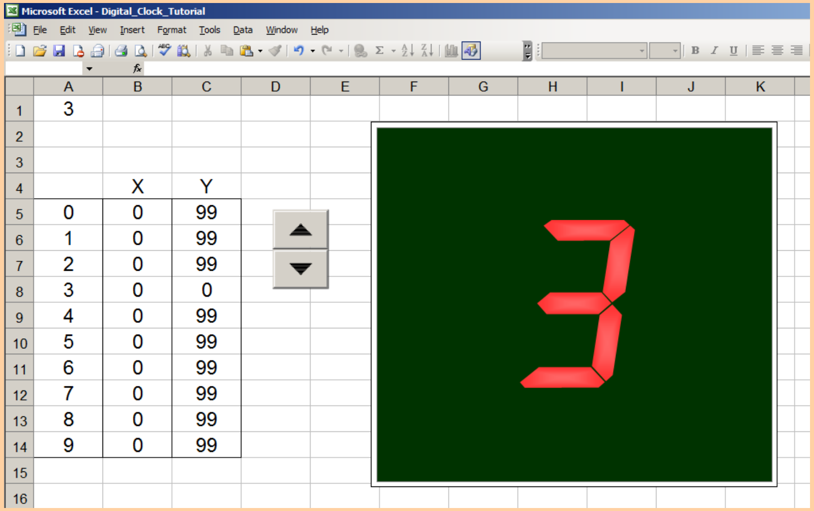
	A	B	C
1	1		
2			
3			
4		X	Y
5	0	0	99
6	1	0	0
7	2	0	99
8	3	0	99
9	4	0	99
10	5	0	99
11	6	0	99
12	7	0	99
13	8	0	99
14	9	0	99
15			
16			

- Select sprite “2” -> Shift -> Edit -> Copy Picture
- > As Shown On Screen -> OK
- Click the spin button until cell A1 = 2
- Click on the data point on the screen then wait 1-2 seconds then click again until the cursor looks like a cross
- Paste. After that we can see a “2” on the chart


Microsoft Excel - Digital_Clock_Tutorial
File Edit View Insert Format Tools Data Window Help
fx

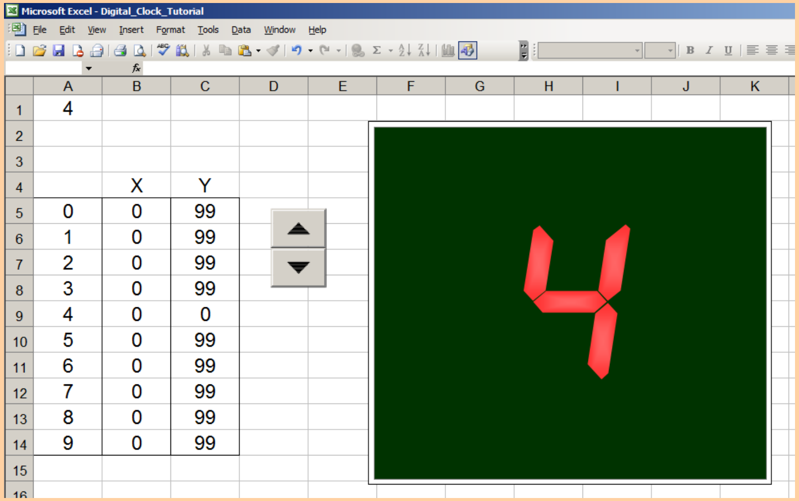
	A	B	C
1	2		
2			
3			
4		X	Y
5	0	0	99
6	1	0	99
7	2	0	0
8	3	0	99
9	4	0	99
10	5	0	99
11	6	0	99
12	7	0	99
13	8	0	99
14	9	0	99
15			
16			

- Select sprite “3” -> Shift -> Edit -> Copy Picture
- > As Shown On Screen -> OK
- Click the spin button until cell A1 = 3
- Click on the data point on the screen then wait 1-2 seconds then click again until the cursor looks like a cross
- Paste. After that we can see a “3” on the chart


Microsoft Excel - Digital_Clock_Tutorial
File Edit View Insert Format Tools Data Window Help

	A	B	C
1	3		
2			
3			
4		X	Y
5	0	0	99
6	1	0	99
7	2	0	99
8	3	0	0
9	4	0	99
10	5	0	99
11	6	0	99
12	7	0	99
13	8	0	99
14	9	0	99
15			
16			

- Select sprite “4” -> Shift -> Edit -> Copy Picture
- > As Shown On Screen -> OK
- Click the spin button until cell A1 = 4
- Click on the data point on the screen then wait 1-2 seconds then click again until the cursor looks like a cross
- Paste. After that we can see a “4” on the chart


Microsoft Excel - Digital_Clock_Tutorial
File Edit View Insert Format Tools Data Window Help

	A	B	C
1	4		
2			
3			
4		X	Y
5	0	0	99
6	1	0	99
7	2	0	99
8	3	0	99
9	4	0	0
10	5	0	99
11	6	0	99
12	7	0	99
13	8	0	99
14	9	0	99
15			

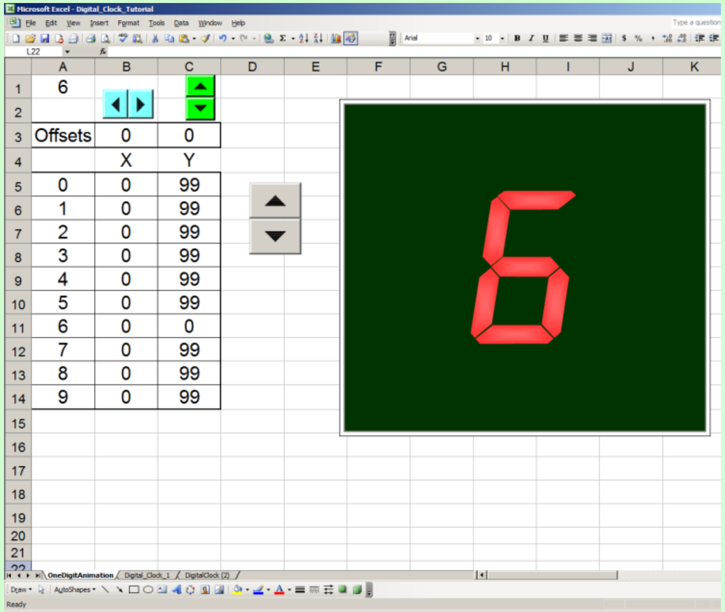
Continue the process until you finish with digit “9”, then you can check the functionality of the display by clicking extensively the spin button up and down.

Let’s introduce spatial offsets in the “sprite” driver table:

- Create two more spin buttons: View -> Toolbars -> Control Toolbox -> Click Design Mode -> Spin button (drag-create twice)
- Right click the left button: Properties -> (Name) = SpatialOffsetX, Max =20, Min=-20 -> OK
- Right click the right button: Properties -> (Name) = SpatialOffsetY, Max =20, Min=-20 -> OK
- B5: “=B$3”
- C5: “= IF(A$1=A5,0,99)+C$3”
- Copy down both B5 and C5 to row 14
- Write the following associated macros:

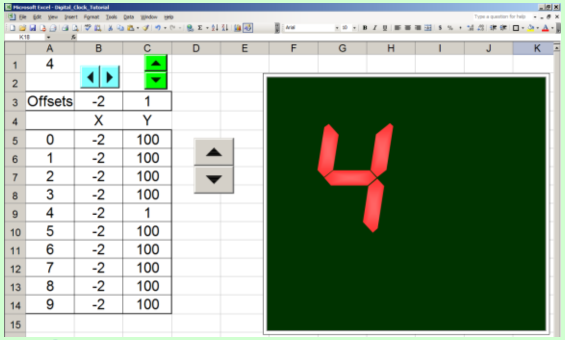
```
Private Sub SpatialOffsetX_Change()
    Range("B3") = SpatialOffsetX.Value / 10
End Sub

Private Sub SpatialOffsetY_Change()
    Range("C3") = SpatialOffsetY.Value / 10
End Sub
```

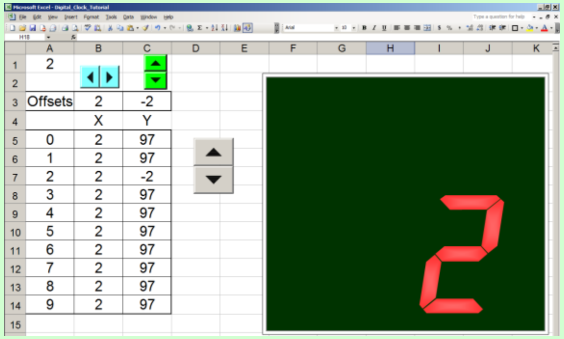

Microsoft Excel - Digital_Clock_Tutorial
File Edit View Insert Format Tools Data Window Help
OneDigitAnimation
Digital_Clock_1
DigitalClock (2)
Ready

	A	B	C
1	6		
2			
3	Offsets	0	0
4		X	Y
5	0	0	99
6	1	0	99
7	2	0	99
8	3	0	99
9	4	0	99
10	5	0	99
11	6	0	0
12	7	0	99
13	8	0	99
14	9	0	99

Verify the functionality of
the sprite offset buttons =>



	A	B	C
1	4		
2			
3	Offsets	-2	1
4		X	Y
5	0	-2	100
6	1	-2	100
7	2	-2	100
8	3	-2	100
9	4	-2	1
10	5	-2	100
11	6	-2	100
12	7	-2	100
13	8	-2	100
14	9	-2	100



	A	B	C
1	2		
2			
3	Offsets	2	-2
4		X	Y
5	0	2	97
6	1	2	97
7	2	2	-2
8	3	2	97
9	4	2	97
10	5	2	97
11	6	2	97
12	7	2	97
13	8	2	97
14	9	2	97

A parenthesis - how to extract various digits from a number:

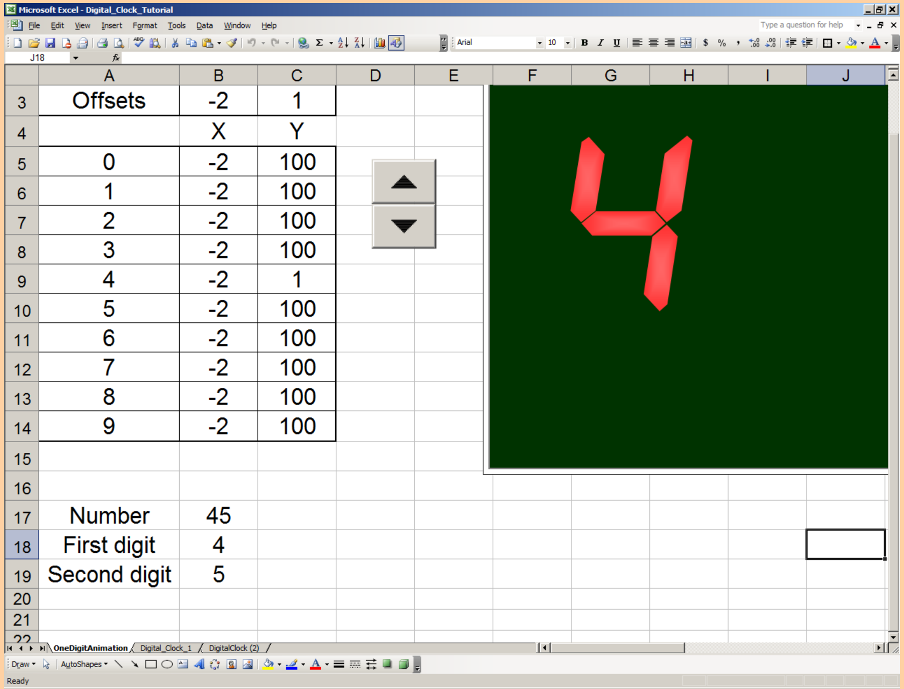
- If we have a 2-digit number let's say 47 (representing either hours or minutes or seconds) in a cell, what spreadsheet functions do we use to extract the first digit (4) and second digit (7) and place them in two different cells respectively?
- There are other ways to do it (I encourage you do it differently) but in this case I happened to just use these two functions: the "**Right()**" function and "**Trunc()**" function (you can do a search in the "Help" menu on them).
- The "Right()" is a text manipulation function so I found that I needed to multiply it by 1 in order to make it yield a number not text.

Let's implement this in the spreadsheet:

- Type the following labels in the range A17:A19: "Number", "First digit", "Second digit"

- B17: "=45" (or any 1 or 2-digit number), B18: "=TRUNC(B17/10)", B19: "=1*RIGHT(B17)"

- Verify the functionality of the formulas by typing various 1 or 2 digit numbers in cell B17



	A	B	C
3	Offsets	-2	1
4		X	Y
5	0	-2	100
6	1	-2	100
7	2	-2	100
8	3	-2	100
9	4	-2	1
10	5	-2	100
11	6	-2	100
12	7	-2	100
13	8	-2	100
14	9	-2	100
15			
16			
17	Number	45	
18	First digit	4	
19	Second digit	5	

Getting time and date recorded on the spreadsheet:

The following macro is designed to be started or stopped by clicking the same button. For this purpose the Boolean variable "RunClk" was declared:

```
Dim RunClk As Boolean
---------------------------------------------------------
Sub RunPauseClk()

            RunClk = Not (RunClk)

            Do While RunClk = True
            DoEvents
            Range("A29") = TimeValue(Now)
            Range("A30") = Now()
            Loop
End Sub
```

This statement in the macro logically "flips" the "RunClk" variable and this has the effect of exiting the "Do" loop if the loop is active, or of starting it if the loop is inactive.

This is the conditional "Do" loop used to display the time in cell "A29" and the date in cell "A30".

Additional spreadsheet functions used:

- On our spreadsheet the macro will update the time in cell "A29" and date and time in cell "A30"
- We'll calculate the hours in cell "A33""

Cell A33: "=HOUR(A29)"

hour()	Extracts the number of hours from a date
minute()	Extracts the minutes from a date
second()	Extracts the seconds from a date

- The minutes and seconds will be calculated in cell "B33" and "C33" respectively:

Cell B33: "=MINUTE(A29)", Cell C33: "=SECOND(A29)"

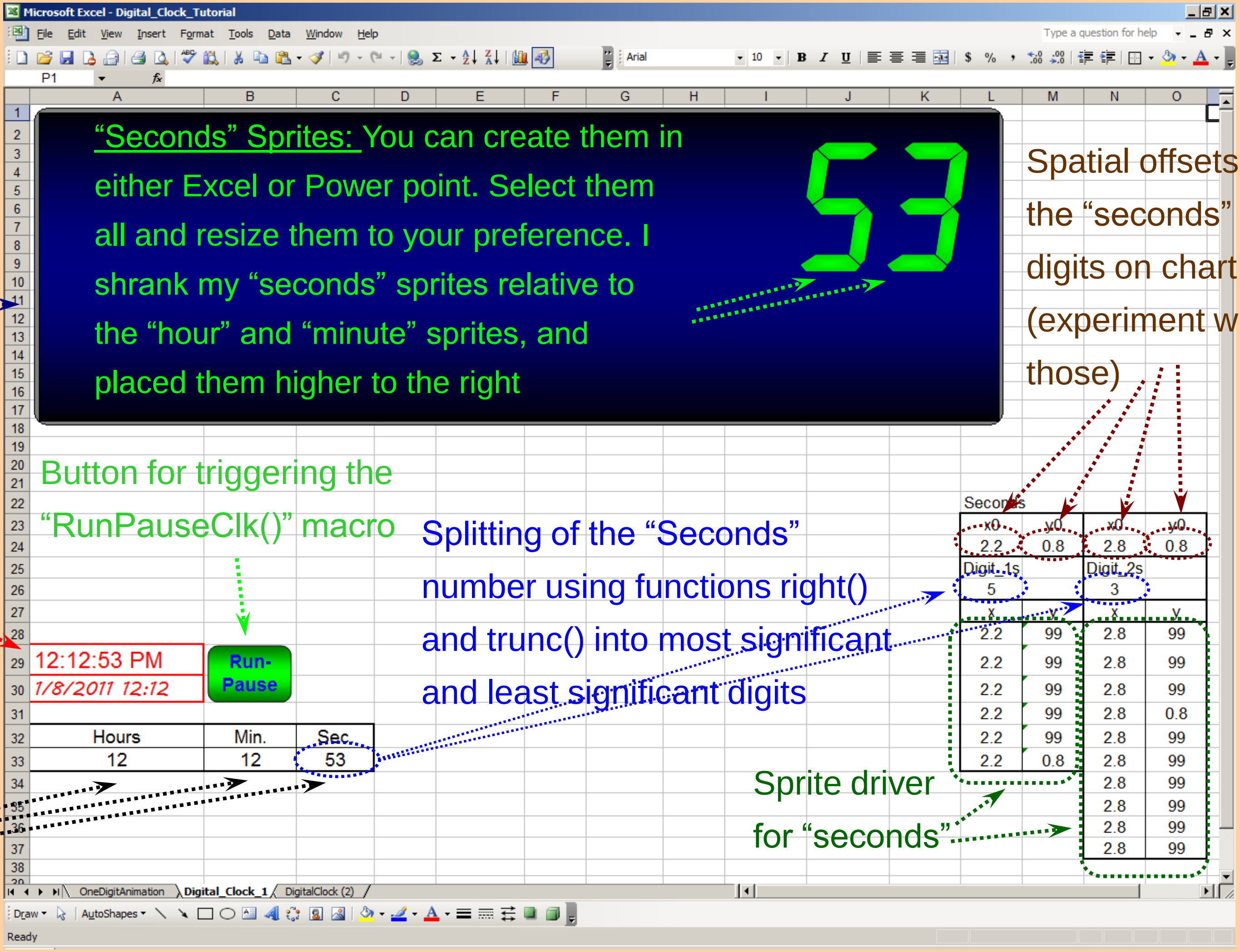
A tour of the digital clock spreadsheet

The picture below contains the “seconds” part of the implementation:

Clock Scatter Chart: set the Y axis range to [-2, 2] and the X axis range to [-3.3, 3.3] then delete both axes

Time inserted in the worksheet by the “RunPauseClk()” macro

Separation of the time figure (from cell A29) in : hours, minutes and seconds



“Seconds” Sprites: You can create them in either Excel or Power point. Select them all and resize them to your preference. I shrank my “seconds” sprites relative to the “hour” and “minute” sprites, and placed them higher to the right

Spatial offsets of the “seconds” digits on chart (experiment with those)

Button for triggering the “RunPauseClk()” macro

Splitting of the “Seconds” number using functions right() and trunc() into most significant and least significant digits

Sprite driver for “seconds”

12:12:53 PM
1/8/2011 12:12

Hours	Min.	Sec.
12	12	53

Seconds

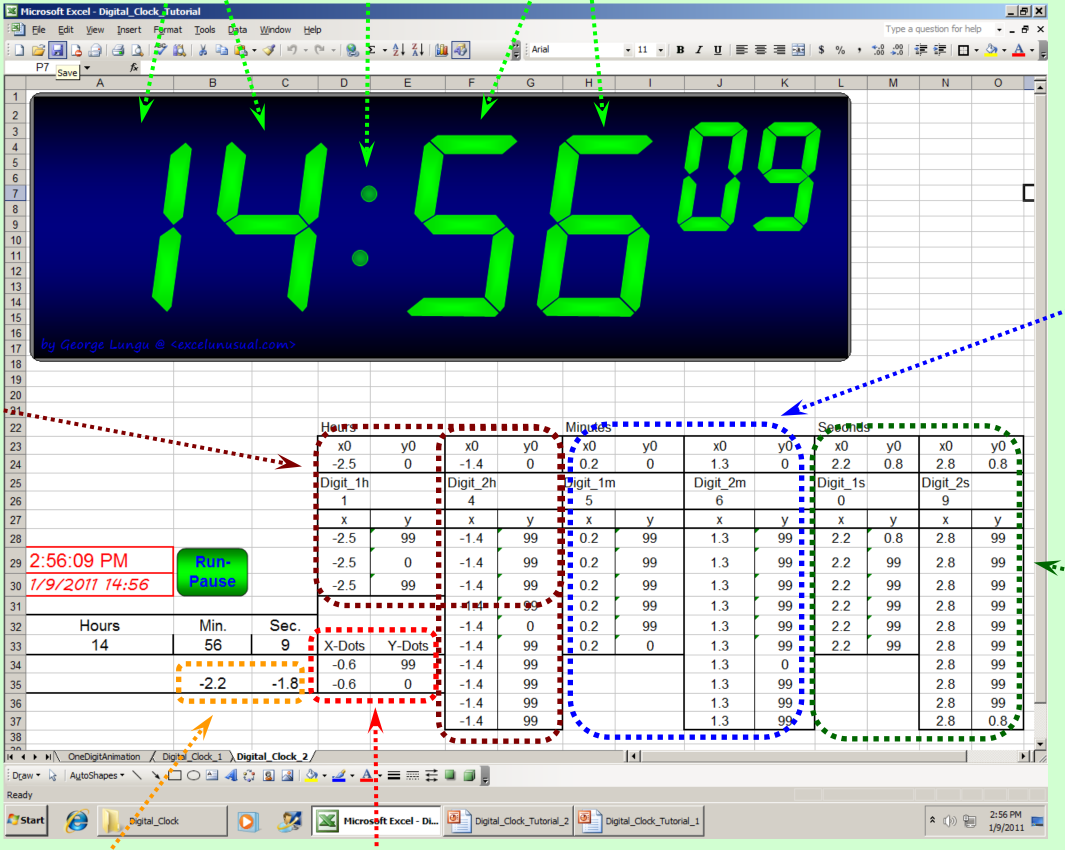
x0	y0	x0	y0
2.2	0.8	2.8	0.8
Digit_1s		Digit_2s	
5		3	
x	y	x	y
2.2	99	2.8	99
2.2	99	2.8	99
2.2	99	2.8	99
2.2	99	2.8	0.8
2.2	99	2.8	99
2.2	0.8	2.8	99
		2.8	99
		2.8	99
		2.8	99
		2.8	99

A tour of the final digital clock spreadsheet

Hours

Blinking Dots

Minutes



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
22				Hours				Minutes				Seconds			
23				x0	y0	x0	y0	x0	y0	x0	y0	x0	y0	x0	y0
24				-2.5	0	-1.4	0	0.2	0	1.3	0	2.2	0.8	2.8	0.8
25				Digit_1h		Digit_2h		Digit_1m		Digit_2m		Digit_1s		Digit_2s	
26				1		4		5		6		0		9	
27				x	y	x	y	x	y	x	y	x	y	x	y
28				-2.5	99	-1.4	99	0.2	99	1.3	99	2.2	0.8	2.8	99
29	2:56:09 PM	Run-Pause		-2.5	0	-1.4	99	0.2	99	1.3	99	2.2	99	2.8	99
30	1/9/2011 14:56			-2.5	99	-1.4	99	0.2	99	1.3	99	2.2	99	2.8	99
31						-1.4	99	0.2	99	1.3	99	2.2	99	2.8	99
32	Hours	Min.	Sec.			-1.4	0	0.2	99	1.3	99	2.2	99	2.8	99
33	14	56	9	X-Dots	Y-Dots	-1.4	99	0.2	0	1.3	99	2.2	99	2.8	99
34				-0.6	99	-1.4	99			1.3	0			2.8	99
35		-2.2	-1.8	-0.6	0	-1.4	99			1.3	99			2.8	99
36						-1.4	99			1.3	99			2.8	99
37						-1.4	99			1.3	99			2.8	0.8

Sprite driver for "hours"

Sprite driver for "minutes"

Sprite driver for "seconds"

Logo (name) sprite driver

Sprite driver for the two dots between hours and minutes - I created two different sprites for the dots, one with the same color scheme as the digits and one darker. I alternate them every second which gives the impression of blinking dots.

Conclusions:

- A simple method for creating a sprite driver was developed
- Using the sprites from the previous presentation and the sprite driver a one-digit display was generated
- A step-by-step means of inserting the sprite group on a scatter chart was demonstrated
- A macro for updating the time was written
- Spreadsheet functions for extracting the hours, minutes and seconds, as well as splitting those numbers into digits were presented
- Map-like explanation sheets for the full digital models were shown