

1-19-2015

## Enabling students to make investigations through spreadsheets

Erol -. KARAKIRIK -

*Abant Izzet Baysal University*, [karakirik@gmail.com](mailto:karakirik@gmail.com)

Follow this and additional works at: <http://epublications.bond.edu.au/ejsie>



This work is licensed under a [Creative Commons Attribution-Noncommercial-No Derivative Works 4.0 License](https://creativecommons.org/licenses/by-nc-nd/4.0/).

---

### Recommended Citation

KARAKIRIK, Erol -. - (2015) Enabling students to make investigations through spreadsheets, *Spreadsheets in Education (eJSiE)*: Vol. 8: Iss. 1, Article 2.

Available at: <http://epublications.bond.edu.au/ejsie/vol8/iss1/2>

This In the Classroom Article is brought to you by the Bond Business School at [ePublications@bond](mailto:epublications@bond.edu.au). It has been accepted for inclusion in Spreadsheets in Education (eJSiE) by an authorized administrator of [ePublications@bond](mailto:epublications@bond.edu.au). For more information, please contact [Bond University's Repository Coordinator](mailto:epublications@bond.edu.au).

---

# Enabling students to make investigations through spreadsheets

## Abstract

Spreadsheets are widely used in education to save time and simulate many scenarios in many different disciplines. However, they are not usually employed to provide rich interactions in the class although they provide huge computational powers and relate data in different places. It is argued in this paper that spreadsheets could also be used as an empowering tool for making inferences in the class by enabling students to investigate an open-ended problem, to make discussions about the problem and to share their results by turning a spreadsheet into an empowering tool. Constructivist approach requires students make conjectures and test them through cognitive tools provided such as Dynamic geometry environments. User could be required to investigate an open-ended problem by the help of available macros or templates provided by the instructor in a spreadsheet. It not only motivates the user to participate in the class but also make them think about the problem at hand. Our approach is exemplified through macros prepared for a math class and divisibility features of binomial coefficients were investigated through spreadsheets in this paper.

## Keywords

spreadsheet, mathematics, discussion, investigation, microworld

## Distribution License



This work is licensed under a [Creative Commons Attribution-Noncommercial-No Derivative Works 4.0 License](https://creativecommons.org/licenses/by-nc-nd/4.0/).

## Cover Page Footnote

-

# Enabling students to make investigations through spreadsheets

EROL KARAKIRIK

*Abant Izzet Baysal University, Bolu, TURKEY*

[karakirik@gmail.com](mailto:karakirik@gmail.com)

## **Enabling students to make investigations through spreadsheets**

**Abstract:** Spreadsheets are widely used in education to save time and simulate many scenarios in many different disciplines. However, they are not usually employed to provide rich interactions in the class although they provide huge computational powers and relate data in different places. It is argued in this paper that spreadsheets could also be used as an empowering tool for making inferences in the class by enabling students to investigate an open-ended problem, to make discussions about the problem and to share their results by turning a spreadsheet into an empowering tool. A constructivist approach requires students to make conjectures and test them through cognitive tools provided such as dynamic geometry environments. The user could be required to investigate an open-ended problem by the help of available macros or templates provided by the instructor in a spreadsheet. It not only motivates the user to participate in the class but also make them think about the problem at hand. Our approach is exemplified through macros prepared for a math class and divisibility features of binomial coefficients were investigated through spreadsheets in this paper.

**Keywords:** spreadsheets, mathematics, discussion, investigation, microworld

## Introduction

Devising new tools to solve problems or to change the way one solves a problem has been a significant feature of human beings throughout history. However, invention of new tools without exhausting the full potential of the existing ones is a common occurrence. It could be argued that one does not make use of full powers of calculators and computers in educational settings including spreadsheets. Spreadsheet calculations and their time saving nature steps forward rather than their usage as an empowering tool for making inferences in the classroom. It is generally accepted that students can support their ideas by numbers and graphs and keep records of daily activities through spreadsheets. However, not many people use spreadsheets in the classroom to enable students to come up with new inferences about a topic since spreadsheets are not usually planned to use to provoke new thoughts or to create a discussion environment. Ready-made simulations, exemplifying a certain mathematical concept or relation with dynamic data and requiring users to change certain parameters in a fixed scenario to test the validity of an Excel activity to reinforce a concept may remind us the structured instructions of behaviouristic times.

Use of spreadsheets as a problem solving tool or exemplifying how a method works is very common. However, changing only certain parameters to visualize a mathematical relationship or understanding of mathematical concept could be regarded as a form of passive participation without much interaction. Many students do not even bother to change the parameters of a spreadsheet and regard this kind of activity as the manifestation of a concept and demonstration of expertise of their teachers. In fact, one of the purposes of the educational computer application, LOGO, was explicitly planned to teach programming to students since it is regarded as laying the foundations of rational thinking. However, some early optimistic expectations did not eventuate though LOGO. This helped to change the way computers are used in the classroom [1]. LOGO experience confirmed the fact that it is not reasonable to expect students to write special programs to test their conjectures. Many subsequent software packages such as CAS systems (Mathematica, MatLab, Derive etc.) and Dynamic Geometry Environments (Sketchpad, Cabri, Geogebra etc.) provided huge computational powers to be used in math classes. They

provided a microworld where users make use of, get new insights and expand their mathematical knowledge since learning to use them required deep understanding and being familiar of many mathematical terms. However, one needed to invest a lot of time and energy into these programs since not many teachers even today were able to use them effectively in the classroom.

Given tasks [2] and what students do [3] in class mostly determines what students learn in the class. Hence, one needs to create meaningful mathematical tasks and activities that make students to think in math classes. It is argued that any sufficiently powerful computer tool could be turned into a microworld, a constructivist learning environment, through open-ended tasks. Means [4] regards spreadsheets as "general purpose tools". Spreadsheets, in this regard, could be regarded as another microworld where students make conjectures and inference about certain mathematical concepts by the help of the macros or activities prepared by the teacher. Students do not need to worry about any kind of programming or specific restrictions of a new environment or subtleties of a mathematical concept or method in a spreadsheet. However, they need to be able to make some meaningful deductions, generalizations and even find some results of their own by the help of the provided spreadsheets. This way they come to do mathematics through spreadsheets rather than learning to manipulate or operate a spreadsheet activity. Requiring students to solve an open-ended problem by the help of spreadsheet functions provided through macros may greatly change the perception of spreadsheet among educators. An example of usage of spreadsheets for investigating the binomial coefficients in a Pascal triangle was used to demonstrate our idea.

### **Pascal's Triangle**

Pascal's triangle is a triangular array of the binomial coefficients. It is named after the French mathematician Blaise Pascal who lived in 17<sup>th</sup> century, though many mathematicians uncovered it centuries before him.

We will firstly present the way we construct Pascal triangle and then discuss how it could be used in the class to create a discussion environment.

Coefficients of the first 20 rows a typical Pascal triangle are shown in Figure 1 which is produced in Excel by the help of a special macro

named *BinomCoefficients* which asks for the number of rows in an input box.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	1																			
2	1	1																		
3	1	2	1																	
4	1	3	3	1																
5	1	4	6	4	1															
6	1	5	10	10	5	1														
7	1	6	15	20	15	6	1													
8	1	7	21	35	35	21	7	1												
9	1	8	28	56	70	56	28	8	1											
10	1	9	36	84	126	126	84	36	9	1										
11	1	10	45	120	210	252	210	120	45	10	1									
12	1	11	55	165	330	462	462	330	165	55	11	1								
13	1	12	66	220	495	792	924	792	495	220	66	12	1							
14	1	13	78	286	715	1287	1716	1716	1287	715	286	78	13	1						
15	1	14	91	364	1001	2002	3003	3432	3003	2002	1001	364	91	14	1					
16	1	15	105	455	1365	3003	5005	6435	6435	5005	3003	1365	455	105	15	1				
17	1	16	120	560	1820	4368	8008	11440	12870	11440	8008	4368	1820	560	120	16	1			
18	1	17	136	680	2380	6188	12376	19448	24310	24310	19448	12376	6188	2380	680	136	17	1		
19	1	18	153	816	3060	8568	18564	31824	43758	48620	43758	31824	18564	8568	3060	816	153	18	1	
20	1	19	171	969	3876	11628	27132	50388	75582	92378	92378	75582	50388	27132	11628	3876	969	171	19	1

Figure 1: Coefficients of 20 rows in a Pascal triangle in Excel

The first and the last entries in each row are equal to 1 and other entries are computed as the sum of two entries in a previous row, which are directly the above entry and the entry left to it. For instance, in order to find the value of B3, one needs to compute B1+A1. B3= B1+A1=1+1=2. Similarly, to compute the value of F9, one needs to compute E8+F8. F9= E8+F8=35+21=56.

Entries in the Pascal triangle provides the binomial coefficients which are used to expand the  $(x + y)^n$  as

$$(x + y)^n = \sum_{k=0}^n \binom{n}{k} x^{n-k} y^k \quad \text{where} \quad \binom{n}{k} = \frac{n!}{(n-k)!k!} \quad (1)$$

There are n+1 coefficients in the equation and first coefficient is computed by taking k as equal to 0. For instance, the following coefficients are shown in the fourth row of a Pascal triangle.

$$(x + y)^3 = 1x^3 + 3x^2y + 3xy^2 + 1y^3$$

Similarly these coefficients could be computed as

$$\text{The first coefficient, } \binom{3}{0} = \frac{3!}{(3-0)!0!} = \frac{3!}{3!0!} = 1$$

$$\text{The second coefficient, } \binom{3}{1} = \frac{3!}{(3-1)!1!} = \frac{3!}{2!1!} = 3$$

The third coefficient,  $\binom{3}{2} = \frac{3!}{(3-2)!2!} = \frac{3!}{1!2!} = 3$

The fourth coefficient,  $\binom{3}{3} = \frac{3!}{(3-3)!3!} = \frac{3!}{0!3!} = 1$

Although above representation makes it easy to compute the subsequent entries of Pascal triangle in a spreadsheet, it is not visually satisfying to show that which entries are added together to find another entry. Typical Pascal triangle visually shows how the next entries are computed. Figure 2 shows a better visual of the first 20 rows a Pascal triangle which is produced the help of a special macro named *PascalBinom* which asks for the number of rows in an input box.

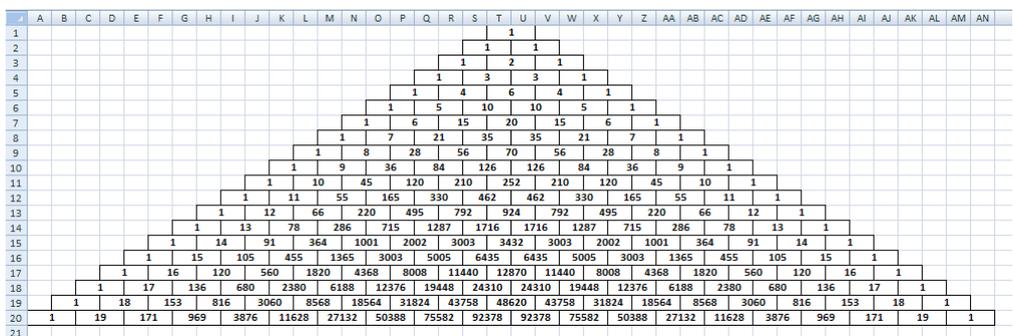


Figure 2: A Pascal triangle 20 rows in Excel

Some of the cells in this table are merged together in a way that shows how the value in that cell is computed, i.e., which cells affect the value of a specific cell. Furthermore, some of the entries are moved to the right to create a symmetric “triangle”. As it can be seen it is very easy to create a visually satisfying Pascal triangle in Excel. However, Excel is not designed for making huge mathematical computations as are Computer Algebra Systems (CAS). Since the coefficients of the Pascal triangle increments very rapidly and generate huge numbers that Excel cannot manipulate, Excel macros shows an overflow error or cannot display the computed number correctly using the approximate scientific notations. We have used two different versions of algorithms for implementation to get binomial coefficients.



Hence we added another macro making this process automatic through a macro called *PascalBinomRemainderColour*.

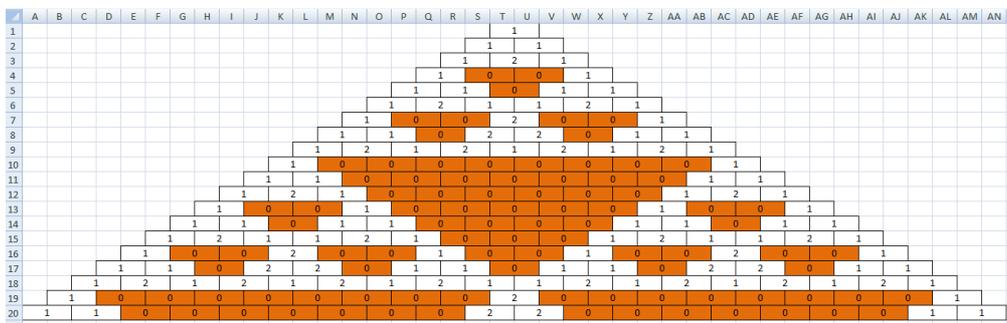


Figure 4: A Coloured Pascal triangle mod 3 of 20 rows in Excel

Now, we have outlined the macros we have developed for our activity. Let's see how it could be used in the class to make investigations about Pascal triangles.

**Aim of the activity:** *You are provided with the Excel macros to construct the coefficients of a Pascal triangle or the remainders of coefficients of Pascal triangle. Investigate the coefficients of Pascal triangles with respect to different divisors to find a pattern. You can use conditional formatting to give a visual meaning to the remainders. You could increase the number of rows of a Pascal triangle if you would like to get a better picture.*

This activity resembles the Bruner's [5] famous prime number activity. Students in that activity could choose different number of beans to group differently. Similarly, we do not want students to inspect any particular number of rows or divisor here. It is up to a student to decide which number of rows and divisor to investigate for instance whether to choose a prime number or not. In fact, any number promising to provide a clear triangle like above could be called a prime number. Students can easily make this inference after a few trials for different numbers.

When the number of rows is increased, the visual display of the results creates some problems since it does not fit into one page. Hence, students could be directed to decrease the width of the columns and the height of the rows. Our macros automatically set column widths and column heights to provide a better display. It is set to 0.5 and row height to 10pt for figures having 500 lines and set the page setup as landscape and 1x1 to be able to compare the figures we get.

Pascal triangles formed by the remainders of 3 are shown below with 20, 50 and 500 entries respectively in Figure 5 and Figure 6.

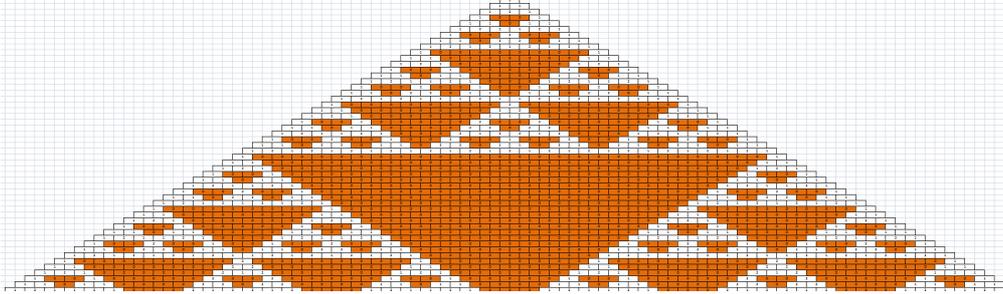


Figure 5: A Coloured Pascal triangle mod 3 of 50 rows in Excel

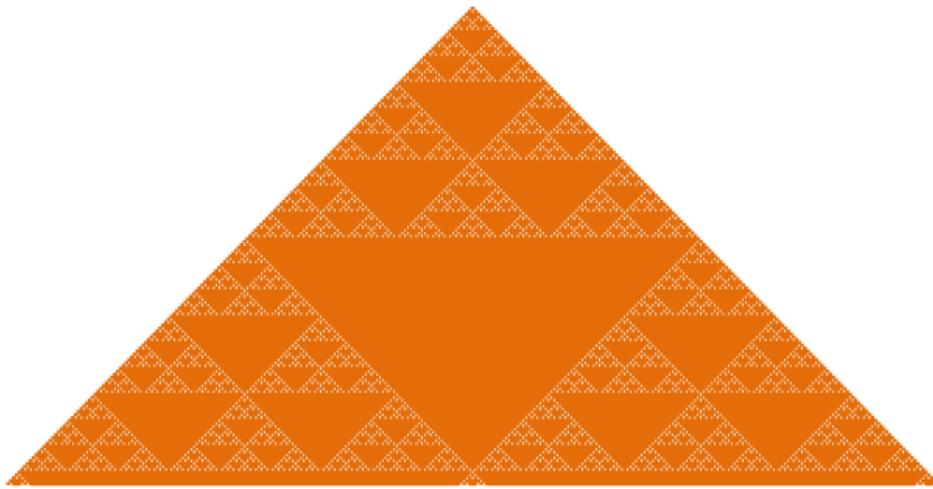


Figure 6: A Coloured Pascal triangle mod 3 of 100 rows in Excel

Similarly, Pascal triangles formed by the remainders of 17 are shown below with 20, 50 and 500 entries respectively in Figure 7, Figure 8 and Figure 9.

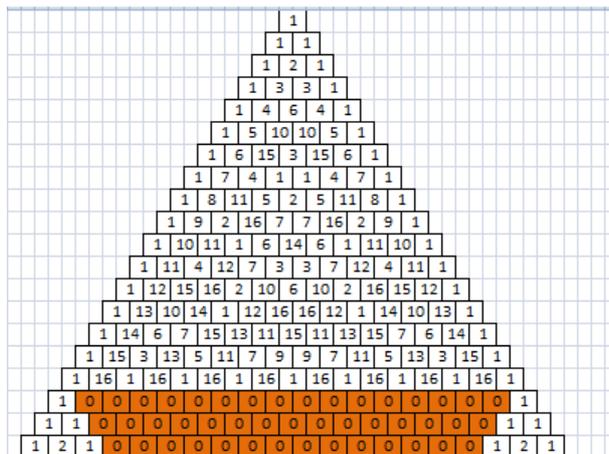


Figure 7: A Coloured Pascal triangle mod 17 of 20 rows in Excel

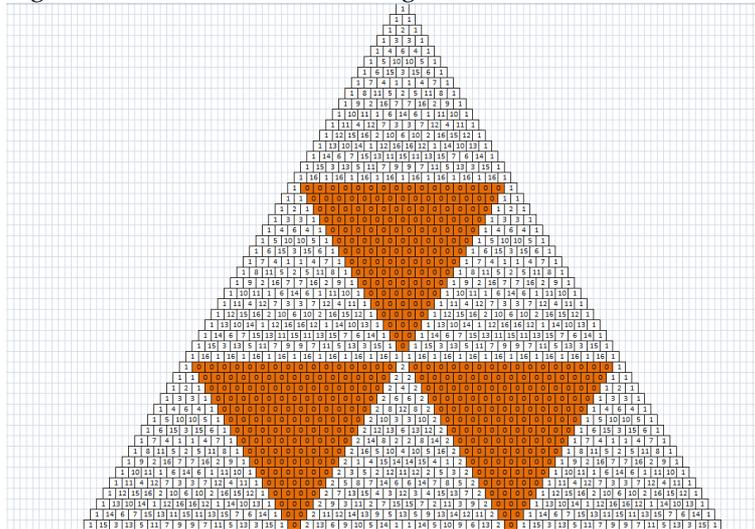


Figure 8: A Coloured Pascal triangle mod 17 of 50 rows in Excel

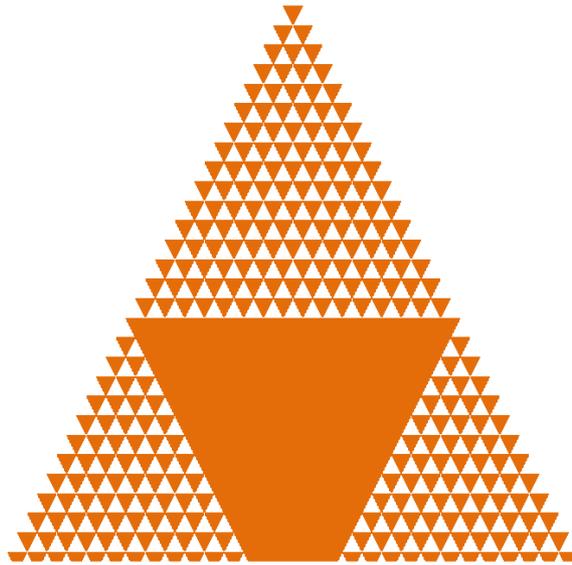


Figure 9: A Coloured Pascal triangle mod 17 of 100 rows in Excel

As it can be seen, a clear picture or pattern emerges as one increase the number of rows in a Pascal triangle. We provide the figures having 501 rows for the numbers 2 to 25 at the end of the paper and in the attached files to make investigations since it takes around 20 minutes in Excel to create each figure. We will discuss some emerging patterns in Pascal triangles this section though we will not make an in-depth analysis. Any prime number  $N$  has a special figure having recursion of  $N-1$  rows. In other words, every  $N$ th row constitutes a triangle. Similarly, every  $N$ th  $\times N$ th row constitutes a bigger size triangle so on. For instance, prime number 3 forms 4 different size triangles starting from 3<sup>rd</sup>, 9<sup>th</sup>, 81<sup>st</sup>, 243<sup>rd</sup> rows while prime number 17 forms 2 different size triangles starting from 17<sup>th</sup> and 289<sup>th</sup> rows. If  $N$  times of a certain size of triangle formed, then a bigger size of triangle starts to be formed. If  $N$  is not a prime number, there seems to be nested or intersecting triangles all around. In fact, if the figure constructed is a cluttered, it could be said that it is not prime. For instance, figures constructed for 10 and 12 are cluttered since they are not prime numbers.

If  $N$  is a product of two prime numbers, such as 6, or  $N$  is the square of a prime number, such as 4, there are nested triangles but they do not intersect. However, if  $N$  includes a power of a prime number more than 1, the figure becomes a bit clustered since some of the nested triangles intersect, such as 12.

We have shown that just by the appearance of the figures constructed we can conclude whether a number is prime or not or a square of a prime number. However, there are many other aspects of investigation and it is up to students and teachers' guidance what to investigate.

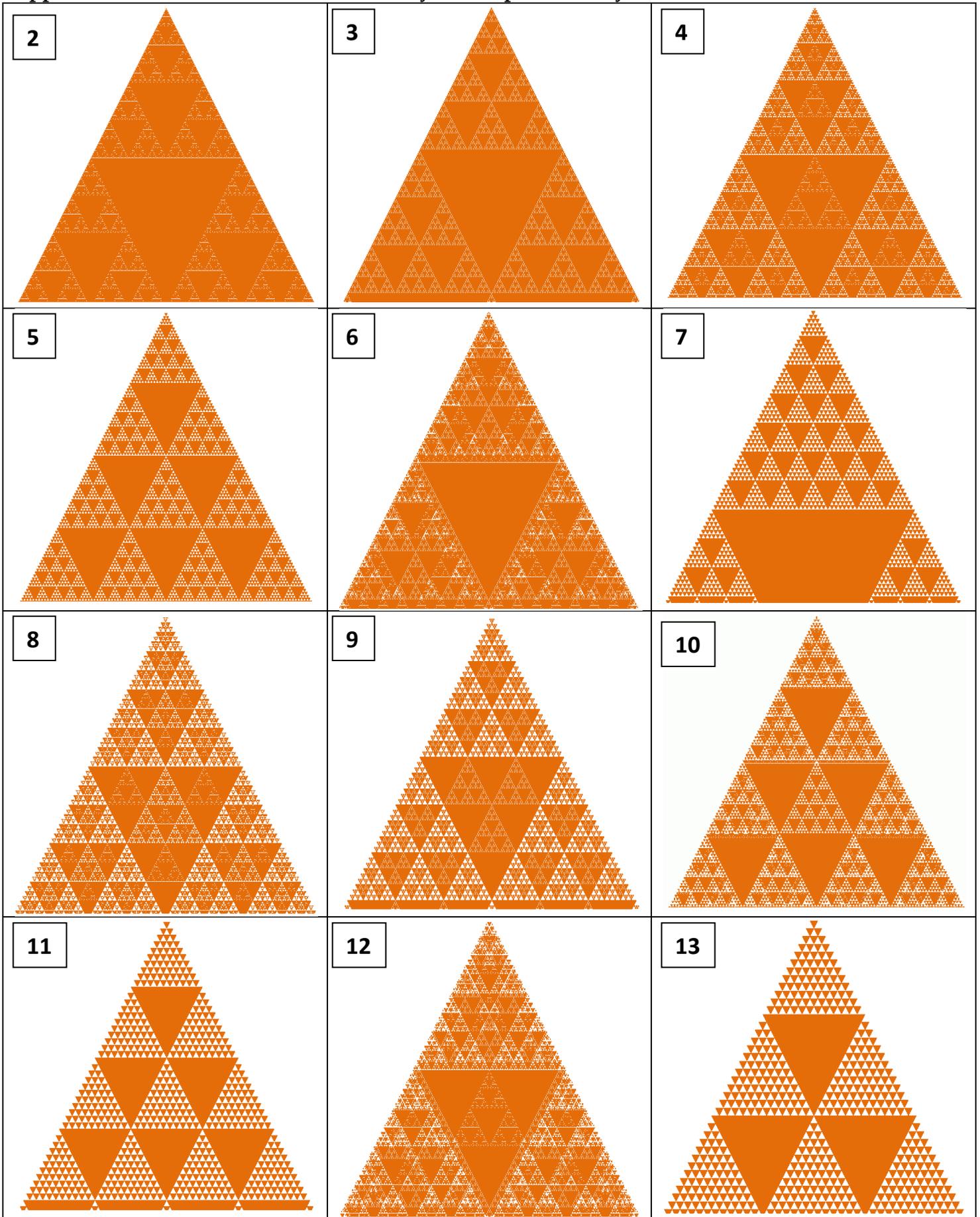
## Conclusion

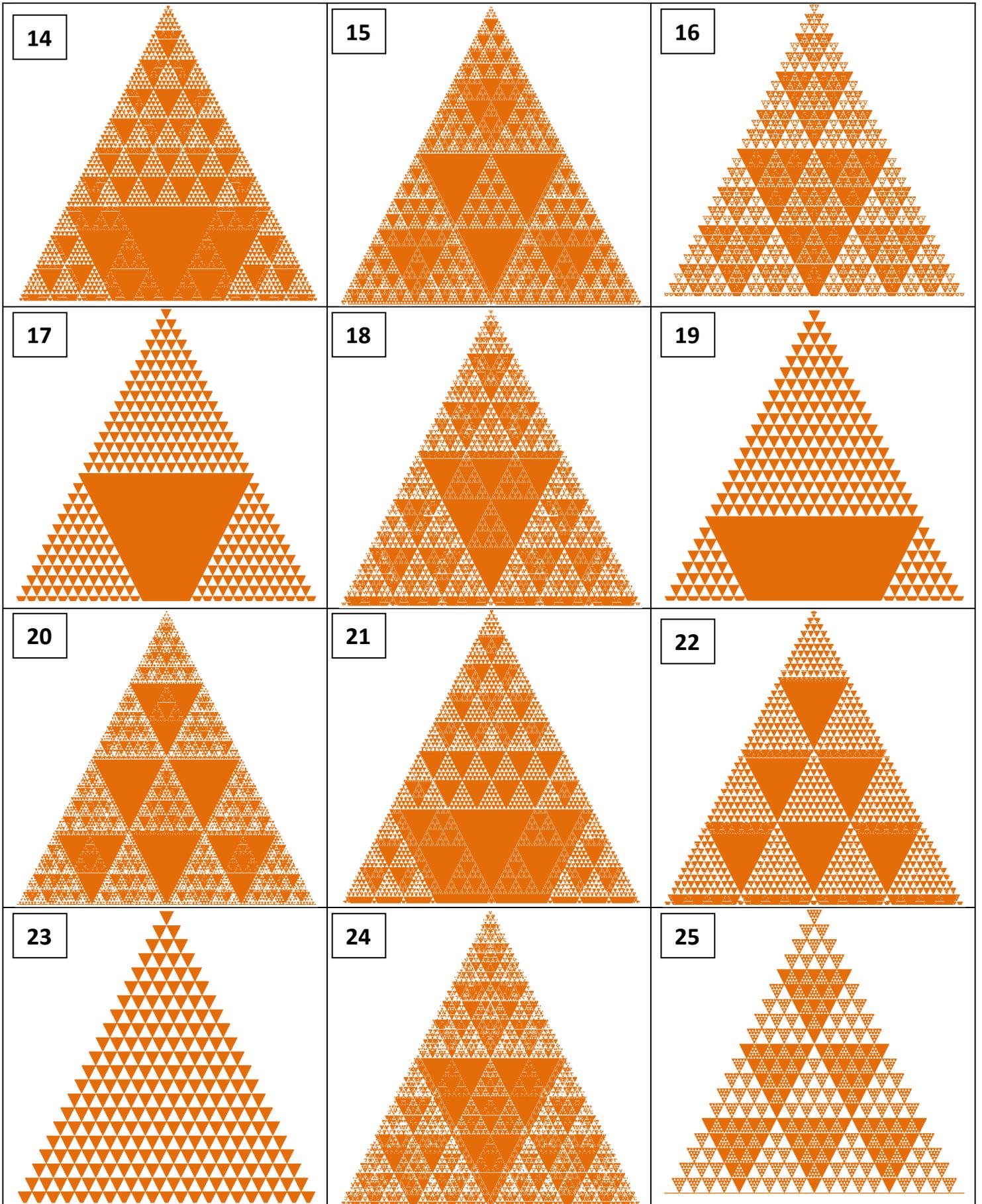
Spreadsheets are said to have the potential of solving almost any problem involving numbers or formulas, and are very powerful for manipulating data repetitively. However, it is argued in this paper that teachers should not expect students to develop their own templates in a specific content area and solve problems through spreadsheets. Instead, they should provide open-ended tasks to make conjectures and investigate specific concepts through macros and appropriately designed macros and facilities. These macros should work as an empowering tool and no way direct or guide students into certain problem solutions. It could easily be seen that Pascal triangle activity exemplified in this paper provides a good problem for students' investigation in the classroom.

## References

1. Feurzeig, W. (2010). Toward a Culture of Creativity: A Personal Perspective on Logo's Early Years, Legacy and Ongoing Potential. *International Journal of Computers for Mathematical Learning*, Volume 15, Issue 3, pp 257-265.
2. Hiebert, J., ve Wearne, D. (1993). Instructional tasks, classroom discourse and students' learning in second grade arithmetic. *American Educational Research Journal*, 30(2), 393-425.
3. Doyle, W. (1983). Academic work. *Review of Educational Research*, 53, 159-199.
4. Means, B., Blando, J., Olson, K., Middleton, T. (1993). *Using technology to support education reform*. Washington: Education Department Corporation. 12-42.
5. Bruner, J. S. (1973). *Going beyond the information given*, New York: Norton.

Appendix 1: Binomial Coefficients Mod by 2 to 25 produced by an Excel Macro





## Appendix 2: Some of the Functions Used in Macros

### Function ColumnOne(iCol) As String

'Computes the name of a column name having just a literal from column number

```
Dim iAlpha, iRemainder As Long
iAlpha = Int((iCol - 1) / 26)
iRemainder = iCol - (iAlpha * 26)
If iAlpha > 0 Then
ColumnOne = Chr(iAlpha + 64)
Else
ColumnOne = ""
End If
If iRemainder > 0 Then
ColumnOne = ColumnOne & Chr(iRemainder + 64)
End If
```

**End Function**

### Function ColumnTwo(iCol) As String

'Computes the name of a column name having one or two literals from column number

```
Dim a, b, c As Long
If iCol > 702 Then
a = Int((iCol - 701) / 676)
b = Int(((iCol - 702 - (a * 676)) - 1) / 26)
c = (iCol - 702 - (a * 676)) - (b * 26)
ColumnTwo = Chr(a + 65) & Chr(b + 65) & Chr(c + 64)
Else
ColumnTwo = ColumnOne(iCol)
End If
```

**End Function**

### Public Sub MakeBinomPascalView()

'makes a Pascal triangle of column number row

```
Dim col As Integer
col = InputBox("Please enter the number of columns to change to Pascal view:")
Call MakeBinomPascalViewInner(col)
```

**End Sub**

### Private Sub MakeBinomPascalViewInner(ByVal col As Integer)

'makes a Pascal triangle of col row

```
Dim sut, yer, yer2, val As String
Application.ScreenUpdating = False
For a = 1 To col
Application.StatusBar = a
For b = a To 1 Step -1
sut = ColumnTwo(col - a - 1 + 2 * b)
sut2 = ColumnTwo(col - a - 1 + 2 * b + 1)
yer2 = sut & a & ":" & sut2 & a
sut = ColumnOne(b)
yer = sut & a
val = Range(yer).Value
Range(yer).Value = ""
```

```

Call MakeFrame(yer2, val)
Next b
Next a
Application.ScreenUpdating = True
Application.StatusBar = False
End Sub

```

**Private Sub MakeBinomPascalViewRemainderInner(ByVal col As Integer, iscoloured)**

'makes a Pacal triangle of col row, coloured if iscoloured value not 0

```

Dim sut, yer, yer2, val, m As String
Application.ScreenUpdating = False
For a = 1 To col
Application.StatusBar = a
For b = a To 1 Step -1
sut = ColumnTwo(col - a - 1 + 2 * b)
sut2 = ColumnTwo(col - a - 1 + 2 * b + 1)
yer2 = sut & a & ":" & sut2 & a
sut = ColumnOne(b)
yer = sut & a
val = Range(yer).Value
Range(yer).Value = ""
Call MakeFrameRemainder(yer2, val, iscoloured)
Next b
Next a
Call SetNewHeightWidth(col)
Application.ScreenUpdating = True
Application.StatusBar = False
End Sub

```

**Private Sub PascalBinomRemainderInner(ByVal col As Integer, ByVal div As Integer)**

'makes a Pacal triangle of remainders of div

```

Dim sut, yer, yer2, yer3 As String
Dim sh As Worksheet
Set sh = AddNewSheet
s_ad = div & "_" & col
s_ad = GetNewSheetName(s_ad, 1)
sh.Name = s_ad
For a = 1 To col
sut = ColumnTwo(1)
yer = sut & a
sut = ColumnTwo(a)
yer2 = sut & a
Range(yer).Value = "1"
Range(yer2).Value = "1"
For b = 2 To a - 1
sut = ColumnTwo(b - 1)
yer = sut & (a - 1)
sut = ColumnTwo(b)
yer2 = sut & (a - 1)
yer3 = sut & a
Range(yer3).Value = (Range(yer).Value + Range(yer2).Value) Mod div

```

```

Application.StatusBar = a
Next b
Next a
End Sub

```

**Private Sub PascalBinomInner(ByVal col As Integer)**

```

'constructs a Pascal triangle of col row
Dim sut, yer, yer2, yer3 As String
Call AddNewSheet
For a = 1 To col
sut = ColumnTwo(1)
yer = sut & a
sut = ColumnTwo(a)
yer2 = sut & a
Range(yer).Value = "1"
Range(yer2).Value = "1"
For b = 2 To a - 1
sut = ColumnTwo(b - 1)
yer = sut & (a - 1)
sut = ColumnTwo(b)
yer2 = sut & (a - 1)
yer3 = sut & a
Range(yer3).Value = Range(yer).Value + Range(yer2).Value
Application.StatusBar = a
Next b
Next a
End Sub

```

**Sub MakeFrameRemainder(yer, a, iscoloured)**

```

'sets the frames of the remainders
Range(yer).Select
With Selection
.HorizontalAlignment = xlCenter
.VerticalAlignment = xlCenter
.WrapText = False
.Orientation = 0
.AddIndent = False
.IndentLevel = 0
.ShrinkToFit = False
.ReadingOrder = xlContext
.MergeCells = True
.Value = a
End With
With Selection.Borders(xlEdgeLeft)
.LineStyle = xlContinuous
.ColorIndex = xlAutomatic
.TintAndShade = 0
.Weight = xlThin
End With
With Selection.Borders(xlEdgeTop)
.LineStyle = xlContinuous

```

```
.ColorIndex = xlAutomatic
.TintAndShade = 0
.Weight = xlThin
End With
With Selection.Borders(xlEdgeBottom)
.LineStyle = xlContinuous
.ColorIndex = xlAutomatic
.TintAndShade = 0
.Weight = xlThin
End With
With Selection.Borders(xlEdgeRight)
.LineStyle = xlContinuous
.ColorIndex = xlAutomatic
.TintAndShade = 0
.Weight = xlThin
End With
```

```
If (a = 0) And (iscoloured <> 0) Then
With Selection.Interior
.Pattern = xlSolid
.PatternColorIndex = xlAutomatic
.ThemeColor = xlThemeColorAccent6
.TintAndShade = -0.249946592608417
.PatternTintAndShade = 0
End With
End If
End Sub
```

**Function ColumnValues(a, b) As String**

'Computes the range name of column a row b

```
Dim s1, s2 As String
s1 = ColumnTwo(a)
s2 = ColumnTwo(a + 1)
ColumnValues = s1 & b & ":" & s2 & b
End Function
```

```
Sub ColumnValueFrame(a, b, c)
'Sets value of column a row b to c
Dim s1, s2, s3 As String
s1 = ColumnValues(a, b)
Call MakeFrame(s1, c)
End Sub
```

**Sub PascalBinomRemainder()**

```
Call DoPascalBinomRemainder(0)
End Sub
```

```
Sub PascalBinomRemainderColour()
Call DoPascalBinomRemainder(1)
End Sub
```

```
Sub DoPascalBinomRemainder(iscoloured)
'makes a Pascal triangle, coloured if iscoloured value not 0
Dim col, div As Integer
```

```

col = InputBox("Please enter the number of columns:")
div = InputBox("Please enter the number to divide:")
Call PascalBinomRemainderInner(col, div)
Call MakeBinomPascalViewRemainderInner(col, iscoloured)
End Sub
Private Function GetNewSheetName(ad, no)
'get a new sheet name
Dim wsSheet As Worksheet
On Error Resume Next
Set wsSheet = Sheets(ad)
On Error GoTo 0
If Not wsSheet Is Nothing Then
GetNewSheetName = GetNewSheetName(ad & "_" & no, no)
Else
GetNewSheetName = ad
End If
End Function

Sub BinomCoefficients()
'computes binom coefficients
Dim col As Integer
col = InputBox("Please enter the number of columns to change to Pascal view:")
Call PascalBinomInner(col)
End Sub

Sub PascalBinom()
'computes binom coefficients and constructs a Pascal triangle
Dim col As Integer
col = InputBox("Please enter the number of columns to compute binom coefficients:")
Call PascalBinomInner(col)
Call MakeBinomPascalViewInner(col)
End Sub

Private Sub SetNewHeightWidth(col)
'sets the widths and heights of the cells
Cells.Select
If (col >= 100) Then
Selection.ColumnWidth = 0.5
Selection.RowHeight = 10
ActiveWindow.Zoom = 20
Else
If (col >= 35) Then
Selection.ColumnWidth = 4
Selection.RowHeight = 10
ActiveWindow.Zoom = 50
End If
End If
With ActiveSheet.PageSetup
.Orientation = xlLandscape
.FitToPagesWide = 1
.FitToPagesTall = 1

```

End With

**End Sub**

**Private Function AddNewSheet() As Worksheet**

'adds a new sheet

Dim sh As Worksheet

Set sh = Sheets.Add

Set AddNewSheet = sh

End Function

Sub MakeFrame(yer, a)

'make framed cells

Range(yer).Select

With Selection

.HorizontalAlignment = xlCenter

.VerticalAlignment = xlCenter

.WrapText = False

.Orientation = 0

.AddIndent = False

.IndentLevel = 0

.ShrinkToFit = False

.ReadingOrder = xlContext

.MergeCells = True

.Value = a

End With

With Selection.Borders(xlEdgeLeft)

.LineStyle = xlContinuous

.ColorIndex = xlAutomatic

.TintAndShade = 0

.Weight = xlThin

End With

With Selection.Borders(xlEdgeTop)

.LineStyle = xlContinuous

.ColorIndex = xlAutomatic

.TintAndShade = 0

.Weight = xlThin

End With

With Selection.Borders(xlEdgeBottom)

.LineStyle = xlContinuous

.ColorIndex = xlAutomatic

.TintAndShade = 0

.Weight = xlThin

End With

With Selection.Borders(xlEdgeRight)

.LineStyle = xlContinuous

.ColorIndex = xlAutomatic

.TintAndShade = 0

.Weight = xlThin

End With

**End Sub**