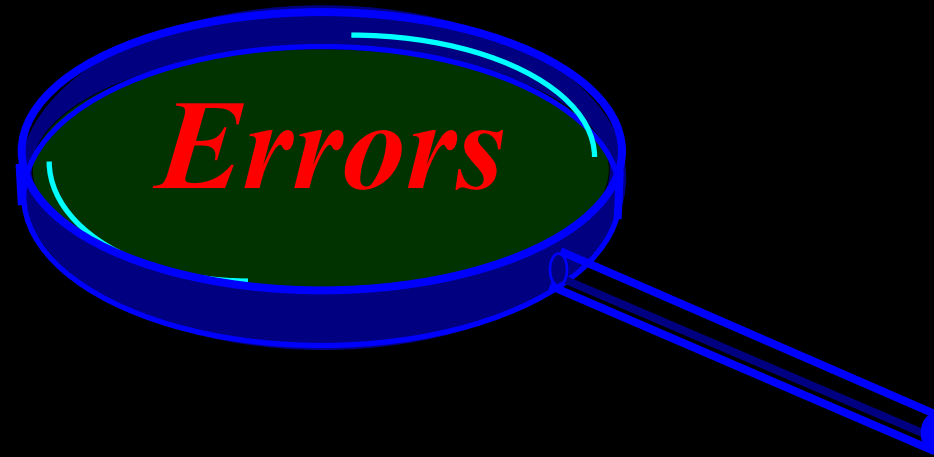


The case of the Invisible Spreadsheet



The Spreadsheet Detective, Read On...

(Ctrl+PgDn)

(Just press Esc or Enter for any initial circular reference and external links messages when this sheet was opened.)

Version 5.8, January 1999

	A	B	C	D	E	F	G	H	I	J	K
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Can you find *all* the errors in even this simple spreadsheet?

	C	D	E	F	G	H
31		Qtr 1	Qtr 2	Qtr 3	Qtr 4	Total
32	Sales (Gross)	600	1,700	1,900	1,400	5,000
33	Cost of Goods Sold	400	1,500	1,400	1,100	4,000
34	Gross Profit	200	200	550	300	1,050
35	Fixed Costs	79	94	94	28	
36	Capital	4,000	4,000	5,000	6,000	
37	Profitability	3.0%	2.7%	9.1%	4.5%	

Spreadsheets are notoriously difficult to validate, and undetected errors have caused large financial losses. The following worksheets show how the **Spreadsheet Detective** can clarify a spreadsheet's meaning and **highlight the errors** within it. It goes well beyond Excel's in built Audit functions.

www.uq.net.au/detective, detective@uq.net.au
 Southern Cross Software Queensland
ACN 079 368 200
 Phone +61 7 3391 7727 or +61 (500) 51 7727

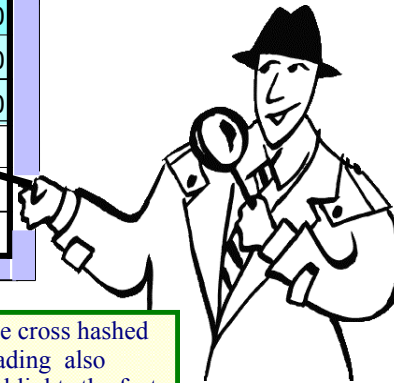
Shaded Profit Example (Available in Unregistered Shareware)

This spreadsheet calculates a company's Profitability based on Sales, Costs and Capital. The original spreadsheet is in black, and the (Re)Shade Sheet(s) entry in the SDetective menu has been used to automatically add blue shading to all cells that contain a formula. This makes it clear that F34 does not contain a formula which is why the total in H34 is wrong. Horizontal stripes indicate that the formula has been copied from the formula to the left, while vertical stripes indicate that the formula has been copied from above. This highlights the fact that the formula in cell G35 is inconsistent with that in cell F35.

These errors could easily be overlooked without the *Spreadsheet Detective*.

	C	D	E	F	G	H	
31		Qtr 1	Qtr 2	Qtr 3	Qtr 4	Total	
32	32	Sales (Gross)	600	1,700	1,900	1,400	5,000
33	33	Cost of Goods Sold	400	1,500	1,400	1,100	4,000
34	34	Gross Profit	200	200	550	300	1,050
35	35	Fixed Costs	79	94	94	28	
36	36	Capital	4,000	4,000	5,000	6,000	
37	37	Profitability	3.0%	2.7%	9.1%	4.5%	

Shading Overview



The cross hashed shading shows that cell D34 contains a new formula, namely "= D32 - D33".

The horizontal stripes indicates that cell E34 has an equivalent formula to D34, ie. "= E32 - E33". (or range if multi-cell array formula.)

There is no formula in cell F32, just a constant input number.

The lack of shading indicates that there is also no formula in cell F34, just an input number. This is why the Total Gross Profit is wrong.

The cross hashed shading also highlights the fact that the Fixed Costs in the Fourth Quarter is inconsistent.

The SDetective | UnShade Sheet(s) entry removes the shading. Any preexisting colours are preserved, but any preexisting patterns are removed as discussed in the Shading2 worksheet later in this workbook. If a range of cells or worksheets is selected before this is run then just the selection is (re)shaded.

Trivial formulas that do not reference other cells are not shown by default, but this can be changed via the SDetective | Options | Show ... Precedents. The stripes are also used to accurately show the range of multi-cell array formulas rather than how they are copied. This can highlight errors that would be almost impossible to find without the *Spreadsheet Detective*. See the Formula worksheet in this workbook for more details of these features.

(The meaning of the cross hashed shading has changed in Version 5.5. Shading is available in the unregistered shareware version.)

	A	B	C	D	E	F	G	H	I	J	K																																																																										
1	Describe One Cell (Available in Unregistered Shareware)																																																																																				
2	<p>In this worksheet cell D34 has been selected and then the SDetective Describe 1 Cell option has been used to add the green box that describe the formula within that cell. The <i>Spreadsheet Detective</i> has added green <i>AutoNames</i> to the blue formulas which describe cell references based on cell labels. Thus the reference to D33 has been decorated with "<i>CosOfGooSol</i>" which is an abbreviation of the label in C33. Unlike conventional Named Ranges, <i>AutoNames</i> are automatically updated as the model evolves and the labels change. This is particularly important in larger spreadsheets where one cannot easily see which cell is being referenced.</p> <p>The "#" indicates that D33 is an input value, and dubious references can be highlighted in red as described later in the Checks worksheet. This option is usually used in conjunction with shading as shown.</p> <p>The green box can simply be deleted if no longer required. It is available in the unregistered shareware version.</p>																																																																																				
30																																																																																					
31												<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th>C</th> <th>D</th> <th>E</th> <th>F</th> <th>G</th> <th>H</th> </tr> </thead> <tbody> <tr> <td>31</td> <td></td> <td style="text-align: center;">Qtr 1</td> <td style="text-align: center;">Qtr 2</td> <td style="text-align: center;">Qtr 3</td> <td style="text-align: center;">Qtr 4</td> <td style="text-align: center;">Total</td> </tr> <tr> <td>32</td> <td>Sales (Gross)</td> <td style="text-align: center;">600</td> <td style="text-align: center;">1,700</td> <td style="text-align: center;">1,900</td> <td style="text-align: center;">1,400</td> <td style="text-align: center;">5,000</td> </tr> <tr> <td>33</td> <td>Cost of Goods Sold</td> <td colspan="2" style="text-align: center;">D34: = D32`Sales# - D33`CosOfGooSol#</td> <td style="text-align: center;">1,400</td> <td style="text-align: center;">1,100</td> <td style="text-align: center;">4,000</td> </tr> <tr> <td>34</td> <td>Gross Profit</td> <td style="text-align: center;">200</td> <td style="text-align: center;">200</td> <td style="text-align: center;">550</td> <td style="text-align: center;">300</td> <td style="text-align: center;">1,050</td> </tr> <tr> <td>35</td> <td>Fixed Costs</td> <td style="text-align: center;">79</td> <td style="text-align: center;">94</td> <td style="text-align: center;">94</td> <td style="text-align: center;">28</td> <td></td> </tr> <tr> <td>36</td> <td>Capital</td> <td style="text-align: center;">4,000</td> <td style="text-align: center;">4,000</td> <td style="text-align: center;">5,000</td> <td style="text-align: center;">6,000</td> <td></td> </tr> <tr> <td>37</td> <td>Profitability</td> <td style="text-align: center;">#NAME?</td> <td style="text-align: center;">#NAME?</td> <td style="text-align: center;">#NAME?</td> <td style="text-align: center;">#NAME?</td> <td></td> </tr> <tr> <td>38</td> <td colspan="6" style="text-align: center;">Full Documentation</td> </tr> </tbody> </table>												C	D	E	F	G	H	31		Qtr 1	Qtr 2	Qtr 3	Qtr 4	Total	32	Sales (Gross)	600	1,700	1,900	1,400	5,000	33	Cost of Goods Sold	D34: = D32`Sales# - D33`CosOfGooSol#		1,400	1,100	4,000	34	Gross Profit	200	200	550	300	1,050	35	Fixed Costs	79	94	94	28		36	Capital	4,000	4,000	5,000	6,000		37	Profitability	#NAME?	#NAME?	#NAME?	#NAME?		38	Full Documentation					
												C	D	E	F	G	H																																																																				
31													Qtr 1	Qtr 2	Qtr 3	Qtr 4	Total																																																																				
32												Sales (Gross)	600	1,700	1,900	1,400	5,000																																																																				
33												Cost of Goods Sold	D34: = D32`Sales# - D33`CosOfGooSol#		1,400	1,100	4,000																																																																				
34												Gross Profit	200	200	550	300	1,050																																																																				
35												Fixed Costs	79	94	94	28																																																																					
36												Capital	4,000	4,000	5,000	6,000																																																																					
37												Profitability	#NAME?	#NAME?	#NAME?	#NAME?																																																																					
38												Full Documentation																																																																									
39												<p>This annotation just describes the one selected cell, D34. Note that the <i>AutoNames</i> `Sales and `CosOfGooSol clarifies cryptic references like D32 and D33. Any invalid references are highlighted by incorrect <i>AutoNames</i>.</p>																																																																									
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46																																																																																					
47												<p>By default, this option remembers any Names and Autonames that were derived previously by it or (re)Annotate Sheet(s) which avoids having to determine them again. However, this can be inaccurate if Excel Names or cell labels change between invocations. Invoking SDetective About flushes the cache and so forces Names to be determined next time a cell is described. SDetective Options Names Reload Names each time can suppress this optimization if necessary. Other options are described later in this workbook and in the technical reference manual.</p>																																																																									
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Annotated Profit Example (Registered Licence Only)

The following spreadsheet demonstrates a more convenient graphical representation of the formulas and Named Ranges in a way that is integrated with the main spreadsheet. This powerful representation is not available in the unregistered shareware version, but the report described in the next worksheet provides an alternative that is available.

The red schema box shows that cell D34 contains a new formula, namely "= D32 - D33". The *AutoNames* "Sales" and "CosOfGooSol" have been added to make it easy to verify cryptic A1 references such as "D32".

The red dot indicates that cell E34 has an equivalent formula to D34, ie. "= E32 - E33". (Or range if multi-cell array formula. All the solid dots may be suppressed.)

There is no formula in cell F32, just a constant input number.

The open circle indicates that there is also no formula in cell F34, just an input number. This is why the Total Gross Profit is wrong. (The circles are never suppressed.)

The new red schema box highlights the fact that the Fixed Costs in the Fourth Quarter is **inconsistent** and refers to the wrong cell.

	C	D	E	F	G	H
31		Qtr 1	Qtr 2	Qtr 3	Qtr 4	Total
32	Sales (Gross)	600	1,700	1,900	1,400	5,000
33	Cost of Goods Sold	400	1,500	1,400	1,100	4,000
34	Gross Profit	= D32`Sales# - D33`CosOfGooSol#	200	550	300	1,050
35	Fixed Costs	= Fixed!C19`FixeCosts	94	94	= Fixed!F17`FloorArea#	28
36	Capital	4,000	4,000	5,000	6,000	
37	Profitability	= (D34`GrosProfit - D35`FixeCosts) / Income#	#NAME?	#NAME?	#NAME?	#NAME?

Full Documentation

"~Income=> G36" shows that the Excel Named Range "Income" has been incorrectly defined as "D36:G36". This makes the formula in D37 very misleading. It is very difficult to find Name errors without these annotations.

The "Σ" line indicates the range being summed by the schema in H32, which makes it easy to see that D32 has been accidentally omitted from the SUM in H32. (The formula in H33 sums the corresponding range, ie. SUM(E33:G33).)

The "#" indicates that FloorArea is an input value. This is particularly useful for inter-sheet references.

The default options produce slightly different annotations because the solid dots are suppressed for efficiency but the circles are never suppressed so the meaning is still clear. Diagonal lines are also added to cells that contain precedents. This is described in detail in the AssetReg98/97 worksheets.

As with shading, trivial formulas that do not reference other cells are not shown by default, but this can be changed via the SDetective | Options | Show ... Precedents. The lines and dots are also used to accurately show the range of multi-cell array formulas rather than how they are copied. This can highlight errors that would be almost impossible to find without the Detective. See the Formulas worksheet in this workbook for more details of these features.

Each red box contains a "Schema" which describes the formula in the corresponding cell. These descriptions make it easy to verify that cell D34 contains the formula "= D32 - D33", and that cell E34 contains the formula "= E32 -E33" but that cell F34 does not contain a formula. This is why the Total in H34 is wrong. The new schema box in G35 also highlights the fact that this formula is inconsistent. (See the Misc worksheet for array formulas.)

The "Σ"s in row 32 indicate which cells are being summed by the formula in cell H32, namely "= SUM(E32:G32)". This makes it clear that D32 is not included in the total which highlights another error in this model. This has been copied down the column, so cell H33 contains "= Sum(E33:G33)"

The Spreadsheet Detective has automatically augmented the reference to cell D32 in the schema in cell D34 with the AutoName "Sales" because "Sales (Gross)" is the label in cell C32. Automatically including labels with formulas makes them easier to understand as well as making incorrect references more obvious. Likewise "CosOfGooSol" in cell D34 is an abbreviation of the label "Cost of Goods Sold".

The

Formula Report (Available in Unregistered Sharware)

The following worksheet contains a report of the formulas in the previous Profit worksheet. It is available in the unregistered shareware version.

Note that a formula "Schema" is only printed once for each range of cells that contains the same formula, subject to normal relative addressing. Thus row 10 indicates that cell H32 contains the formula "`=SUM(E32:G32)`", while cell H33 contains essentially the same the formula "`=SUM(E33:G33)`".

The first column describes the range of cells that contain the schema. Thus row 11 indicates that all cells in the range D34:G34 except cell F34 contain the schema. This is why the Total in H34 is wrong. The second column contains an abbreviation of the labels that describes the first cell in the range. The third column contains the text of the schemas and the Spreadsheet Detective has automatically added AutoNames in the same way as they were added to the green boxes of the previous DescOne worksheet.

Row 14 shows that the Named Range "~Income" has been defined to be D36:G36. Referring back to the original spreadsheet shows that this definition is wrong, and that formulas that use it such as the one in D37 are thus very misleading. This is further highlighted by the second column in the report because the label on the row is "Capital". Excel provides basic tools to find the definition of a specific Named Range, but this report makes it easy to find and validate which Named Ranges are def

	A	B	C	D
1	The Spreadsheet Detective Formula Report			
2	Double click on a row to go to the corresponding cell, press F5 to return to this worksheet			
3	Range	Label	Formula/Defined Range Name	
4				
10	H32:H34	`Total`Sales	= SUM(E32:G32`Qtr2:`Qtr4#)	
11	D34:G34 - F34	`Qtr1`GrosProfit	= D32`Sales# - D33`CosOfGooSol#	
12	D35:F35	`Qtr1`FixeCosts	= Fixed!C19`FixeCosts	
13	G35	`Qtr4`FixeCosts	= Fixed!F17`FloorArea#	
14	D36:G36	Capital	~Income	
15	D37:G37	`Qtr1`Profity	= (D34`GrosProfit - D35`FixeCosts) / Income#	
16				
17				
18	Statistics for this sheet annotated on 19-Oct-1998 15:52 Size: 37 Rows by 8 Columns Nr Formulas: 14 Nr Schemas: 5 * Average nr symbols per Schema: 4.2 = Total Complexity: 21 Schemas that have non numerics are:- Reference to Non Numerics: {} Constants: {} Large formulas: {} Unprotected Schemas: {} Unprocessed Ranges: {}			
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32	Formula Map ' ': Empty, '#': Number, '"': Text, 'Ss': Schema, '^'/'<': Schema is Above/Below, '?': Error, '\$': Trivial Formula			
33				
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39	30	.."" ""..		
40		ABCDE FGHIJ		
41				
42	31	.#." ""..		
43	32	.#"## ##S..		
44	33	.#"## ##^..		
45	34	.#"S< #<^..		
46	35	.#"S< <S...		
47	36	.#"## ##...		
48	37	.#"S< <<...		
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50				








Installing and Using the *Spreadsheet Detective*

To use the *Spreadsheet Detective* select appropriate entries from the **SDetective** menu or toolbar. If these are not visible, then simply open the file **Detect.xla** which should be in the same folder as this workbook.

The **(Re)Shade Sheet(s)** entry can then be chosen from the **SDetective** menu or toolbar to **shade selected spreadsheets**. The **Unshade Sheet(s)** entry removes the shadings. Likewise **(Re)Annotate Sheets** will add the graphical annotations while **UnAnnotate Sheet(s)** will remove them. If more than one spreadsheet is selected they will all be processed. If a range of multiple cells is selected then just that range within a worksheet is quickly processed. Preexisting annotations are always removed from the entire spreadsheet except when **ReShading** in which case just the selected range is processed. Other entries can describe a single formula, produce reports, and compare a spreadsheet as described in this workbook.

This workbook contains the main documentation, but additional information can be found in the **DetectTS.rtf** technical supplement. **SDetective | Insert Legend** will also insert a one page summary of the main features which can be included with any annotated spreadsheets that are given to clients or managers.

The main menu options are repeated in the **SDetective** Toolbar as follows:-

 (Re)Shade Sheet(s)	 Report Sheet(s)
 UnShade Sheet(s)	 Report on a Cell's Precedents
 Describe 1 Cell	 (Re)Compare Sheet(s)
 (Re)Annotate Sheet(s)	 UnCompare Sheet(s)
 UnAnnotate Sheet(s)	 Options

The *Spreadsheet Detective* is also available as a **shareware version**. This contains the core functionality including the shading, formula report, map, AutoNames, error highlighting, and describe one cell. However, the following advanced functionality is **not available** in the unregistered shareware version:-

- The graphical annotations added to the active worksheet.
- Year 2000 Analysis
- The Precedent Report
- Spreadsheet Comparison

Annotated worksheets are used to demonstrate several features such as external reference and named range processing in this document, but most of these features are also available in the formula report for unregistered users.

If you are using the shareware version regularly then you are **required to register** it to help fund the tool's development. We are a small company that depends on registration fees. You will find that the graphical annotations are a very convenient way to review a spreadsheet.

There is also a time limited but otherwise **unrestricted evaluation version** of the tool which may be obtained by contacting us at the address on the Profit worksheet. This can be distinguished from the shareware version because the shareware version has the words "Unregistered Shareware" in very large letters on the initial splash dialog.

Licence conditions can be found in the file **order.htm**.

To **install the *Spreadsheet Detective* from a floppy disk** simply copy the entire **Detect*** directory (where * is the version number) to a suitable place on your hard disk or network drive such as **C:\Program Files\Detect*** and go to step 5 below.

To **install a Web/E-Mail version** do the following:-

1. Create a folder in which to place the software such as "**\Program Files\Detect***" (where * is the version number). Make sure the folder is empty.
2. Unattach/Save the **Detecta.Exe** attachment there. Windows Explorer's default mode will hide the ".exe" part so the file may look like "**Detecta**", but note the trailing "a".

Also make sure that you press the shift key should you need to move the file or windows may create a short cut instead of moving the file. If this happens then delete the short cut and try again. If you have difficulty try to copy the file and then delete the original. It is essential that the "**Detecta.exe**" Application file is in the folder, not just a short cut.

3. Now execute the **Detecta.exe** program (double click on it) and the files will then "pop out" of the compressed archive. They pop out to the folder in which the **Detecta.exe** file is in.

4. If you have registered (purchased) the *Spreadsheet Detective* you will also received a **Detecti.ini** file as a separate attachment that acknowledges your licence. Simply replace the default evaluation **Detecti.ini** file that popped out of the archive with the attached version.

5. Invoke a new copy of Excel and open the add-in file. There are four versions, for Excel 95 and 97 use DetectR.xla (Registered), DetectUR.xla (Unregistered), or use Detect2R.xla or Detect2U.xla for Excel 2000 security versions. Do not use any existing FormScheme/SDetective toolbars the very first time that you invoke a new version of an add-in such as the Detective.

6. Next time Excel is invoked, the SDetective toolbar will appear and pressing any button will cause the add-in to be loaded. Alternatively, simply open the DetectR.xla or DetectUR.xla file directly and then invoke the software from the SDetective menu.

7. For Excel 2000 versions the add-in is self signed to Southern Cross Software Queensland. The first time you use it Excel will present a security dialog. The first time you use the Detective Excel 2000 will present a security dialog. Enable macros and click "Always trust macros from this source". See the Installation sheet for more on security.

To uninstall the software simply delete the files and folder, and then delete the SDetective toolbar. The Spreadsheet Detective does not tinker with the registry or any other system configuration files.

When installed in this manner, the Detective will not appear in the Tools | Add-Ins list. Extra information is available in the Installation! worksheet in this workbook should that be necessary.

The Spreadsheet Detective has been written using Excel 7.0 (for Windows 95) and has been tested and

tuned for Excel 97. Excel 5.0a (for Windows 3.11) is no longer supported due to a lack of demand. It also appears to work on the Macintosh, but this version is also not supported -- please contact us if you require a major benefit of the *Spreadsheet Detective* is that it enables the annotated spreadsheets to be printed in reports that provide a meaningful record of the assumptions that underlie the model. Many people find that it is easier to review a printed report because a normal paper page is much bigger than a computer screen so that more cells can be seen at once. Several pages can be taped together to produce an even more comprehensive view. It is also convenient to be able to tick off the formulas as they are verified.

If any page breaks had been set manually before the spreadsheet was annotated, they will probably need to be changed to print the annotated spreadsheet correctly. The easiest way to do this is to set the File | Page Setup | Fit To to an appropriate number of pages wide and tall because this option causes any manual page breaks to be ignored but not forgotten. If the Adjust to % zoom option is subsequently re-enabled when the worksheet is unannotated, the original manual page breaks will be reinstated. (The *Spreadsheet Detective* cannot automate this because detecting manual page breaks can be extremely slow in Excel.)

The *Spreadsheet Detective* automatically enables gridlines and row/column headings. It is also recommended that the size of the margins be substantially reduced for large spreadsheets. The File | Page-Setup | Sheet | Black-and-White may occasionally be useful on some black and white printers to make the coloured text sharper.

Excel provides in built tools that enable individual formulas to be examined and edited after a problem has been detected. For example, the "Audit" tools can show an individual cell's dependent and precedent cells, while Excel 97 enables a cell's precedents to be coloured while the cell is being edited. However, Excel provides no effective way to review and document a spreadsheet as a whole.

This makes the presence of subtle errors notoriously difficult to detect. Several surveys have found that a large proportion production spreadsheets of even moderate complexity often contain significant errors despite users expressing a high degree of confidence in their correctness. Thus it is important that all the formulas in a model be carefully reviewed before any important decisions are based upon them.

The *Spreadsheet Detective* can be an important aid in this process because it highlight inconsistent formulas and so greatly reduces the number of formulas that need to be reviewed. Adding AutoNames to the "A1" references within each schema makes them much easier to understand as well as making incorrect cell references much easier to detect, and dubious constructs are automatically highlighted in the reports.

Large, complex formulas will produce large, complex annotations. The *Spreadsheet Detective* uses a number of techniques to simplify the annotations. However, a key to good modeling regardless of whether the Detective is used is to split complex formulas into intermediate formulas which can be placed in hidden rows and columns if necessary. While the *Spreadsheet Detective* is an important tool for dealing with complexity, there is no substitution for good modeling techniques. More information can be found on the web site.

While Southern Cross Software Queensland (SCSQ) has taken care to produce a professional product SCSQ obviously does not accept any liability for the consequences of using the tool. The software is supplied "as is" and no warranties are made as to the tool's merchantability or fitness for any particular purpose. In no event shall SCSQ or anyone involved in the creation, production or delivery of the software be liable for any damages whatsoever arising out of the use of this software. The entire risk arising out of the use or performance of the software remains with the purchaser and user.

Other licencing information can be found in Order.htm (via SDetective | About)

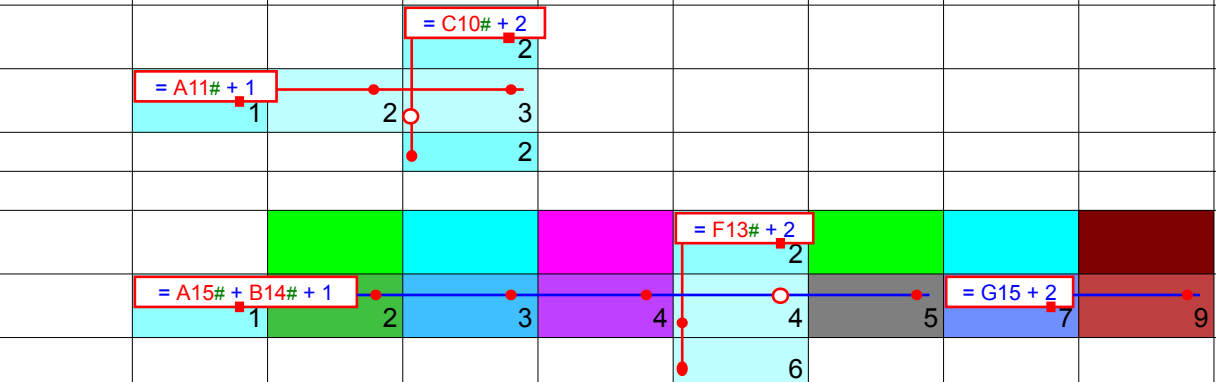
Colours and Shading

This worksheet has been both annotated and shaded to illustrate additional details about the shading option.

The heavy speckled shading in cell D12 indicates the formula has been copied from another cell in the same row or column, but that there is an intervening cell that does not contain the same formula. In this case D12 is the same as D10, but not D11. Thus speckled shading is essentially a new schema, but provides the additional information that the formula has been copied from somewhere else.

The cells in row 15 had been coloured the same as the ones in the row above, and then the annotations and shading were applied to the sheet. Note that D15 was already blue, so the *Spreadsheet Detective* has used pink stripes instead of blue ones. The original colours can still be seen through the patterns. I15 had a pre-existing pattern and so was changed to horizontal stripes and will not be restored when the sheet is unshaded (this case is rare in practice). (The diagonal stripes have actually been added after the shading for this example.)

Note that the colour of the schema line is blue rather than red to make it more visible against the pink in E15.



Statistics for this sheet annotated on 19-Oct-1998 18:42
 Size: 16 Rows by 9 Columns
 Nr Formulas: 15
 Nr Schemas: 5 * Average nr symbols per Schema: 4.4 = Total Complexity: 22
 Schemas that require particular care:-

Reference to Non Numerics: {D10, B11, F14, B15}
 Constants: {}
 Large formulas: {}
 Unprotected Schemas: {}
 Unprocessed Ranges: {}

	A	B	C	D	E	F	G	H	I	J
1	Other Checks and Warnings (Available in Unregistered Shareware)									
2	This worksheet describes how the Spreadsheet Detective highlights dubious constructs. These features are also available in the formula report in the unregistered version as illustrated in the following worksheet.									
3	The formula in cell D14 has non-numeric Precedent cells, which suggests an error. The second range is not highlighted because the non-numeric cell is a blank cell at the edge of the range.									
4	Forward references are references to cells that extend below or to the right of the referencing cell and are on the same worksheet. B17 and F17 illustrate how the Spreadsheet Detective can highlight forward references. Some modelers consider them to be bad style because it obscures an orderly data flow from input cells to output ones. Cell B20 contains non-trivial constants which is definitely bad style.									
5	D22 and F22 contain circular references as indicated by the large circles. This particular one converges and may be deliberate, but in general circular references should be avoided. Just the references that form the circle are also shown in bold red, i.e. the reference to B22 is not highlighted. The big circles have been included because there are obscure cases in which circular references do not pass through schemas as demonstrated in I23/H24 . The Describe 1 Cell option has then been used to describe I23 , note that the reference to H24 is in bold red.									
6										
7										
8										
9										
10										
11										
12										
13										
14	Bad Precedence	42		=SUM(A14:C14#, B14:C14#, C14#)	84					
15										
16		16				1	2	3		
17	Forward Reference	=C17# + B18# + B16#	595	123	=SUM(G16:G17#) + SUM(E18:F18#) + SUM(E16:G16#) + SUM(E16:E18#)	8	42	4		
18		456				7	6			
19										
20	Constant	=B16# + 0 + 1 + 100% + 2 + 3 + 456.7 - 1	479							
21										
22	Circular References	50	=B22# + FixedIC28	Err:522	=D22 + E22#	Err:522	=D22 + F22	Err:522	=H23#	10
23								H24: = I23		
24								=H23#	10	Err:522
25	The formula in C30 is highlighted in pink because it is not locked . Formulas should normally be locked to prevent them being accidentally overridden when the worksheet is protected. (They are listed in the statistics in the report.)									
26	Finally, ranges are rendered in italic purple if they could not be fully processed by the Detective, usually because of Excel problems with three dimensional ranges or references to other workbooks. This affects Circular reference detection and dependent lines as described shortly.									
27										
28										
29										
30	Unprotected Formulas		=B16# + 2	18	2					
31										
32	Cannot Process Reference		=SUM(TotalChange~AssetReg97:AssetReg98!\$D\$21~#)	0						
33		1	2	3	4	5	6	7	8	
34	Complex Formula		=B33# + C33# + D33# + E33# + F33# + G33# + H33# + I33# + B33# + C33# + D33#	42						
35	There are options to control what is highlighted. By default only bad precedents and unprotected formulas are highlighted because many users do not mind forward references, it is easy to find constants anyway, and looking specifically for date functions is a rather specialized activity. Circular references are also not highlighted by default because detecting them can be slow on large spreadsheets. They are also shown in the statistics box , which highlights which parts of a spreadsheet might require further attention. A list of overly complex formulas that contains over 20 symbols such as C34 is also included in the statistics box.									
36	Note that the statistic "Excel's first circular reference" is simply the first circular reference that Excel has detected. It is not the result of the Detective's full circular reference detection. Occasionally, Excel reports phantom circular references where there are in fact none in the workbook.									
37										
38										
39										
40										
41										
42										
43										
44										
47										
48	Statistics for this sheet annotated on 21-Oct-1998 16:44									
49	Size: 43 Rows by 9 Columns									
50	Nr Formulas: 15									
51	Nr Schemas: 12 * Average nr symbols per Schema: 8.2 = Total Complexity: 98									
52	Schemas that require particular care:-									
53	Circular references: {D22, F22, I23, H24}									
54	Excel's first circular reference: {F22}									
55	Reference to Non Numerics: {D14}									
56	Date processing: {}									
57	Forward References: {B17, F17}									
58	Constants: {B20}									
59	Large formulas: {C34}									
60	Unprotected Schemas: {C30}									
61	Unprocessed Ranges: {C32}									
62										

The *Spreadsheet Detective* Formula Report

Double click on a row to go to the corresponding cell, press F5 to return to this worksheet

Range	Label	Formula/Defined Range Name
D14	`BadPrece	= SUM(A14:C14# , B14:C14# , C14#)
B17	`ForwRefee	= C17# + B18# + B16#
F17	`ForwRefee	= SUM(G16:G17#) + SUM(E18:F18#) + SUM(E16:G16#) + SUM(E16:E18#)
B20	`Constnt	= B16# + 0 + 1 + 100% + 2 + 3 + 456.7 - 1
D22	`CircRefes	= B22# + Fixed!C28
F22	`CircRefes	= D22 + E22#
G22	`CircRefes	= D22 + F22
I22:I23	`CircRefes	= H23#
G24:H24		= H23#
C30:D30	`UnprForms	= B16# + 2
C32	`CanProRef	= SUM(<i>TotalChange</i> ~=AssetReg97:AssetReg98!\$D\$21~#)
C34	`CompForma	= B33# + C33# + D33# + E33# + F33# + G33# + H33# + I33# + B33# + C33# + D33#

Statistics for this sheet annotated on 21-Oct-1998 16:45

Size: 34 Rows by 9 Columns

Nr Formulas: 15

Nr Schemas: 12 * Average nr symbols per Schema: 8.2 = Total Complexity: 98

Schemas that require particular care:-

Circular references: {D22, F22, I23, H24}

Excel's first circular reference: {F22}

Reference to Non Numerics: {D14}

Date processing: {}

Forward References: {B17, F17}

Constants: {B20}

Large formulas: {C34}

Unprotected Schemas: {C30}

Unprocessed Ranges: {C32}

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Special Formulas (No Precedents and Array)												
2	<p>In order to reduce clutter, schemas that do not have precedents and so just contain constant numbers are not normally documented. Thus cell D10 would not normally be annotated despite the fact that it contains the formula "=1+2". The SDetective Options Show formulas without Precedents option had been enabled before this worksheet was annotated. The formula would not normally be shaded either.</p> <p>Row 13 shows how the Spreadsheet Detective accurately shows the range of array formulas. Each of the formulas in the row look identical, and Excel's built in Edit Go To Special Row Difference function would confidently report that they are the same. However, some of them are array formulas, and what is almost impossible to detect without the Spreadsheet Detective is that there are in fact two array formulas.</p> <p>The notation is used differently for array formulas because the dots and shading in row 13 show the range of the array, rather than how it has been copied. This means that copies of array formulas such as Row 14 are shown explicitly to make it clear that they are separate arrays. (Array formulas are not often copied in practice so a new notation for this case is not justified.)</p> <p>However, Single cell array formulas such as D20 are sometimes copied and so use the dots to indicate copies like ordinary formulas. They are distinguished by having a "1" in front of the schema. Thus E20 has a copy of the formul in D20, but H20 is part of the same array formula as in G20. Note that SDetective Describe 1 Cell can be used to distinguish these cases if the shading is used.</p> <p>If you re</p>												
3													
4													
5													
6													
7													
8													
9													
10	Formulas without precedence			= 1 + 2 3									
11													
12				2	4	6	8	10	12	14	16		
13	.Different Array Formulas			{ = \$D12:\$K12# } 2	4	6	{ = \$D12:\$K12# } 2	4	6	8	{ = \$D12:\$K12# } 16		
14	.Copies of Array Formulas			{ = \$D13:\$K13 } 2	4	6	{ = \$D13:\$K13 } 2	4	6	2	16		
15													
16													
17	.Single Cell Array Formulas			1 2	2 3	4 5	6 7	8 9					
18				3	4	6	8	10					
19													
20				1 { = SUM(D17:D19#R + D17#) } 9	15	27	{ = SUM(G17:G19#R + G17#) } 39	39					
21													
22													
23													

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	~!Print_Area=N39													
	Large Formulas													
2	<p>The formula in cell D11 contains the long formula "'C:\Anthony\BackedUp\V55UnReg\Detect55\[Dummy.xls]WorkSheetName'!\$B\$3 + 'C:\Anthony\BackedUp\V55UnReg\Detect55\[Dummy.xls]WorkSheetName'!\$B\$4 + 'C:\Anthony\BackedUp\V55UnReg\Detect55\[Dummy.xls]WorkSheetName'!\$B\$5" which contains references to other workbooks. Excel inserts the full file and folder names into the formulas which makes them very difficult to read as well as making it difficult to confirm that the correct workbooks are being referenced. The Spreadsheet Detective abbreviates the filenames in the annotation and then places the full name in a table at the end of the worksheet.</p> <p>All external file references are shown in the abbreviation table, even if they are short so the table shows all external references in formulas. The SDetective Options Special OLE Link Table option has also been set with this worksheet which also lists any Excel Named Ranges that refer to external cells. These are generally bad style, it is usually much clearer to have a worksheet that refers to any external cells and then reference that sheet from the rest of your model. Cell D12 shows how long worksheet names, strings, named ranges and function names are also abbreviated. This facility is also available in the formula report.</p> <p>The "Ⓐ20Ⓑ" notation in B15 indicates that the description of its large formula has been moved to the end to minimize the size of the annotated worksheet. This can be important in large multi column worksheets but only happens if there is no room for the large schema. However, there normally is room, and in the example a schema had to be placed in cell C15 to force the schema in B15</p>													
3														
4														
5														
6														
7														
8														
9														
10														
11														References to other workbooks
12	Long Strings, Names etc,			#NAME?										
13	A Very Long Named Range	42												
14														
15	Large, complex formula	Ⓐ20Ⓑ		= B15 * 0										
16														
17														
18														
19														
20	B15:= IF(VLOOKUP(3 , SquareTable~Fixed!\$C\$23:\$D\$26~# , 2) > VLOOKUP(2 , SquareTable~Fixed!\$C\$23:\$D\$26~# , 2) , NPV(6.7 , 1000 , 2023 , 3056) * HLOOKUP(4 , SquareTable~Fixed!\$C\$23:\$D\$26~# , 2) , NPV(8.6 , 15343 , 4314 , 3243) * HLOOKUP(2 , Sq...													
21														
22														
23	External Links and Abbreviations Table													
24														
25	C:\An\BaUp\[Dummy]WoShNa#1	{D11, D11, D11}												
26	'C:\Anthony\BackedUp\V55UnReg\Detect55\[Dummy.xls]WorkSheetName'													
27	"AVerLonStrToBe"#2	{D12}												
28	"A very long String to be abbreviated at the end: "													
29	C\Ant\BacUp\V5#3	{D12}												
30	'C:\Anthony\BackedUp\V55UnReg\Detect55\Dummy.xls'													
31	AVerLonNamRan#4	{D12}												
32	A_Very_Long_Named_Range													
33	Excel Names with Links Table													
34														
35	ExternalName													
36	='C:\Anthony\BackedUp\V55UnReg\Detect55\[Dummy.xls]WorkSheetName'!\$B\$6													
37														
38	Workbook.LinkSources(xlExcelLinks):-													
39	C:\Anthony\BackedUp\V55UnReg\Detect55\Dummy.xls													

Precedent Report (Registered version only)

The next worksheet contains a precedent report that describes how the Profitability cell (D37) in the previous "Profit" spreadsheet was calculated. The report lists the formula in D37, then the precedent cells referenced by it, and then the precedents of those cells recursively. This report is also unavailable in the unregistered shareware version.

Cell Profit!D35 refers to Fixed!C19, and so row 13 of the report describes formulas on the Fixed worksheet. Being able to see inter-sheet calculations is particularly useful when analyzing complex models that contain multiple worksheets. If a particular cell is referenced twice by a given formula, there is an option to only include in the report for the first reference.

The report is an outlined spreadsheet, and so clicking on a "+" or "-" will expand or collapse a set of precedents respectively.

Double clicking on a line within the report will go to the corresponding cell in the original worksheet. Pressing Excel's normal F5 function key will return to the report. This enables one to use the precedent report to conveniently move through different sheets in the model. This feature uses functions within the Detective so no code is inserted into your workbooks which could cause problems with virus detection etc. However, this means that Excel disables this feature when the worksheet is closed, in which case the report can simply be regenerated.

Note the way that the "#" makes it clear which referenced cells are input values and so avoids the need to look at those referenced cells explicitly.

	A	B	C	D
1	The Spreadsheet Detective Precedent Report			
2	Double click on a row to go to the corresponding cell, press F5 to return to this worksheet			
3	Cell	Label	Formula	Depth
4				
10	Profit!D37	`Qtr1`Profity	= (D34`GrosProfit - D35`FixeCosts) / Income#	+
11	Profit!D34	`Qtr1`GrosProfit	= D32`Sales# - D33`CosOfGooSol#	++
12	Profit!D35	`Qtr1`FixeCosts	= Fixed!C19`FixeCosts	++
13	Fixed!C19	`FixeCosts	= C18`LeaseCost + C15`Inter	+++
14	Fixed!C18	`LeaseCost	= C17`FloorArea# * C16`UnitPrice#	++++
15	Fixed!C15	`Inter	= C14`InterRate * (D11`Date# - C11`Date#) / 365 * C13`Loan#	++++

	A	B	C	D	E	F	G	H	I	J	K																																																																	
1	Comparison Example (Registered version only)																																																																											
2	<p>This worksheet is also a copy of the previous Profit worksheet but it has been modified and then compared with the original worksheet. The "Δ" in D34 indicates that the Gross Profit formula has changed, while the "€"s in row 36 shows that these values are new, in this case because the row has been inserted. The heavy dashed vertical line indicates that column F (Qtr 3) had been deleted.</p> <p>The Spreadsheet Detective only marks changes for cells with formulas if the formula changes. Thus cell F38 has not been marked as being different even though its calculated value has increased from 4.5% to 6.4% because the formula has not changed. This is important because one small change in an input value can change the values of many calculated cells which can make it difficult to see the underlying cause. The statistics at the end of this worksheet summarize the differences, with "-F" indicating that column F was deleted.</p> <p>It is important to be able to compare a draft with a final version to ensure that new errors have not been introduced. It can also substantially reduce the time required to check a new version of a model. Note that unlike Excel 97, this feature does not require the restrictive share mode.</p> <p>This powerful feature is unavailable in the unregistered version.</p>																																																																											
30																																																																												
31												<table border="1" style="margin: auto;"> <thead> <tr> <th></th> <th>C</th> <th>D</th> <th>E</th> <th>F</th> <th>G</th> </tr> </thead> <tbody> <tr> <td>31</td> <td></td> <td>Qtr 1</td> <td>Qtr 2</td> <td>Qtr 4</td> <td>Total</td> </tr> <tr> <td>32</td> <td>Sales (Gross)</td> <td>600</td> <td>1,700</td> <td>1,400</td> <td>3,100</td> </tr> <tr> <td>33</td> <td>Cost of Goods Sold</td> <td>400</td> <td>1,500</td> <td>1,100</td> <td>2,600</td> </tr> <tr> <td>34</td> <td>Gross Profit</td> <td>Δ . . . 240</td> <td>. . . 350</td> <td>Δ 410</td> <td>760</td> </tr> <tr> <td>35</td> <td>Fixed Costs</td> <td>79</td> <td>94</td> <td>28</td> <td></td> </tr> <tr> <td>36</td> <td>Net Profit</td> <td>€ 161</td> <td>. . . . 256</td> <td>€ 382</td> <td></td> </tr> <tr> <td>37</td> <td>Capital</td> <td>4,000</td> <td>4,000</td> <td>6,000</td> <td></td> </tr> <tr> <td>38</td> <td>Profitability</td> <td>#NAME?</td> <td>#NAME?</td> <td>#NAME?</td> <td></td> </tr> </tbody> </table>												C	D	E	F	G	31		Qtr 1	Qtr 2	Qtr 4	Total	32	Sales (Gross)	600	1,700	1,400	3,100	33	Cost of Goods Sold	400	1,500	1,100	2,600	34	Gross Profit	Δ . . . 240	. . . 350	Δ 410	760	35	Fixed Costs	79	94	28		36	Net Profit	€ 161 256	€ 382		37	Capital	4,000	4,000	6,000		38	Profitability	#NAME?	#NAME?	#NAME?	
												C	D	E	F	G																																																												
31													Qtr 1	Qtr 2	Qtr 4	Total																																																												
32												Sales (Gross)	600	1,700	1,400	3,100																																																												
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35												Fixed Costs	79	94	28																																																													
36												Net Profit	€ 161 256	€ 382																																																													
37												Capital	4,000	4,000	6,000																																																													
38												Profitability	#NAME?	#NAME?	#NAME?																																																													
39												Compared																																																																
41												<div style="display: flex; justify-content: space-around;"> <div style="border: 1px solid green; padding: 5px; width: 20%;"> <p>The "Δ" indicates that the Gross Profit formula has been changed.</p> </div> <div style="border: 1px solid green; padding: 5px; width: 20%;"> <p>The "€" indicates that all the values in row 36 are new, ie. the row has been inserted.</p> </div> <div style="border: 1px solid green; padding: 5px; width: 20%;"> <p>The dashed purple line indicates that column F has been deleted, namely column "Qtr 3".</p> </div> <div style="border: 1px solid green; padding: 5px; width: 20%;"> <p>The change in Gross Profit has meant that the Profitability has also changed. However, the formula in F38 is unchanged so there is no "Δ" in that cell F38.</p> </div> </div>																																																																
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47																																																																												
48																																																																												
49												<p>Ranges can be compared by selecting a range of cells in the new workbook, invoking the Compare Sheets entry, and then entering a range of cells on the old workbook in the Compare Dialog. Using ranges is mainly used to restrict what is compared in different workbooks, and to assist if the insert/delete correlation is not optimal.</p> <p>It is also possible to compare entire workbooks by first selecting a range of spreadsheets in the new workbook, invoking Compare Sheets and then selecting an arbitrary cell in an arbitrary worksheet in the old workbook. Only worksheets that have the same name in both workbooks will be compared. The dialog box contains prompts that describe what is required for each option.</p> <p>The Spreadsheet Detective uses the leftmost (topmost) labels to determine whether rows (or columns) have been inserted or deleted. These labels need not be unique and care is taken to match nearby rows and columns. However, if the labels have been substantially changed then it may not be possible to match them and so may incorrectly infer that the rows have been inserted and deleted. One way to prevent this is to include a hidden row (and column) at the beginning of the worksheet that contains a copy of the old labels before the worksheet is changed. This hidden column will then be used to accurately match the new and old versions. Alternatively, if it is known that no rows or columns have been inserted or deleted, there is an option to suppress column or row correlation.</p> <p>Note the way that relative and absolute addresses within formulas are correctly compared. This is achieved by copying the old workbook, inserting and deleting rows and columns as necessary to correlate it with the new workbook, and then comparing the new worksheet with the copy of the old workbook which is then normally deleted.</p>																																																																
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79																																																																												
80	<p>Range C31:G38 was compared with [DetectEg.xls]Profit!C31:G38 7 cells were found that had different formulas Compared on 10-Dec-1998 19:20</p> <p>Different Cells: {-F, D34, F34, C36, F36}</p>																																																																											
81																																																																												
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85																																																																												

	A	B	C	D	E	F
1	Year 2000 Analysis (Registered version only)					
2	<p>The Year 2000 problem with two digit years can cause serious problems in information systems. The <i>Spreadsheet Detective</i> has an option to highlight date processing in pink as illustrated in cell C11:E12. The addresses of cells with date processing are listed in the <i>statistics box</i> at the end of the worksheet. This makes it is easy to know which cells to check. Date functions and references to cells formatted as dates are highlighted, while cells with formulas that return dates such as C12 have just the "=" highlighted and they are included in the summary.</p> <p>These options are unavailable in the unregistered shareware version.</p>					
3						
4						
5						
6						
7						
8						
9						
10						
11						
12			= "12/3/45" + E11#	6-Dec-1945	= B11# / 365	0
13	<p>Excel treats dates entered with two digit years less than about 30 as being in the 21st century, which is sensible if undocumented. However, no indication is made if a cell with two years is outside this range. For example, B19 and C19 both appear to have the same date, but the second is in 1902, not 2002 as you would expect. To highlight this the <i>SDetective Select YY Dates</i> utility selects all cells on a worksheet that have been formatted with a two digit year but are less than 20 years in the past or more than 10 years in the future (or as specified in the dialog that appears). These can then be reformatted as required by using Excel's normal <i>Format Cells</i> entry. It is also possible to select all two digit years regardless of which year value they currently have. (Use the Tab key to move through a selection of cells.)</p> <p>To demonstrate this feature in the example the cells with two digit years have been selected, but then shaded diagonal Pink rather than have their formatting changed. Cell E19 has not been selected because surprisingly it cannot be a date in Excel 95, although it could be a date in Excel 97 in which case it would be selected. E21 has not been selected because it does not contain any year (such a date would be used for dates that must refer to the current year).</p> <p>If a range of cells is selected before <i>SelectYYDates</i> is invoked then only cells from within the range are selected. Additional details about the <i>Spreadsheet Detective's</i> Year 2000 compliance can be found in the <i>Technical Supplement (DetectTS.rtf)</i>.</p>					
14						
15						
16						
17						
18						
19		2/1/2002	2/1/1902	3/2/1990	2/03/2090	..
20	= YEAR(B19#)	2002	1902	1990	2090	
21		2/1/1934	2/02/1934	3-Feb-34	4-Feb	
22		2/1/1934	Feb-34	3-Feb-1934	February 4, 1934	
23		February 1, 1934	February 2, 34	3-February-34	34/2/4	
24		1/02	1/34	Feb	Sunday, February 4	
25						
26						
27						
28						
29	<p>Statistics for this sheet annotated on 19-Oct-1998 19:15 Size: 24 Rows by 6 Columns Nr Formulas: 7 Nr Schemas: 4 * Average nr symbols per Schema: 9.0 = Total Complexity: 36 Schemas that require particular care:-</p> <p>Reference to Non Numerics: {} Date processing: {C11, C12, E12, B20} Constants: {E12} Large formulas: {C11} Unprotected Schemas: {} Unprocessed Ranges: {}</p>					
30						
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Workbook Precedent Report (Available in Unregistered Sharware)

It can be very difficult to trace the dependencies between workbooks in large, multi-workbook models. The **SDetective | Inter Workbook Precedent Report** cause a dialog to be presented which enables workbooks in a folder to be selected. The **Spreadsheet Detective** will then **open each of these workbooks** in turn and produce a report of each workbook's Precedent workbooks.

An **example** of this report is shown in the following worksheet. The first column contains the name of each selected workbook in the folder and the second column contains the names of the referenced, Precedent workbooks. One row with no Precedents is always created for of the selected workbooks so that it is clear which workbooks have been selected even though some workbooks will not have precedent workbooks. The following columns contain the full path in case there are different version of the same spreadsheet in different folders.

The report is formatted as a Data worksheet, so **Data | Sort** can be used to **sort by Precedent**, in which case it will show each workbooks' Dependent workbooks. This can be an important feature when determining whether a workbook is redundant.

Each time this option is run it produces a new report, but they can easily be combined as needed using ordinary cut and paste. The combined reports can then be sorted as desired. All other workbooks **should be closed** before running this report. This option does not parse each formula and Named range in each workbook, but relies on Excel's built in `LinkSources(xlExcelLinks)` option.

(This report is likely to be significantly enhanced in future versions of the **Registered Licence**.)

Inter Workbook Precedents

Referencing Name	Precedent Name	Full Referencing Path	Full Precedent Path
Prec11		C:\Anthony\BackedUp\V57\Source\ PrecRep\Prec11.xls	
Prec11	Prec22	C:\Anthony\BackedUp\V57\Source\ PrecRep\Prec11.xls	C:\Anthony\BackedUp\V57\Source\ PrecRep\Prec22.xls
Prec11	Prec21	C:\Anthony\BackedUp\V57\Source\ PrecRep\Prec11.xls	C:\Anthony\BackedUp\V57\Source\ PrecRep\Prec21.xls
Prec21		C:\Anthony\BackedUp\V57\Source\ PrecRep\Prec21.xls	
Prec21	Prec33	C:\Anthony\BackedUp\V57\Source\ PrecRep\Prec21.xls	C:\Anthony\BackedUp\V57\Source\ PrecRep\Prec33.xls
Prec22		C:\Anthony\BackedUp\V57\Source\ PrecRep\Prec22.xls	
Prec22	Prec33	C:\Anthony\BackedUp\V57\Source\ PrecRep\Prec22.xls	C:\Anthony\BackedUp\V57\Source\ PrecRep\Prec33.xls
Prec33		C:\Anthony\BackedUp\V57\Source\ PrecRep\Prec33.xls	
Prec33	Prec11	C:\Anthony\BackedUp\V57\Source\ PrecRep\Prec33.xls	C:\Anthony\BackedUp\V57\Source\ PrecRep\Prec11.xls

	A	B	C	D	E	F	G	H	I	
1	~!Print_Area=L41	Cross Reference Lines								
2	<p>Green diagonal cross reference lines in the top of left of a cell indicate that the cell is being referenced by another formula schema and so has dependents. For example, cell D12 has a cross reference line because it is being referenced by the schema in C17.</p> <p>In order to reduce clutter, only cells that are referenced by a <i>schema</i> have diagonal lines. Thus cell F15 does not have a line despite being referenced by the formula in cell F19 because that cell does not contain a schema but is just a copy of the schema in cell C19. As one would expect, references that are indicated with range lines also do not produce diagonal lines. Thus cell F16 also does not have a diagonal line despite being referenced by G16. Cell C16 does have a diagonal line because it is also being referenced by the schema in cell C19. Lines are also not produced for schemas repeated to the right of a long row as described later.</p>									
3										
4										
5										
6										
7										
8										
9										
10										
11	Asset Register 1997									
12	Depreciation Rate		15%							
13										
14		Qtr1	Qtr2	Qtr3	Qtr4	Total				
15	Opening	456	= C19`Qtr1`Closing	646	596					
16	Purchases	100	120	50	30	= SUM(C16:F16`#R)				
17	Depreciation	83	99	104	94	45				
18	Sales	15	15	100	75	205				
19	Closing	541	646	596	551					
20										
21	<p>Surprisingly, cell C17 does not have a diagonal line, which highlights the fact that the Depreciation is not being used in the calculation of the Closing Balance. Details about how an individual cell is actually being referenced can be obtained using Excel's in built "Audit" functions. However, the diagonal lines are valuable because they provide an overview of how cells are referenced and thus can highlight errors without having to apply the "Audit" functions to each individual cell in a large worksheet.</p> <p>The length and angle of the green line changes slightly depending on how many times the cell is referenced cells in different rows and columns. If a cell is referenced by another cell on a different worksheet then the reference line is thickened and coloured brown (F19 in the example). Intersheet references can only be shown if both the precedent and dependent sheets are annotated at the same time. If one formula references a large range of cells then only the top left and bottom right six cells are marked to improve performance.</p> <p>The opening balance schema in D15 is an offset reference to the closing balance of the previous quarter as indicated by the "Qtr1`Closing". Note the way that the AutoNames make the meanings of the A1 references clear.</p> <p>The crossed schema lines in cell G17 show that it has been copied from C17 rather than G16, which highlights another error. These types of errors in large spreadsheets can be very hard to detect without the Spreadsheet Detective.</p>									
22										
23										
24										
25										
26										
27										
28										
29										
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31										
32										
33										
34										
35										
36										
37										
38										
39										
40										
41										

	A	B	C	D	E	F	G	H	
1	~!Print_Area≡ H25	Optimized Mode & Three Dimensional Models							
2	<p>This example is the same as the AssetReg97 one, but it has been annotated with the default options which suppresses the solid dots. They are suppressed by default because it can take Excel a long time to draw the dots on larger spreadsheets. (The time is proportional to the square of the number of dots.) Note that the meaning is still unambiguous because the circles are never suppressed so the error in cell G17 is still clear. Only the first and last "R" of the range is displayed.</p> <p>This example also shows how the Spreadsheet Detective handles three dimensional worksheets. This worksheet is a copy of the previous one that describes the previous year. The schemas that are the same as that worksheet have been annotated with a dashed box. This highlights the difference in the method of calculating the Closing balance. Only cells in exactly the same position are compared, more complete analysis can be done by using the Compare Sheet(s) entry as described in the Compared worksheet in this workbook.</p> <p>Solid dots are still provided for cells with formulas that are empty such as E23 and E24 to ensure that there can be no ambiguity. (Zero values have been suppressed in this worksheet.)</p>								
3									
4									
5									
6									
7									
8									
9									
10									
11	Asset Register 1998								
12	Depreciation Rate		✓	15%					
13									
14			Qtr1	Qtr2	Qtr3	Qtr4	Total		
15	Opening	<small>= AssetReg97!F19`Qtr4`Closing</small>	551	<small>= C19`Qtr1`Closing</small>	525	518	359		
16	Purchases		90	120	10	20	<small>= SUM(C16:F16`#R)</small>	240	
17	Depreciation	<small>= (C15`Opening + C16`Purchases#) * \$D12`DepreRate#</small>	96	97	79	57		36	
18	Sales		20	30	90	60		200	
19	Closing	<small>= C15`Opening + C16`Purchases# - C17`Depreon - C18`Sales#</small>	525	518	359	262			
20									
21									
22	Empty Value	<small>= IF(C18`Sales# < 80 , "<80" , "")</small>	<80	<80		<80			
23		<small>= B23`EmptValue# - 1</small>	3	2	1	0		-1	
24									
25									

Fixed Costs: = SERIES(Misc!\$B\$35# , Misc!\$C\$34:\$F\$34# , Misc!\$C\$35:\$F\$35`Qtr1`FixeCosts:`Qtr4# , 1)

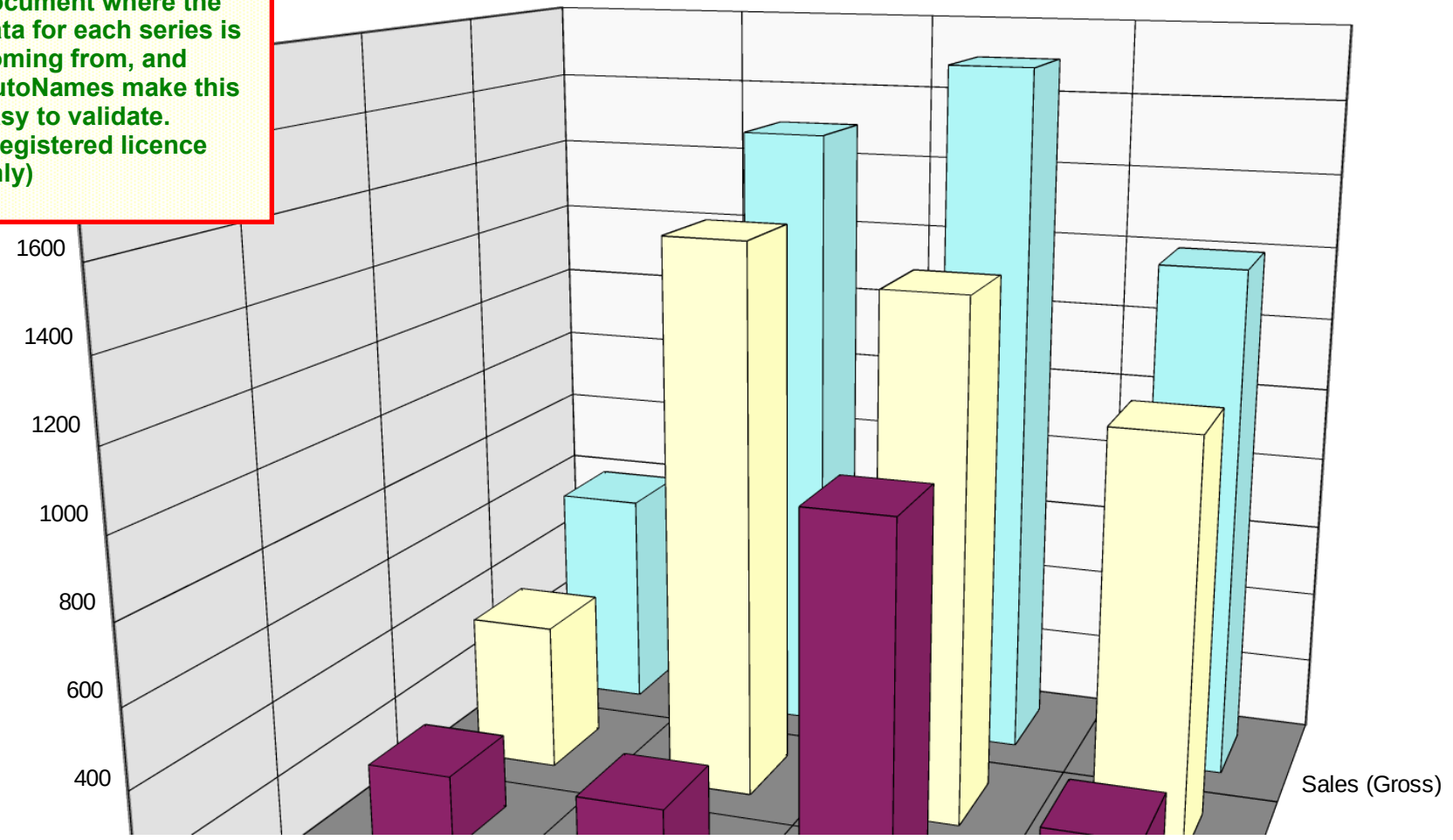
Gross Profit: = SERIES(Misc!\$B\$36# , Misc!\$C\$34:\$F\$34# , Misc!\$C\$36:\$F\$36`Qtr1`GrosProfit:`Qtr4# , 2)

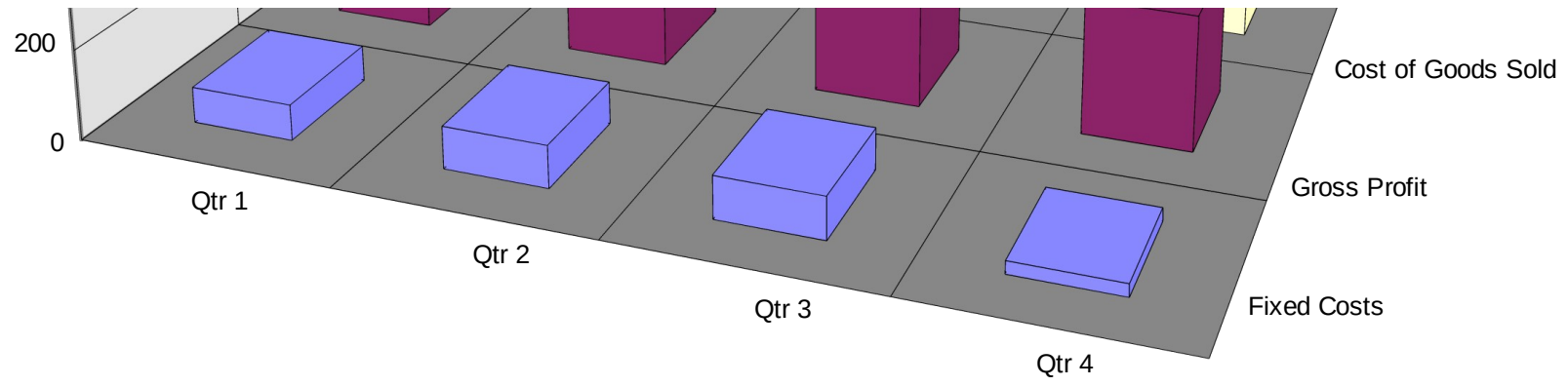
Cost of Goods Sold: = SERIES(Misc!\$B\$37# , Misc!\$C\$34:\$F\$34# , Misc!\$C\$37:\$F\$37`Qtr1`CosOfGooSol:`Qtr4# , 3)

Sales (Gross): = SERIES(Misc!\$B\$38# , Misc!\$C\$34:\$F\$34# , Misc!\$C\$38:\$F\$38`Qtr1`Sales:`Qtr4# , 4)

Invalid charts can produce invalid decisions. The annotations above document where the data for each series is coming from, and AutoNames make this easy to validate. (Registered licence only)

But what does it really mean?





The **Spreadsheet Detective** uses sophisticated heuristics to determine which labels in a spreadsheet should be used to produce AutoNames, and the experience with numerous production spreadsheets is that these algorithms produce sensible results in the vast majority of cases. However, it is also possible to manually override the AutoNames with minor changes to the labels and layout. (This also applies to the report.)

AutoNames are made out of text labels and dates that are in positions where one would expect to find a label. Thus the reference to A10 from G10 has been labeled "A10`01Jan90". The reference to B10 has not been given an AutoName because 1234 is a number. C9 has been used as an AutoName despite being a number because it looks like a four digit year ([Now-20..Now+10]). This exception works well in practice because it is very rare for a number to look like a four digit year and be in a position that one would expect to find a label.

Two digit numbers such as the one in D9 are never made into AutoNames. Years should normally be entered as four digits anyway to make their meaning clear and to be year 2000 compliant. However, two digit years can be used as AutoNames as illustrated by E9 which has been entered with a leading apostrophe as "'93" and so is actually a right justified text string. Alternatively, F9 is actually a date that has been formatted as "YY".

The special option SDetective | Names | Show AutoName Definitions has been enabled to help illustrate how AutoNames are created by showing their definitions with annotations such as "'\A10" in A9.

9	1-Jan-90	1234	1991	92	93	94
10	1	2	= A10`01Jan90# + B10# + C10`1991# + D10# + E10`93# + F10`94#			
			4	6	8	10
						31

The **Spreadsheet Detective's** AutoName algorithms basically search from the referenced cell to the edge of a block of cells and choose the leftmost or topmost appropriate label. Thus the reference to D23 from D27 has been documented as "D23`MarkTran" because "123" is a number and "XZ" is too short to be a label as well as being to the right of "Marketing Transport". The word "(Gross)" is not used in the AutoName because it is in parenthesis.

"MT-456" is used to name the reference to D24, because it is not a number. If the user would prefer to use the Full Name for the AutoName, this can be achieved by either placing a "." after the Full Name as had been done in B25, or by placing one before the code as has been done in A26. In this example, the dot had actually been added to a custom format for A26, which means that the Code can still be used in functions such as VLookup().

The reference to H23 from H26 uses "High" for the AutoName because it is in a new block. A block is essentially an area of cells that are surrounded by blank cells.

It is also possible to stop the **Spreadsheet Detective** from searching for a label by placing "." in an intervening cell. Thus the reference to D29 from E29 has not been named "Value" because of the "." in cell D28. Likewise, one can cause the search to continue to the right/above by including a "." in otherwise empty cells.

Code	Full Name	Extra Param	Value	New Block
123	Marketing Transport (Gross)	XZ	1	High 5
MT-456	Marketing Telephones		3	Low 1
DS-123	Distribution Salaries.		5	Inter 3
DT-321	Distribution Transport		7	Average 3
= (H23`High# + H24`Low# + H25`Inter#) / 3				
= D23`MarkTran# + D24`Mt-456# + D25`DistSala# + D26`DistTran#				
16				
..				
= C29`ExtrParam# + D29#				
Other Values 456 567 1023				

Note that AutoNames are inferred each time the **Spreadsheet Detective** annotates a worksheet. This means that they will automatically remain consistent with the text labels as the spreadsheet is refined and enhanced. This is in stark contrast to conventional Excel Named ranges because while the Insert | Names | Create function can automatically create Names from labels, no facilities are provided to automate the maintenance of these Names as the spreadsheet labels are modified. If the old Names are not manually replaced correctly they can become very misleading.

	A	B	C	D	E	F	G	H	
1	~!Print_Area≡H38		Qualification						
2	<p>The following spreadsheet summarizes the fortunes of the Work division and the Sheet division. The formula in B23 consolidates these figures, and refers to B15 and B21. However both of these have been labeled "Gross Profit" which would produce ambiguous AutoNames.</p> <p>To address this, the SDetective Options Qualify Duplicate AutoNames option has been enabled to automatically Qualify AutoNames. This has caused the <i>Spreadsheet Detective</i> to prepend the headings to produce AutoNames ""WorDiv_GrosProfit" and ""SheDiv_GosProfit". Likewise the reference to E12 and C12 from F12 have been qualified ""1997_Actual" and ""98_Actual" respectively.</p>								
3									
4									
5									
6									
7									
8									
9		1997		98					
10		Budget	Actual	Budget	Actual	Difference			
11	Work Division								
12	Sales	95	110	100	135	25			
13	Cost Of Goods Sold	60	65	60	70	5			
14	Fixed Costs	25	15	20	25	10			
15	Gross Profit	10	30	20	40	10			
16									
17	Sheet Division..	(Including Book Division)							
18	.								
19	Income	70	65	60	100	35			
20	Expenses	45	35	30	45	10			
21	Gross Profit	25	30	30	55	25			
22									
23	Consolodated	35	60	50	95	35			
24									
25	<p>Qualifiers for horizontal labels such as "Gross Profit" must be above or to the left of the label without any intervening blank lines. Qualifiers must also have blank cells to the right.</p> <p>Unlike ordinary AutoNames, Qualifiers often need minor changes to the layout of a spreadsheet to work effectively which is why they are not enabled by default. Thus "Sheet Division" has had ".." appended to it to force the <i>Spreadsheet Detective</i> to use it as an Qualifier despite the fact that B17 is not empty. There also is a "." in A18 to prevent the otherwise blank line from terminating the search for a qualifier.</p> <p>Qualifiers for vertical labels such as "Actual" must be above or to their left, and must be centered accross the columns, possibly just using spaces.</p> <p>This example also illustrates how an Excel Named Range CoGS can be used to override the default abbreviation for the reference to B13 in B15.</p>								
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									

	A	B	C	D	E	F	G	H
1	~!Print_Area⇒H41	Names in Detail						
2	<p>Although AutoNames makes the use of Excel Named Ranges largely redundant, the <i>Spreadsheet Detective</i> takes care to accurately show the definitions of any Names that may be present in a worksheet.</p> <p>The arrow in the annotation in cell A10 indicates that the Name "ExcelName" defines the range from the cell to the right of A10 through to C10, i.e. B10:C10. The word "Intra_Name" does not appear in the brown annotation in A11 because it is similar to the text label. Name definitions are shown in cells with relevant labels where possible, but the Name "NameInCell" is defined to be D11:E12 and so the annotation had to be placed in cell D11 with the "⇒" indicating that the range starts in the same cell as the annotation.</p> <p>If a Name was used explicitly in a formula then its definition is normally only expanded if it does not refer to a range on the same sheet. Thus the references to "SquareTable" and "OneTwo" have been expanded in cell B14, but the reference to "Intra_Name" in B13 has not been expanded.</p>							
3								
4								
5								
6								
7								
8								
9								
10	~ExcelName⇒C10 ExcelNamedRange	12	34					
11	~⇒C11 Intra Name	123	234	~NameInCell⇒E12 345	456			
12				567	678			
13	Intra Name Ref	= Intra_Name# 123						
14	Inter Name	= SUM(SquareTable~Fixed!\$C\$23:\$D\$26~#) + OneTwo~1+2~# 43				= OR(TRUE , FALSE , Switch~TRUE~#) 1		
15								
16	<p>Excel Names can refer to multiple disjoint rectangular areas in which case "\$n" is appended to their definitions to indicate the area number. Thus the annotations in A26 and A28 indicate that "Mult_Area" has been defined to be the range "Names!\$B\$26:\$C\$26, Names!\$B\$28:\$C\$28". By default, Names with multiple areas are expanded in schemas that use them.</p> <p>Most Excel Names are global but local Names may be created when a worksheet is copied. The annotation in A30 makes it clear that "Local_Name" is Name that is defined locally to this worksheet because of the "!". Likewise the annotation in cell A1 shows the definition of the Print_Area local Name, which is how Excel remembers the print area. The annotation in A32 shows that the "Misc!InterSheet" Name is local to the Misc worksheet but actually refers to cell B32 in the Names worksheet! These potentially very misleading Names are created automatically when worksheets are copied and then cells are moved.</p> <p>The Named Range annotation "~!(solver_adj)" in cell B34 shows that the Solver has created a hidden Named Range which indicates what cells were adjusted in order to optimize D34.</p> <p>These types of Excel Names can be very difficult to verify without the <i>Spreadsheet Detective</i>.</p>							
17								
18								
19								
20								
21								
22								
23								
24								
25								
26	~Mult_Area\$1⇒C26 Mult Area1	5	10					
27		= C28~Mult_Area\$2# 20	= SUM(Mult_Area~Names!\$B\$26:\$C\$26,Names!\$B\$28:\$C\$28~#) 50					
28	~Mult_Area\$2⇒C28 Mult Area2	15	20					
29								
30	~!Local_Name⇒B30 Local	789						
31								
32	~Misc!InterSheet⇒B32 InterSheet Name	666						
33								
34	~!(solver_adj)⇒C34 Hidden Solver Names	Adjust	~!(solver_opt)⇒E34 5 Optimize		= - (C34# ^ 2) + 10 * C34# 25			
35								
36	<p>Because AutoNames are automatically updated, it is recommended that Excel Names should rarely be used. However, if Names are defined, it further recommended that Names not be used in the formulas themselves. Unfortunately Excel 97 may automatically put some Names into formulas as they are entered if the cell references are added by pointing to the referenced cell. It does not appear to be possible to disable this feature but simply entering the A1 references directly prevents this automatic substitution. It is also recommended that the new "Natural Language" features are not be used for models for which correctness is important because they can be very misleading as described in the NatLangEg.xls Excel 97 workbook.</p>							
37								
38								
39								
40								
41								

The Spreadshee Detective



- Production spreadsheets often contain serious **undetected errors**
- Shading/Annotations highlight **inconsistent formulas**
- AutoNames convert "D57" into "D57~DivA_NetProfit"
- **Precedent report** makes it easy to track how a value was calculated intersheet
- Comprehensive options for complex spreadsheets, including **Year 2000**
- Can **compare versions** including insertions and deletions without sharing
- Can be **printed for review** by the author, colleagues and clients
- First released November 1997, Last upgraded October 1998
- **Customers** include KPMG, Price Waterhouse, Ernst & Young, Deloitte, Arthur Andersen, CitiBank, Morgan Stanley, Macquarie Bank
- DetectTS.rtf contains a Technical Supplement which includes a comparison with existing Excel features.

(The following sheets provide additional information.)

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Phone +61 7 3391 7727 or +61 (500) 51 7727

Installation Alternatives and Troubleshooting

The *Spreadsheet Detective* is an ordinary Excel add-in and does not require any special installation procedures. The basic instructions are in the Using worksheet earlier in this workbook.

The *Spreadsheet Detective* has a toolbar that you may wish to display. If you follow the instructions in the Using worksheet the Detect*.xla add-in file will not be automatically reloaded the next time you start Excel and so the SDetective menu will not appear. However, unlike menus, Excel toolbars remain in Excel independently of whether their add-in is loaded into memory. Thus the SDetective toolbar will remain, and pressing a button on it will cause Excel to automatically reload Detect*.xla. Alternatively it may be manually opened and the menu used.

However, if an add-in is moved to a different folder, Excel does not automatically update the toolbar. To fix this, restart Excel, and manually open the Detect*.xla file. The Detective will automatically delete and then recreate any of its toolbars that point to a different directory from which it was invoked.

Note that all functions on the toolbar are also on the menu so there is no need to display the toolbar.

An alternative approach is to copy *all* the files into the MSOffice\Excel\Library folder of Excel 95 or Program Files\Microsoft Office\Office\Library of Excel 97. The next time Excel is loaded, the Tools | Add-Ins command will include the *Spreadsheet Detective* in the list of Add-Ins. The Detective may then be loaded by placing a tick in the box next to it, and the SDetective menu will then appear.

However, this option is not generally recommended because it means that the *Spreadsheet Detective* will be loaded into memory each time Excel is started, whereas if the toolbar is used then it is only loaded the first time a button is pressed.

It is also possible to place an add-in in a directory of your choice and then use the Tools | Add-Ins | Browse button to load it as an add-in. However this is not recommended because we have encountered problems with Excel when trying to uninstall an add-in which has been installed in this manner.

The first time that a registered version of the *Spreadsheet Detective* is run it may prompt you for a Licence Name and Enabling Key. This means that the licence information is incorrect in the Detecti.ini file that is created in the same folder that contains DetectR.xla. A separate Detecti.ini file should have been included with the distribution which should be used to replace the one in the DetectR.xla folder. If one was not provided then contact your distributor.

The *Spreadsheet Detective* has been written using Excel 7.0 (for Windows 95) and has been tested and tuned for Excel 97. Excel 5.0a (for Windows 3.11) is no longer supported due to a lack of demand.

The Excel 2000 versions (Detect2U.xla, Detect2R.xla) are identical to the pre Excel 2000 versions except that they have been certified with a self signed certificate. The Excel 2000 Beta had bugs with add-in security and could reject valid Add-Ins. If this happens you can install the Add-In in the Library folder as described above and ensure that Tools | Macro | Security | Trust all installed Add-Ins is set. Alternatively obtain an Excel 95/97 unsigned version (DetectUR.xla, DetectR.xla) which will also work on Excel 2000 but will cause the macro security dialog to be issued each time you load it into Excel.

If two copies of the *Spreadsheet Detective* are loaded into Excel there will be two SDetective menus. This can happen if both the registered and unregistered versions are loaded at the same time. Excel will behave unpredictably if this occurs. It is best to exit and then restart Excel if this happens.

If there is a menu present when Excel first starts but the Detective is not in the Tools | Add-Ins list, then a version may have been placed in the Library or XLStart directories. First try to use the Tools | Add-Ins menu to remove the SDetective Add-In and thus Menu. If this does not work then remove the Detect*.xla file from MSOffice\Excel\XLStart or Program Files\Microsoft Office\Office\XLStart).

The *Spreadsheet Detective* Technical Details

The annotated schema can be edited although the annotations are not automatically updated. The size of rows and columns can be changed, but extensive changes to the layout of a spreadsheet and moving of cells should be done when the spreadsheet is unannotated to ensure that Excel does not lose track of the sizes of the rows and columns in the unannotated worksheet. The date and time the spreadsheet was last annotated is included in the statistics box at the end of an annotated spreadsheet.

If a spreadsheet is Zoomed for viewing, then it is best to annotate them after it has been zoomed. This is because Excel does not zoom fonts in textboxes correctly and so annotations may occasionally not fit properly until the spreadsheet is re-annotated. If the spreadsheet has been zoomed very small, Excel may display the "R" symbol as an "A".

The *Spreadsheet Detective* protects the drawing objects on a sheet to prevent them being accidentally changed. No password is used, so Tools | Protection | Unprotect Sheet may be used to remove this protection if it is necessary to edit user defined drawing objects. Alternatively, the user defined objects can be selected and then the Format | Object | Protection | Locked/Lock_Text properties can be cleared on them. If the worksheet or workbook has been protected in any other way then the Detective will issue a message and not attempt to annotate it.

The Tools | Options | Edit | Cut, Copy and Sort objects with cells option is also disabled because it causes the annotation to be copied with cell contents. As this is an application level setting, the *Spreadsheet Detective* cannot restore it meaningfully. We recommend that it be left permanently disabled as it may cause unexpected results even with unannotated sheets and is very rarely useful.

There have been a long series of serious problems with Excel 97 not recalculating formulas correctly. The normal solution is to use the undocumented Ctrl+Alt+F9 key which forces all cells to be recalculated. By default, the *Spreadsheet Detective* performs this automatically after annotating a spreadsheet if the Tools | Options | Calculation | Automatic option has been set to ensure that the annotated spreadsheets are not displaying obsolete values. If this takes too long on large spreadsheets then either set calculation to manual, or use the SDetective | Special | Never option to suppress this feature.

If manual calculation is enabled then note that it is necessary to press Ctrl+Alt+F9 to fully recalculate the spreadsheet. Just pressing F9 or using the Tools | Options | Calculation dialog may not properly recalculate all formulas.

When the *Spreadsheet Detective* annotates a spreadsheet it removes any window splits and frozen panes for Excel 7/95 because this is very slow (this is not a problem in Excel 97). Gridlines and headings are also enabled for both display and printing. The original settings are remembered in an invisible textbox. It is best not to change these settings while a spreadsheet is annotated because the changes might be lost next time the spreadsheet is unannotated. It is also usually best to reduce the size of the wide margins that Excel provides by default. The File | Page Setup | Sheet | Black & White option may improve the clarity of the coloured text for some (but not most) black and white printers.

When the *Spreadsheet Detective* determines the size of spreadsheet to annotate, it stops after finding a block of 100 empty rows or 50 empty columns. An unusual sheet that contains such a construct can still be completely annotated by explicitly selecting a range to be annotated, provided that entire rows and columns are not selected. The Detective may also extend the worksheet two columns to the right in order to provide extra space for schema boxes if necessary. The amount of space can be varied by changing the size of these two columns.

There are options to control most aspects of the *Spreadsheet Detective*, and it is also possible to change the characteristics of the annotations by altering a prototype worksheet. These are described in the Technical Supplement, DetectTS.rtf which also contains information about the following:-

- A detailed comparison with existing Excel 97 features.
- A Year 2000 compliance statement
- A description of all the options available in SDetective | Options

Licencing information is available in Order.htm. The web site <http://www.uq.net.au/Detective> contains more current information as well as a concise overview of the tool's main features and links to other web sites that describe spreadsheet tools and errors.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	~!Print_Area=M49												
2	Miscellaneous Features												
3	<p>This spreadsheet demonstrates some additional features.</p> <p>C18 demonstrates how AutoNames are used to succinctly describe both ends of multi-cell ranges. This technique is used whenever the reference is not on the row or column so an "R" line cannot be used, as well as being used in the reports.</p> <p>The range H16:K19 shows how formulas that have been copied in complex patterns are annotated.</p>												
16		1994	1995	1996	1997	1998	..				= J16# + 2		
17	Sales	123	234	345	456	567			= I16# + H17# + 1	1	2	5	
18	Previous Year (No R line)	{ = B17:E17 '1994'Sales:'1997# }											
19		123	234	345	456					13	16	22	
20										14	31	33	
21	<p>Schemas for formulas that are copied more than 10 (by default) times are repeated at the end as illustrated in M29 and M30. This is useful when one needs to scroll a window right and thus cannot see the left hand schema. Repeated Schemas are not included in the report, are not counted as Schemas in the statistics and do not produce diagonal dependents lines.</p> <p>Row 33 has been aligned to the top of the cell so the Spreadsheet Detective has placed the schema and Name definition in the bottom of the row so that they does not cover the original contents.</p> <p>Embedded charts may also be annotated so as to make it possible to verify that the correct data is being displayed. Invalid charts can produce invalid decisions.</p>												
28	Repeated Schema	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
29	Opening	42	= B30'Jan'Closing	51	56	61	68	74	82	90	99	= L30'Nov'Closing	120
30	Closing	= B29'Opening# * 110%	51	56	61	68	74	82	90	99	109	= M29'Opening * 110%	132
33	Aligned Top	1	1	2	3	5	8						
34				= C33'Feb# + B33'Jan#									
35		<p>Fixed Costs: = SERIES(Misc!\$B\$52# , Misc!\$C\$51:\$F\$51# , Misc!\$C\$52:\$F\$52'Qtr1'FixeCosts:'Qtr4# , 1)</p> <p>Gross Profit: = SERIES(Misc!\$B\$53# , Misc!\$C\$51:\$F\$51# , Misc!\$C\$53:\$F\$53'Qtr1'GrosProfit:'Qtr4# , 2)</p> <p>Cost of Goods Sold: = SERIES(Misc!\$B\$54# , Misc!\$C\$51:\$F\$51# , Misc!\$C\$54:\$F\$54'Qtr1'CosOfGooSol:'Qtr4# , 3)</p> <p>Sales (Gross): = SERIES(Misc!\$B\$55# , Misc!\$C\$51:\$F\$51# , Misc!\$C\$55:\$F\$55'Qtr1'Sales:'Qtr4# , 4)</p>											
36	Profit Figures												
37													

Empty Schema Boxes and the Formula Map

This worksheet has been annotated with the **SDetective | Options | Layout | Show schemas as Empty boxes** option enabled which produces a more **compact layout** without shading. This can be useful for spreadsheets that have been manually shaded with patterns rather than just colours, or for printers that have trouble with shading. There are also options to suppress the **Named range definitions**, or to only show the **Named Range definitions** and completely suppress the schemas.

The **SDetective | Options | Special | Produce trailing Formula Map** option has also been enabled which produced the **very compact map** at the end of the sheet which describes each cell by a single character. A legend for the map appears in the title. The **bold green dashed box** shows that just rows 10 to 16 were selected to be annotated.

	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Total
Sales (Gross)	600	1,700	1,900	1,400	5,000
Cost of Goods Sold	400	1,500	1,400	1,100	4,000
Gross Profit	200	200	550	300	1,050
Fixed Costs	79	94	94	28	
Capital <small>~!Income=>G15</small>	4,000	4,000	5,000	6,000	
Profitability	#NAME?	#NAME?	#NAME?	#NAME?	

Formula Map
 ' ': Empty, '#': Number, '": Text, 'Ss': Schema,
 '^'/'<': Schema is Above/Below, '?': Error, '\$': Trivial Formula

	ABCDE	FGH
10	. " " " " "	
11	"## ##S	
12	"## ##^	
13	"S< #<^	
14	"S< <S.	
15	"## ##.	
16	"S< <<.	

	A	B	C	D	E	F	G	H	I
1	~!Print_Area=I19	Local and Global Named Ranges							
2	<p>The following two sheets demonstrate how Excel Names can be very misleading without the Spreadsheet Detective. A close inspection of the figures below will reveal that the Profit below is not B11 - B12 - B13, because the Named Range "Fixed_Cost" does not actually refer to Actual!B13.</p> <p>What happened was that the Budget sheet was initially created without the Fixed Cost row and had the Names created using Insert Names Create. The Budget sheet was then copied to create the Actual sheet so Excel made local copies of the previously global Names. "Fixed Cost" was then added to both sheets, but only Budget had its Names reCreated. Thus while the reference to "Sales" in the formula in B14 refers to Actual!B11, the reference to "Fixed Cost" actually refers to Budget!B13 which is why the Name has been expanded in the schema. The lack of a diagonal line in B13 also highlights the error. Without the Spreadsheet Detective there would be no indication of this error.</p> <p>To further illustrate the subtle nature of Names, the global Name Variance refers to Actual!B16, while Actual!Variance refers to cell Budget!B16. This means that B17 is not twice B16. This would be difficult to verify without the annotations that explicitly show which cells are being referred to by each schema.</p>								
3									
4									
5									
6									
7									
8									
9									
10									
11	Sales	~!>B11	124						
12	CoGS	~!>B12	35						
13	Fixed Cost		45						
14	Profit		###						<- Fixed_Cost refers to Budget Sheet
15	Budget		40						
16	Variance	~>B16	###						<- Global Variance refers to Actual Sheet
17	2 * Variance		###						<- Actual!Variance refers to Budget Sheet!
18									
19									

	A	B	C	D	E	F	G
1	~!Print_Area≡G17 Local and Global Named Ranges (Continued)						
2							
3							
4							
5							
6							
7							
8							
9							
10	Division A Budget						
11	Sales	~⇒B11 ✓	123				
12	CoGS	~⇒B12 ✓	50				
13	Fixed Cost	~⇒B13 ✓	33				
14	Gross Profit	~⇒B14 ✓ = Sales# - CoGS# - Fixed_Cost#	40				
15	Previous Budget	✓	25				
16	Variance	~Actual!⇒B16 ✓ = B14 - Gross_Profit - B15 PrevBudgt#	15				
17							

	A	B	C	D	E	F	G	H	I
1	~!Print_Area≡I18	Comparison to Natural Language							
2	<p>Excel 97 has introduced a new "Natural Language" feature that enables one to enter labels in cells. However, these labels can be very ambiguous as demonstrated in the NatLang.xls Excel 97 spreadsheet which contains several formula errors that cannot be detected by examining the formulas! We therefore do not recommend that Natural Language be used for any spreadsheet for which correctness is important.</p> <p>This example has the same semantics as NatLang.xls, but the Spreadsheet Detective makes the errors in the model clear because it shows both the original A1 references and the AutoNames. In particular:-</p> <ul style="list-style-type: none"> - The schema in G13 is inconsistent with G8 because it incorrectly includes the Average in the sum. - The schema in E15 is also wrong -- it is the total of the Rubber Dept's figures. - The meaning of the Total in D16 is clear. 								
3									
4									
5									
6	Rubbery Figures Inc								
7			1996	1997	Average	Sum			
8		Rubber Dept							
9		Income	150	160	155	310			
10		Expenses	130	140	135	270			
11		Net	20	20	20	40			
12		Figures Dept							
13		Income	130	130	130	390			
14		Expenses	160	170	165	495			
15		Net	-30	20	-5	-15			
16		Total	-10	40					
17									
18									

	A	B	C	D	E	F	G
1	~!Print_Area⇒G29						
	Extended Solver Example						
2	<p>This provides a slightly more complex example of an annotated spreadsheet that was used to determine the optimum amount to spend on Advertising to maximize profits.</p> <p>Note how the annotations automatically document assumptions behind the model such as the method of estimating the Units Sold. AutoNames make the meaning of schemas such as "= B18`GrosMargin - B22`TotaCosts" much clearer than the original "= B18 - B22". The fact that the range line in row 15 does not reach B15 makes it easy to find the incorrect Sum() in F15 and the inconsistant formula in E21 and value in D25 can be found without having to examine each individual formula in the spreadsheet. The erronous definition of the Named Ranges "Product_Cost" and "Product_Price" are also made visible to someone that is reviewing the model.</p>						
3							
4							
5							
6							
7							
8							
9							
10							
11	Solver						
12		Qtr1	Qtr2	Qtr3	Qtr4	Total	
13	Seasonality	0.9	1.1	0.8	1.2		
14							
15	Units Sold	= 35 * B13`Seasoty# * (B20`Adverng# + 3000) ^ 0.5				= SUM(C15:E15`R)	
16	Sales Revenue	= B15`UnitsSold * \$B28`-Product_Price#					
17	Cost of Sales	= B15`UnitsSold * \$B27`-Product_Cost#					
18	Gross Margin	= B16`SaleRevee - B17`CostOfSales					
19	Salesforce	8,000	8,000	9,000	9,000	26,000	
20	Advertising	10,000	27,016	10,000	42,882	79,897	
21	Corp Overhead	= 0.15 * B16`SaleRevee			= 0.12 * E16`SaleRevee		
22	Total Costs	= SUM(B19:B21`R)					
23							
24	Profit Margin	= B25`ProdProfit / B16`SaleRevee					
25	Prod. Profit	= B18`GrosMargin - B22`TotaCosts				=!(solver_opt)=F25	
26							
27	Product Price	\$25.00					
28	Product Cost	\$40.00					
29							

	A	B	C	D	E	F	G	H	
1		~!Print_Area⇒H14	Another example with Solver						
2		~Price⇒C2 ~!(solver_adj)⇒C2	31.50		Markup	#NAME?			
3									
4			Qtr1	Qtr2	Qtr3	Qtr4	Total		
5		Seasonality	1	0.8	0.9	1.2			
6		Units Sold	370	296	333	444	1,073		
7	+	Gross Profit	#NAME?	#NAME?	7,000	#NAME?	#NAME?		
8	-	Plant & Equipment	1,000	1,400	1,300	1,100	4,800	ok	
9	-	Corp. Overheads	#NAME?	#NAME?	2,100	#NAME?	#NAME?		
10	=	Net Profit	#NAME?	#NAME?	2,800	#NAME?	#NAME?		
11		Variance	#NAME?	#NAME?	#NAME?	#NAME?			
12							#NAME?		
13									
14									

	A	B	C	D	E	F	G	H	I
1	(Support Worksheet, Please ignore)								
2	Intrest			Loan	Interest				
3				0	3.50%				
4				200	= E3# - 0.1% 3.40%				
5				1000	3.30%				
6				5000	3.20%				
7				10000	3.10%				
8									
9									
10				
11	Date		Jan-98	Apr-98	Jul-98	Oct-98	Jan-99		
12					
13	Loan		5000	6000	5500	4500			
14	Interest Rate		= VLOOKUP(C13`Loan# , \$D3:\$E7`Loan:Interst , 2)						
15	Interest		39	48	44	37			
16	Unit Price		2	2	2.05	2.05			
17	Floor Area		20	23	24	28			
18	Lease Cost		40	46	49.2	57.4			
19	Fixed Costs		79	94	94	95	= SUM(D19:F19)		
20									
21									
22			Value	Square					
23	~SquareTable=>D26	One	1	1	1				
24		Two	2	4	8				
25		Three	3	9	27				
26		Four	4	16	64				
27									
28	.Intersheet Circular		= Checks!F22`CircRefes / 2						
29									
30									
31									
32									
33	Statistics for this sheet annotated on 21-Oct-1998 19:06								
34	Size: 28 Rows by 7 Columns								
35	Nr Formulas: 22								
36	Nr Schemas: 7 * Average nr symbols per Schema: 6.0 = Total Complexity: 42								
37	Schemas that require particular care:-								
38	Reference to Non Numerics: {}								
39	Constants: {E4, C15}								
40	Large formulas: {}								
41	Unprotected Schemas: {}								
42	Unprocessed Ranges: {}								
43									