



# Worksheets by Design

Need to set up a worksheet but don't know where to start? This beginner's guide provides tips for creating a worksheet that's manageable, accurate, and easy to expand.

*William Urschel*

Every good story—be it a novel, play, movie, or joke—has a basic design called dramatic structure. Any story worth telling sets up the characters, introduces complications, works toward resolution, and arrives at a denouement.

A well-designed worksheet does exactly the same thing. Whether it's a simple affair that calculates an IRA or a magnum opus that computes a corporation's net worth, a properly constructed worksheet should set up the basic assumptions, introduce data, work out the results, and end with a summary.

Structure does more than simply impose order; it helps us understand and explain complex situations. Think of the New York City telephone directory, arranged alphabetically. That's order. Now imagine the same directory arranged by ethnic origin, income lev-

el, or occupation. Suddenly you know a great deal more about New York. That's structure.

Good worksheet structure conveys a sense of flow or progression. For example, when you get to the profit line in a worksheet, you should be able to answer these questions: What are the basic assumptions? Where did the data come from? And what circumstances affected the results? Answer those questions, in that order, and you will convey (and understand) the dynamics of any financial model you create with a spreadsheet program. Change the order, omit an element, or try to combine one part with another, and the worksheet becomes a convoluted mess.

To avoid chaos, build worksheets using a vertical, four-block structure: Assumptions, Input, Calculation, and Bottom Line. Figure 1 provides a blueprint of a worksheet that projects costs and returns for Sisquoc Data, a small company that sells accounting software at retail prices via direct mail (and other venues) and at wholesale prices to dealers. Figure 2 shows the worksheet writ large according to the principles of good worksheet design. (For hands-on tips on creating worksheets, see the sidebar "Nitty-Gritty Setup.")



### The Assumptions Block

Assumptions are the constants in a worksheet—in this example, the list price of the product, the wholesale price per unit, and the materials costs and shipping costs. It's important that all constants be grouped together. If you embed constants at random when setting up a worksheet, anyone else looking at the worksheet won't know what or where the constants are (and you may not either, six months down the road).

Think of the Assumptions block at the top of the worksheet as a control panel. You can change the assumptions to test various "what if" conditions, such as a decrease in the price of raw materials or an increase in the cost of labor. Twist or push one figure here, and the whole worksheet changes.

### The Input Block

The Input block is where you enter the bulky data the worksheet will digest. In Figure 2 this block contains the up-front costs of the business: Fixed Costs such as salaries and rent, and four kinds of Advertising Costs—direct mail, card decks, display ads, and dealers. (Card decks are decks of postcards with an ad on one side and the business's mailing address on the other. Dealer costs include mailing-list rentals, the cost of attending trade shows, and the cost of placing ads in trade magazines.) Calculations performed subsequently in the Calculation and Bottom Line blocks will draw on figures here and in the Assumptions block.

A word of caution: In larger worksheets, the Input block can easily bloat. Fixed costs don't present any problems—the numbers are based on solid historical information, and the data is entered directly into this area of the worksheet. But variable information, such as projected advertising costs, is another story. This data must come from somewhere (unless you're just making a wild guess), and that source must be detailed on the worksheet. Even in this relatively simple example, showing the cost calculations for four different advertising categories would clutter up the Input block, making it harder to

set up, difficult to change, and almost impossible for anyone else to understand.

The solution is to use "satellite" worksheets—separate worksheets (or discrete sections within a worksheet) that pass results to the main worksheet. This example has four satellites; each calculates the costs of (and unit sales generated by) a particular advertising scheme, then forwards the results to the main worksheet's Input and Calculation blocks. The satellites are kept in separate files so the main worksheet remains uncluttered. As Figure 2 shows, satellites use the same block structure as the main worksheet.

A complete separation of the four satellites makes practical sense, since each uses a different process to arrive at estimated costs. For the purposes of this example, just one satellite, the direct mail campaign, is illustrated in Figure 2. (To see how this satellite connects with the Input section, note that total costs data is neatly funneled into row 29 of the Input section.) Farming out calculations to satellite work-

*It's best to segregate macros in the nether regions of the worksheet so they run properly and are not accidentally overwritten by data or corrupted by sorting rows or shuffling columns.*

sheets reaps an extra harvest: The main worksheet remains small and is more speedily recalculated.

One final note on the satellite system: Using a "file combine" procedure, macros can automate the updating process. One keystroke can fetch the costs and results from named ranges in all the satellites and recalculate the main worksheet. Because many spreadsheet programs execute macros line by line until an empty line appears, it's best to segregate macros in the nether regions of the worksheet so they run properly and are not accidentally overwritten by data or corrupted by sorting rows or shuffling columns.



# Building a Worksheet Block by Block

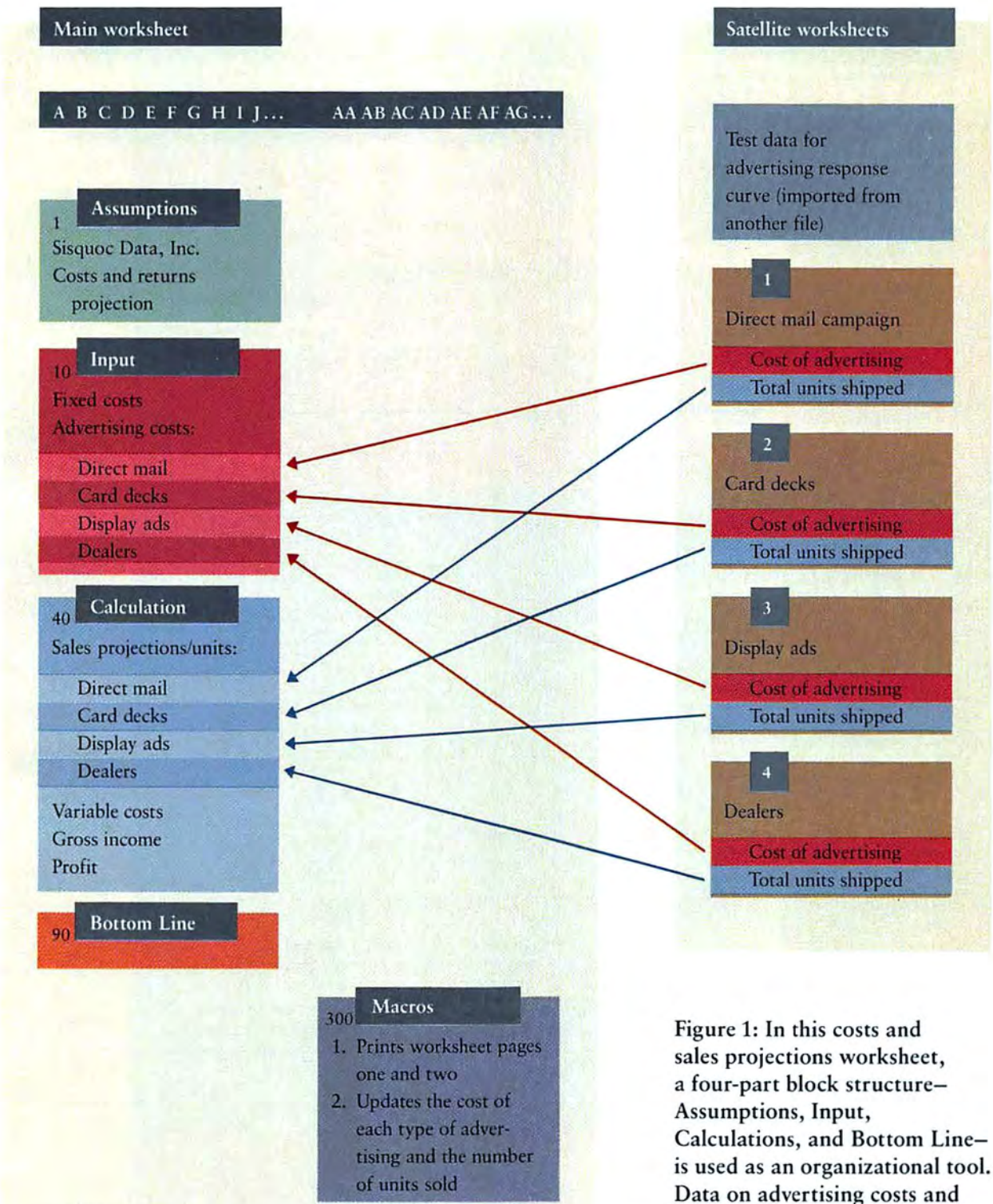


Figure 1: In this costs and sales projections worksheet, a four-part block structure—Assumptions, Input, Calculations, and Bottom Line—is used as an organizational tool. Data on advertising costs and the number of units sold is fed into the main part of the worksheet from four satellites to help keep the central activity uncluttered.



Main worksheet

Sisquoc Data, Inc. Costs and returns projection									
Assumptions									
List price per unit		\$595		Shipping per retail unit		\$7			
Wholesale price per unit		\$350		Shipping per wholesale unit		\$2			
Unit materials cost		\$15							
Fixed Costs									
	Sep 87	Oct 87	Nov 87	Dec 87	Jan 88	Feb 88	Mar 88	Apr 88	
President	5,000	5,000	5,000	5,000	5,250	5,250	5,250	5,250	
Sales manager	4,000	4,000	4,200	4,200	4,200	4,200	4,200	4,200	
Programmer 1	4,000	4,000	4,000	4,000	4,000	4,100	4,100	4,100	
Programmer 2	3,500	3,500	3,600	3,600	3,600	3,600	3,600	3,600	
Production manager	3,000	3,000	3,000	3,000	3,000	3,200	3,200	3,200	
Rent/utilities/insurance	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	
Legal/accounting fees	550	550	550	550	550	550	550	550	
Office furnishings	375	375	375	375	375	375	375	375	
Supplies/misc. printing	625	625	625	625	625	625	625	625	
Mailer artwork & typesetting	1,200	200	0	0	0	1,200	200	0	
Total fixed costs	\$25,750	\$24,750	\$24,850	\$24,850	\$25,100	\$26,600	\$25,600	\$25,400	
Cumulative fixed costs	\$25,750	\$50,500	\$75,350	\$100,200	\$125,300	\$151,900	\$177,500	\$202,900	
Advertising Costs									
	Sep 87	Oct 87	Nov 87	Dec 87	Jan 88	Feb 88	Mar 88	Apr 88	
Direct mail	3,200	6,400	9,600	12,800	16,000	16,000	16,000	16,000	
Card decks	0	210	150	150	150	150	150	150	
Display ads	7,250	7,250	7,250	7,250	7,250	7,250	7,250	7,250	
Dealers	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	
Total advertising costs	\$11,700	\$15,110	\$18,250	\$21,450	\$24,650	\$24,650	\$24,650	\$24,650	
Sales Projections/Units									
	Sep 87	Oct 87	Nov 87	Dec 87	Jan 88	Feb 88	Mar 88	Apr 88	
Direct mail	0	136	281	429	579	729	743	748	
Card decks	0	210	150	150	150	150	150	150	
Display ads	0	75	110	115	115	115	115	115	
Retail subtotal	0	421	541	694	844	994	1008	1013	
Dealers	0	123	132	154	168	172	172	172	
Wholesale subtotal	0	123	132	154	168	172	172	172	
Total unit sales	0	544	673	848	1012	1166	1180	1185	
Variable Costs									
	Sep 87	Oct 87	Nov 87	Dec 87	Jan 88	Feb 88	Mar 88	Apr 88	
Package/printing/disks	0	8,160	10,095	12,720	15,180	17,490	17,700	17,775	
Retail shipping	0	2,947	3,787	4,858	5,908	6,958	7,506	7,091	
Wholesale shipping	0	246	264	308	336	344	344	344	
Total variable costs	\$0	\$11,353	\$14,146	\$17,886	\$21,421	\$24,792	\$25,100	\$25,210	
Gross Income									
	Sep 87	Oct 87	Nov 87	Dec 87	Jan 88	Feb 88	Mar 88	Apr 88	
Direct mail	0	80,920	167,195	255,255	344,505	433,755	442,085	445,060	
Card decks	0	124,950	89,250	89,250	89,250	89,250	89,250	89,250	
Display ads	0	44,625	65,450	68,425	68,425	68,425	68,425	68,425	
Dealers	0	43,050	46,200	53,900	58,800	60,200	60,200	60,200	
Total gross income	\$0	\$293,545	\$368,095	\$466,830	\$560,980	\$651,630	\$659,960	\$662,935	
Profit									
	Sep 87	Oct 87	Nov 87	Dec 87	Jan 88	Feb 88	Mar 88	Apr 88	
Total gross income	0	293,545	368,095	466,830	560,980	651,630	659,960	662,935	
Advertising costs	(11,700)	(15,110)	(18,250)	(21,450)	(24,650)	(24,650)	(24,650)	(24,650)	
Variable costs	0	(11,353)	(14,146)	(17,886)	(21,421)	(24,792)	(25,100)	(25,210)	
Fixed costs	(25,750)	(24,750)	(24,850)	(24,850)	(25,100)	(26,600)	(25,600)	(25,400)	
Total net profit	(\$37,450)	\$242,332	\$310,849	\$402,644	\$489,806	\$575,588	\$584,610	\$587,675	
Cumulative net profit	(\$37,450)	\$204,882	\$515,731	\$918,375	\$1,408,181	\$1,983,769	\$2,568,379	\$3,156,054	
The Bottom Line - (Sep 87 - Apr 88)									
Overall		Copies sold	Gross value	Performance ratios					
					Cost	Sales	Ratio		
Retail copies		5,515	3,281,425		96,000	2,168,775	23		
Wholesale copies		1,093	382,550		1,110	660,450	595		
Total		6,608	3,663,975		58,000	452,200	8		
All costs			(507,921)		10,000	382,550	38		
Total net profit			\$3,156,054						

Assumptions block

Input block

Calculation block

Bottom Line block



## Satellite worksheet #1

	A	B	C	D	E	F	G	H	I			
1				Direct Mail Campaign								
2				Historical data and future schedule								
3	Assumptions											
4												
5												
6	Response curve			Costs						Assumptions		
7		Estimated	Historical									
8	00 - 30 Days	1.36%	1.31%	Printing per piece		00.120						
9	30 - 60 Days	0.09%	0.08%	Postage per piece		00.125						
10	60 - 90 Days	0.03%	0.03%	List rental per 1000		75.000						
11	Over 90 Days	0.02%	0.02%									
12	Total response	1.50%	1.44%									
13												
14	Mailings			Sep 87	Oct 87	Nov 87	Dec 87	Jan 88	Feb 88	Mar 88	Apr 88	Input block #1
15												
16	Total pieces	10,000	20,000	30,000	40,000	50,000	50,000	50,000	50,000	50,000		
17	Average cost/piece	0.320	0.320	0.320	0.320	0.320	0.320	0.320	0.320	0.320	0.320	
18	Total costs	3,200	6,400	9,600	12,800	16,000	16,000	16,000	16,000	16,000	16,000	Calculation block #1
19												
20	Sales Projections			Sep 87	Oct 87	Nov 87	Dec 87	Jan 88	Feb 88	Mar 88	Apr 88	Input block #2
21												
22	00 - 30 Days	0	136	272	408	544	680	680	680	680		
23	30 - 60 Days	0	0	9	18	27	36	45	45	45		
24	60 - 90 Days	0	0	0	3	6	9	12	15	15		
25	Over 90 Days	0	0	0	0	2	4	6	8	8		
26	Total sales in units	0	136	281	429	579	729	743	743	748	Calculation block #2	

Figure 2: Both the main worksheet (left) and the satellite worksheet (above) use a blocklike structure for clarity. With the help of a macro, the satellite's total costs and total sales rows (shaded in red and blue, respectively) are automatically fed into the main worksheet.

### The Calculation Block

This block provides details about Sisquoc Data on a month-by-month basis but doesn't provide insight into the big picture—a job reserved for the Bottom Line block just below it. The Calculation block is almost entirely mechanical; you don't enter any data manually, but let simple formulas here gather data from various sources and crunch away. In fact, once the model is debugged and proven, many spreadsheet jockeys will protect the range of cells containing the Calculation block.

Starting at row 42, projected sales figures for each advertising strategy are pulled in from the four satellites and added up; note that the dealers line is segregated from the retail subtotals for the sake of readability.

Variable Costs (rows 57 through 61) are calculated by formulas that multiply the constants in the

Assumptions block (materials costs and shipping costs) by the total unit sales (row 52). A common design error would include the Variable Costs in the Profit section of the worksheet without showing how they were derived. The end result would be the same, but the supporting logic would be lost.

The Gross Income section generally mimics the structure of the Variable Costs section. Formulas here simply multiply constants in the Assumptions block (in this case, list price and wholesale price per unit) by the number of units sold. For example, direct mail income for October 1987 (cell D67) is the result of multiplying the list price per unit (\$595, in cell C5) by projected units sold via direct mail (136, in cell D42). Formulas tucked into row 72 add up the numbers in rows 67 through 70.

The Profit section works much the same way. Total net profit is merely the gross income minus fixed, advertising, and variable costs. Cumulative net profit represents the company's expected cash flow—a useful line to graph.

## Nitty-Gritty Setup

Figure 2 provides an example of a well-designed worksheet; here are some tips for setting up your own.

### Position Main Sections

#### According to Logical Structure

After determining what your worksheet will accomplish—organizing personal finances, setting up an inventory control system, or creating a business budget—follow the pattern laid out in Figure 1 and block out the worksheet's main sections from top to bottom.

Cast the worksheet's general shape by entering labels for each block, from section titles (such as Assumptions) to the line item labels (such as office furnishings). For convenience' sake, anchor the different blocks in the worksheet to easy-to-remember rows such as A10, A40, and A90. Don't put blocks side by side, because if you later insert rows in one block, you'll encroach on its neighbor. And as noted in the article, create distant satellites that feed data and results into the main part of the worksheet.

### Test Logic With Sample Data

Once you've finished blocking out the worksheet, typing in the labels, and specifying range names, enter the formulas. Then, enter some simple test data and run it through the worksheet so you can flag any errors in

logic or typing. Plug in large round numbers such as 100,000, and make sure they percolate all the way to the bottom line. Then enter the real data.

### Use Range Names to Minimize Reference Errors

Although the worksheet's formulas and macros can reference specific cells or labels, using range names simplifies matters. Range names can be applied to a cell, a row, or an entire block in the worksheet. They minimize typing errors when creating formulas and macros, and most spreadsheet programs include a show function that lists all range names with their beginning and ending cells. Ranges should always be assigned to cells or rows that are used in calculations. For example, the list price per unit (\$595) in the Sisquoc worksheet is named Fullprice and used by the direct mail, card decks, and display ads rows in the Gross Income section to calculate dollar sales.

### Use Global Formats

Next, format the worksheet globally for the type of data most of the cells will hold—percentages, currency, numbers with decimal places. The worksheet in Figure 2 was formatted globally for numbers with no decimal places; later, individual cells and ranges were formatted independently. For example, some costs and totals ranges were formatted to hold figures with parentheses and dollar signs, respectively, to set off these ranges from the others. Other global commands



can then be used to adjust column width and specify whether labels are flush left, flush right, or centered.

### **Protect Macros From Potential Corruption**

Macros should always be below and off to the side of the worksheet's main activities; in Figure 1, for example, macros are fastened at row AA300. After ensuring that everything is drum-tight, use the spreadsheet's cell-protect or read-only feature to protect macros and other areas where data should not be entered.

### **Document, Document, Document!**

Finally, make some room for documentation at the beginning of the worksheet. Just as an article summary helps to guide readers, worksheet documentation helps subsequent users find the information they need. A "table of contents" that lists the main blocks of the worksheet along with range names is a handy guide; it also makes sense to note macro key combinations and describe what each macro does. —W. U.

### **The Bottom Line Block**

The Bottom Line is the report card that delivers, in one pithy group of figures, Sisquoc Data's grades for the semester. In this example, the block identifies how many copies of software were sold and their gross value—in other words, how much revenue was collected. To clarify the effectiveness of Sisquoc Data's advertising, a sales/cost ratio section spells out how well each advertising scheme generated sales.

### **Form and Content, Hand in Hand**

If you set up a worksheet with the block model in mind, each step in the worksheet will be visible and will support the one that follows it. In the case of Sisquoc Data, the four big blocks are made up of smaller, structurally similar blocks, which makes it easier to root out errors in procedures or logic and reduces the number of convoluted calculations. When the formulas that run the worksheet perform simple, straightforward tasks—adding up a column of numbers or taking a value from one cell and multiplying it by another—you're on the right track.

This modular structure even makes it easier to print selected sections of the worksheet. Want to look at just the Fixed Costs section, the dealers costs line, or the cumulative net profit? No problem; mark it and print it out.

Good structure really pays off when you have to modify the worksheet, because it's easier to recognize logically discrete elements, add new blocks, reorder blocks, and orbit new satellites. The worksheet will also make more sense from the start—both to you and to anyone looking over your shoulder—leaving you free to concentrate on the how and why of the bottom line. ●

*William Urschel is president of Arc Tangent, maker of ArcList, a professional mailing-list-management program.*