Chapter 7
Using Formulas and Functions

Although the majority of your analysis can be performed through the Research Assistant, there may be times when you are building a custom report or chart or working in Research Insight's Classic window when you will want to incorporate formulas and functions.

A **Formula** is a mathematical or logical combination of components and operators that you can build to extract information from the database or perform a calculation.

You can use formulas, in one form or another, in almost all of the applications you use in Research Insight. Screens, reports, charts and spreadsheets all require formulas to extract the information you need from the database.

A **Function** is a pre-defined calculation that contains a combination of items, concepts, companies, time periods and other functions.

This chapter shows you how to

- build your own formulas
- add wildcards to your formulas
- add functions to your reports, charts and screens

Formulas in Research Insight

A formula is a mathematical or logical combination of one or more items, concepts, functions and operators that you can build to extract information from the database or perform a calculation.

You can use formulas in Research Insight to

- create screen criteria
- define data in your report or spreadsheet
- add data labels to your report or spreadsheet
- create your own concepts

Formulas consist of combinations of different components and operators. The components tell Research Insight what information it needs to retrieve or calculate. The operators tell Research Insight how to read the formula and perform the calculation.

This formula calculates average sales over a five year period from fiscal year 1996 to fiscal year 2000.

Formula Components

Formula components tell Research Insight what information it needs to retrieve or calculate. There are five different formula components: functions, items, company references, sets, time period references and concepts. Each of these is explained in detail below.

Functions

A function is a pre-defined calculation. Functions can contain a combination of items, concepts, companies, time period references and other functions. Each function begins with the @ symbol and is followed by a short name. Each function also includes an argument. Arguments tell Research Insight which variables to evaluate, enabling you to tailor each function for your specific needs.

Example

Function:	@PAVG(formula, period 1,period 2)
Function with argument:	@PAVG(EPSPX,-4,0)
What it does:	Averages earnings per share over the last five years.

Items

An item is a piece of information collected and stored in a database. Each item is identified by a descriptive name and a mnemonic (abbreviated name). Research Insight contains hundreds of data items covering a wide range of fundamental financial and market information.

Example

Item Name:	Net Annual Sales
Item Mnemonic:	SALE
What it does:	This item represents gross sales (the amount of actual billings to customers for regular sales completed during the period) reduced by cash discounts, trade discounts, and returned sales and allowances for which credit is given to customers.

Company References

Company references allow you to attach a company's ticker symbol or GVKEY* to a formula so that Research Insight will refer to that company's data. When you include a company reference in a formula, you're telling Research Insight to retrieve or calculate that data for a specific company only, regardless of other companies or sets that may be included in your screen, report, chart or spreadsheet.

Example

"IBM":SALE	Retrieves the current year net sales for International Business Machines Corp. (Using the ticker symbol.)
"11217":AT[Y00]	Retrieves total assets for 2000 for Volvo AB. (Using the GVKEY.)

* GVKEY identifies companies in the COMPUSTAT (Global) database.

Sets

A set is a collection of companies, segments, issues or currencies that share a common attribute. All sets begin with a dollar sign ($) and are defined with a set name. Research Insight has an extensive collection of pre-defined sets you can use or you can create your own.

Example

$SP_500	A pre-defined set in the COMPUSTAT (North America) database that contains all of the current companies in the S&P 500 Index.
$F	A pre-defined set in the COMPUSTAT (Global) database that contains active financial companies around the world.

Time Period References

A time period reference tells Research Insight to retrieve a data value for a particular point in time other than the current period. If you do not include time period references in your formulas, Research Insight automatically uses the current period (or the most recently available data).

Example

(IB/SALE)[-3]	Calculates the return on sales value for the period 3 years prior to the current period. If the current period for this company is 2000, this formula returns the value for 1997.

Concepts

Concepts are mathematical or logical combinations of items and/or other concepts. They are generally used to save time and increase accuracy when manipulating data in routine, repetitious or complex expressions. Concepts do not contain values. They are mathematical calculations that are evaluated each time you use them.While Research Insight contains more than 300 pre-defined concepts, you can also create your own customized concepts or modify existing concepts.

Example

OANCF-DV-CAPX	This concept is Operating Activities - Net Cash Flow minus Cash Dividends minus Capital Expenditures, which is the calculation for Free Cash Flow.

Formula Operators

Parentheses and mathematical and relational operators, often referred to as formula operators, tell Research Insight how to read formulas and perform calculations. The following section explains each of these operators in detail.

Parentheses

Parentheses make long formulas easier to read and ensure that Research Insight performs the calculation in the appropriate order. The part of a formula enclosed in parentheses is always performed first. If the parentheses contain other parentheses, the innermost set is calculated first.

Example

NI/((AT+AT[-1])/2)	Calculates net income divided by the average total assets for the current and previous year.

If parentheses are not present, formula calculations are performed in the following order:

Precedence	Operator
1	All functions
2	Exponentiation (^)
3	Negation
4	Multiplication (*) and division (/)
5	Addition (+) and subtraction (-)
6	Relational operators

If your formula contains two or more operators with the same level of precedence, they are performed left to right.

Using Parentheses ( ), Brackets [ ], and Braces { }

When building formulas, it is important to know when to use parentheses, brackets and braces.

Parentheses are used to establish hierarchy within mathematical calculations.

Example 1

(SALE[Y99]+SALE[Y00])/2	Adds annual sales for 1999 and 2000, and divides the result by 2.

Brackets are used for time period referencing.

Example 2

PRCCM[May99]	Returns the monthly close price for May 1999.

Braces are used to create a temporary set of companies.

Example 3

{“dec”,“hwp”,“ibm”,“uis”}	Temporary sets are sets created “on the fly” and not deliberately saved.

Mathematical and Relational Operators

Mathematical and relational operators allow you to combine or compare two or more item values. These operators are consistent with mathematical conventions.

Mathematical operators allow basic mathematical combinations of two values. You can use mathematical operators with decimals, integers, time periods, dates and months. However, items must be the same data type to calculate a valid result.

Mathematical Operators

+	Addition
-	Subtraction
*	Multiplication
/	Division
^	Exponentiation

Example

(SALE+SALE[-1])/2	Adds the current year's annual sales to the annual sales of one year ago and divides the result by 2.

Relational operators allow you to compare 2 values. You can use relational operators with any items, but they must be the same data type to calculate a valid result. The result of a relational operator is either 1 (True) or 0 (False).

Relational Operators

=	Equal
< >	Not equal
<	Less than
>	Greater than
< =	Less than or equal to
> =	Greater than or equal to

Example

SALE > 500	Returns a 1 (true) for a company with current period annual sales greater than $500 million dollars.

Adding "Wildcards" to Your Formula

The Define Name option allows you to create a report or screen with "wildcard" formulas. Wildcards allow you to generate varying report or screen results, depending on how you define the wildcard. Examples of formulas with the Define Name option are shown below.

Example 1

@CAVG(formula1,$SP_500)	Averages whatever formula you enter (formula1) for $SP_500.

Example 2

"IBM":formula2	Retrieves whatever formula you enter (formula2) for International Business Machines.

Functions in Research Insight

A function is a pre-defined calculation that enables you to perform numerous tasks in your reports, screens, charts or spreadsheets. Functions can contain a combination of items, concepts, companies, time period references and other functions.

Research Insight contains more than 100 different functions that can be easily accessed through the Look Up List (Tools Menu>Look Up>Function Tab). All functions are categorized according to the type of analysis they perform. In this chapter, we'll show you the different components of a function and explain how these components work together to perform the calculation. We will also introduce you to each function category and explain how each function performs its task.

The Parts of a Function

Each function begins with the @ symbol and is followed by an abbreviated name, such as PLSG (least squares growth rate). Each function also includes an argument. Arguments tell Research Insight which variables to evaluate, enabling you to tailor each function for your specific needs. The function shown below contains a formula and a time period reference in the argument.

@PLSG(formula,period 1,period 2)

function symbol function name function argument

This function allows you to insert any formula and corresponding time references (beginning time (period 1) and ending time (period 2)). Once you insert the argument, you're ready to use the function.

Research Insight categorizes all functions according to the type of analysis they perform. The following sections explain each category in detail.

Currency Functions

Currency Functions are only used in the Global database and can be used to help you display currency data the way you want to display it. Two examples of currency functions are shown below.

Example 1

Function:	@NATIVE(formula)
Function with argument:	@NATIVE(PRCCM)
What it does:	Displays the monthly closing price in native currency.

Example 2

Function:	@SCALE(formula)
Function with argument:	@SCALE(CEQ)/CSHO
What it does:	Returns units of representation in millions. This function is useful for scaling those currencies presented in Research Insight in billions of currency units, such as the Japanese Yen or Italian Lira. Most other currencies are already presented in millions of currency units. If data for the company is already presented in millions of currency units, then the currency units remain in millions.

Growth Functions

Growth functions can be used to measure growth of an item over time. Research Insight contains several different growth functions to help you in your financial analysis. Two examples of commonly used growth functions are shown below.

Example 1

Function:	@FORECAST(formula,period 1,period 2,period 3)
Function with argument:	@FORECAST(SALE,Y98,Y99,Y00)
What it does:	Forecasts sales for 2000 based on 1999 and 1998 sales.

Example 2

Function:	@PLSG(formula,period 1,period 2)
Function with argument:	@PLSG(SALEQ,Q4Y95,Q4Y00)
What it does:	Calculates quarterly sales growth for the quarterly periods between 4th quarter 1995 and 4th quarter 2000.

Historical Analysis Functions

Historical analysis functions can be used to evaluate data over a period of time. All historical analysis functions allow you to choose a beginning time (period 1) and an ending time (period 2). The examples below show you how you can use historical analysis functions to calculate a company's average earnings per share over the last five years, or calculate the median monthly stock price over a 5-year period.

Example 1

Function:	@PAVG(formula,period 1,period 2)
Function with argument:	@PAVG(EPSPX,-4,0)
What it does:	Averages earnings per share over the last five years.

Example 2

Function:	@PMED(formula,period 1,period 2)
Function with argument:	@PMED (PRCCM,-4,0)
What it does:	Returns the median monthly close price over 5 years.

Example 3

Function:	@EXPSMOOTH(weight,formula,period1,period2)
Function with argument	@EXPSMOOTH(.9,SALE,-4,0)
What it does:	Return the exponential average sales for 60 months.

Information Functions

Information functions return additional information about an item or abbreviate an item's value. For example, you can use the @ELEMENT function to return the inventory valuation method for the second element in a multiple element item. Or, you can use the @DATE function to insert a calendar date into a report. Two examples of information functions are shown below:

Example 1

Function:	@ELEMENT(item,element)
Function with argument:	@ELEMENT(INVVAL,2)
What it does:	INVVAL is a multiple element item. In other words, there is more than one data value available for this item. By stipulating the number 2, you're telling Research Insight that you want to see the item's second data value.

Example 2

Function:	@DATE (YY,MM,DD)
Function with argument:	@DATE(01,06,30)
What it does:	Inserts the date 6/30/01 into a report.

Logical Functions

Logical functions test items and formulas to determine whether or not they meet selected conditions. They are called logical functions because they evaluate a condition to be true or false, and return data depending on specified conditions. You specify the argument for the condition, and Research Insight displays the data as True (1) or False (0). These functions are often used in screens, reports and spreadsheets, and are helpful when building financial models. Two examples of logical functions are shown below

Example 1

Function:	@VALUE(formula 1,formula 2,formula 3)
Function with argument:	@VALUE(PRCCM, PRCCM[-1])
What it does:	Retrieves the current monthly close price. If the current monthly price is not available, it retrieves the price from one month prior.

Example 2

Function:	@INRANGE(formula,value 1,value 2)
Function with argument:	@INRANGE(MKBK,1.0,2.0)
What it does:	Finds those companies with a market to book ratio between 1.0 and 2.0 (inclusive).

Mathematical Functions

Mathematical functions perform many of the same calculations that are possible with your calculator, such as logarithms, square roots and exponents. Research Insight contains several different functions to help you in your financial analysis. Two examples of mathematical functions are shown below.

Example 1

Function:	@RND(formula)
Function with argument:	@RND(PRCCM)
What it does:	Rounds a price up or down to its nearest whole number. For example, if an actual stock price is 15.25 this function rounds and displays the price as 15.

Example 2

Function:	@SQRT(formula)
Function with argument:	@SQRT(144)
What it does:	Calculates the square root of 144; the result is 12.

Period Reference Functions

You can use period reference functions in conjunction with formulas to specify a time period for which you want the formula evaluated. If you do not specify a time period with your formulas, Research Insight uses current period data. Since companies may have different current periods, these functions allow you to align items so that Research Insight displays data using the same time period. Examples of period reference functions are shown below.

Example 1

Function:	@MNT(period)
Function with argument:	PRCCM[@MNT(0Q)]
What it does:	Retrieves the monthly close price as of the last month of the current fiscal quarter.

Example 2

Function:	@DAY(period)
Function with argument:	@DAY(CPDQ)
What it does:	Returns the last day of the current fiscal quarter.

Reference Functions

Reference functions tell Research Insight to refer to a particular geographic area, issue or segment for the formula you're evaluating. An example of a reference function is shown below.

Example

Function:	@ISS(formula,number)
Function with argument:	@ISS(PRCCM,2)
What it does:	Returns the monthly price for the issue 2 of a company.

Screening Functions

Screening functions save time by allowing you to create a set "on the fly" and change set types. This means that you can apply any formula to a set other than just pre-defined or previously saved sets. Examples of screening functions are shown below.

Example 1

Function:	@CHGCO(set_type)
Function with argument:	@CSUM(DVPSXM,@CHGCO(ISSUE))
What it does:	Sums up the dividend per share for all issues of a company

Example 2

Function:	@SET(base set,condition)
Function with argument:	@SET($C,SIC=2834)
What it does:	Screens the active U.S. companies database ($C) for companies in the pharmaceutical industry (SIC=2834).

Example 3

Function:	@ISMEMBER(set_formula)
Function with argument:	@IF(@ISMEMBER($SP_500),"*","")
What it does:	In a table report, will print an "*" next to each company that is a member of the S&P 500.

Example 4

Function:	@TRIMPCT(formula,percentage)
Function with argument:	@CAVG(PEM,@SET($SP_500,@TRIMPCT(ROE,5)))
What it does:	Returns average Return on Equity ratio for the S&P 500, excluding values for companies that are within the top or bottom 5 percent.
Function with argument:	@CAVG(ROE,@SET($SP_500,@TRIMPCT(ROE,1)=1))
What it does:	The average ROE for the S&P 500 is 9.4. This average is distorted by a few outlying values; one company's ROE is over 4000 and another company's ROE is below -7000. If you trim off just 1% of the values, the average ROE for the S&P 500 is 11.5.

Example 5

Function:	@TRIMSTD(formula,trim_factor)
Function with argument:	@IF(TRIMSTD(ROE,2),"","*")
What it does:	Returns a "*" for each company whose Return on Equity is more than 2 times the standard deviation away from the base set's mean. The "*" lets you identify the outliers.

Set Analysis Functions

Set Analysis functions allow you to find out information about set characteristics. For example, you can use set analysis functions to find out how many companies are in a set or to average a formula across an entire set. Examples of set analysis functions are shown below.

Example 1

Function:	@CCOUNT(formula,set)
Function with argument:	@CCOUNT(EPSPX[Y00],$C)
What it does:	Counts the number of active U.S. companies with a value for earnings per share for 2000.

Example 2

Function:	@CAVG(formula,set[match_formula])
Function with argument:	@CAVG(PEM,$C,SECTOR)
What it does:	Selects active companies out of a set that produce the same sector for price to earnings monthly as the base company.

Example 3

Function:	@CAVG(formula,set)
Function with argument:	@CAVG(ROA,$MYSET)
What it does:	Calculates the average return on assets for the companies in the set MYSET.

Example 4

Function:	@CMED(formula, set, [match_formula])
Function with argument:	(PEM/@CMED(PEM,$SP_500,GIND))*100
What it does:	Calculates the relative P/E of a company vs. the median P/E of the S&P 500 companies in the same GICS Industry (6-digit GICS) as the subject company.

Example 5

Function:	@NTILE(formula, num_fractiles, set)
Function with Argument:	@NTILE(PEM,5,@SET($SP_500+@CHGCO(COMPANY), @CHGO(COMPANY):GIND=GIND))
What it does:	returns the quintile in which a company's P/E falls relative to its peers in the S&P 500 in the same GICS industry. This formula will work for any company whether it is on the S&P 500 or not.

Statistical Functions

Statistical functions provide you with the tools you need to generate statistical measures. For example, you can use statistical functions to calculate a fractile or rank order within a set. Two examples of statistical functions are shown below.

Example 1

Function:	@FRAC(formula,set)
Function with argument:	@FRAC(PI/SALE,$C)>.75
What it does:	Identifies the companies in the database for which the pretax income to sales ratio ranks in the top 25%.

Example 2

Function:	@RANK(formula,set)
Function with argument:	@RANK(MKVAL,$SP_500)<=25
What it does:	Ranks companies in the set $SP_500 based on market value and returns the top 25 companies.

Text Functions

Text Functions display the value of an item or formula in a textual format. For example, you can use a text function to see the textual description of an SIC code, or you can use text functions to find companies with specific characters in the company name. Examples of text functions are shown below.

Example 1

Function:	@DESC(value)
Function with argument:	@DESC(SIC)
What it does:	Displays the description of the SIC Code.

Example 2

Function:	@FIND(find_text,within_text)
Function with argument:	@FIND("CHEM",CONM)
What it does:	In screening criteria, this returns companies with the characters CHEM anywhere in the company name. In a report formula, this returns a number representing the beginning character position. For example, in a screen, the company BIOCHEM INTERNATIONAL INC. would be included in the passed set. The same formula in a report would return the number 4. **Note**: The @FIND function is case sensitive.

Database Control Functions

Database Control Functions enable you to target or exclude a specific database layer, so you can specify the type of data Research Insight will return. Examples of database control function are shown below.

Example 1

Function:	@DB(dbname,formula)
Function with argument:	@DB(COMPUSTATDB,SALE[Y99])
What it does:	Returns the value for SALE from the core database layer for 1999.

Example 2

Function:	@EXCLUDEDB(dbname,formula)
Function with argument:	@EXCLUDEDB(CLASSIC,GPMQ[Q2Y99])
What it does:	Returns the gross profit margin - quarterly item from the first database layer it is found in, excluding the Classic layer, for the second quarter of 1999. Research Insight reads sequentially through the database layers, and it will retrieve a value for GPMQ from the first layer where it finds a value for the specified item. **Note**: A time reference is required in order for Research Insight to retrieve the correct data.