

Crystal Reports training topics – days I and II

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Training Topics
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Introduction

Crystal Reports is a well-established, stable and powerful tool for creating reports from almost any database. As well as producing printed reports Crystal can extract sub-sets of data and can export to other data formats.

Database basics

A database is a collection of information in a structured form. A report is the answer to a question we ask of a database. A query is the question itself. Before we can report on our database we need to understand its structure. In this section we cover database types, how databases divide into tables and indexes and what kind of individual data elements we will encounter. The ability to understand our database structure, often referred to as the schema, is the first challenge we face in report writing. Here we break it down and demystify it.

- Types of database:
 - SQL database managers: e.g. SQL Server, Oracle.
 - SQL – Structured Query Language basics.
 - Disk based databases
 - Access; xBase (dBase, FoxPro, Clipper).
 - Excell and other spreadsheets.
- Tables
 - SQL database manager tables and indexes as entities, defined and stored internally.
 - xBase tables as disk files (e.g. names.dbf) with associated index files (e.g. names.cdx)
- Rows and columns
 - Records as rows and fields as columns as in a spreadsheet.
 - SQL views as predefined virtual tables.
 - SQL stored procedures as built-in programs.
- Indexes
 - Indexes for sorting and fast record retrieval.
 - SQL indexed columns.
 - Index scope, reading a range of records rapidly.
- Relationships
 - Retrieving records from more than one table through linking.
- Memo fields
 - SQL text columns.
 - xBase memo files.
- Primary key as a unique identifier.
- Foreign keys as links to other tables.

Data types

We have seen how databases store information in rows and columns, now we look at the different types data we will encounter. For efficient storage and retrieval databases divide down further into separate types for each data element. We show how to mix, match and convert character, numeric, date and logical data types.

- Character.
- Numeric.

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- Currency
- Date/time
- Logical.
- Memo.
- BLOB – binary large object.

A short tour of Crystal

Crystal is a banded report writer, it structures reports in band lines: title, report and page header, group headers, record lines, group footers, page footers, summary. Our short tour of Crystal shows the basic structure of reports and how to choose an output destination.

- Report band lines
 - Title
 - Page headers
 - Group headers
 - Detail lines: the composite record.
 - Group footers
 - Page footers
 - Summary area.
 - Positioning fields
- Output
 - Screen
 - Print
 - File
 - Print file.
 - Data file.
 - PDF
 - HTML
 - Others

Creating reports.

Crystal stores reports as definition files, the first step in creating a new report is to choose a name and place under which to save it. Next we look at how to set up file locations and paths to database tables to make it easy to find things. Then we see how to choose the tables will needed for the report and decide which should be the master table.

- Connecting to data.
- Naming and saving reports.
- File locations and table paths (desktop databases).

Report Design

Make it simple to start with, just an outline that reports on a known data set to check that your record selection is correct. Play around with the query and once you are satisfied, start work on the report presentation.

- Choosing the main table
 - SQL: FROM clause.
- Joining tables.

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- SQL: WHERE clause.
- SQL joins: linking tables.
 - Exact (inner) join: showing only those records where there is a match on both sides of the join clause.
 - Left outer join: showing all records on the left side of the query whether there are any matches on the right side or not.
 - Right outer join.
- Ways to relate tables
 - The concept of the composite record
 - Unique key and foreign keys.
 - Linking with database fields.
 - Linking with calculated fields.
 - Linking with the record number or with expression 1.
 - Full lookup.
 - Equality
 - Partial lookup.
 - LIKE

Report design - formatting

Its the layout that gives reports their look and feel. But it's not just a question of how things look, the report layout is crucial to the presentation – and sometime to the credibility – of data. Learn here how to present titles, headers, records, footers, group summaries and totals for effective reports.

- Band lines.
 - Title.
 - Page headers
 - Group headers.
 - Swapping headers
 - Detail lines.
 - Logical print control
 - How to suppress record lines for summary reports.
 - Group footers.
 - Totals, counts, cross tabs, averages, etc
 - Page footers.
 - Summary.
 - Totals, counts, averages, etc
- Sub-reports.
- Dictionaries
- Using graphics and images.
- Charting and mapping.
 - An overview.
- Formatting objects.
 - Right click and set attributes.
 - Browse field data.
- OLE objects.

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Sorting and grouping

A key part of report writing is giving the reader just the information needed in a concise and easily-read form. Effective sorting and grouping enables us to divide down complex reports to produce both full listings and summaries. Here we look at efficient ways to sort and group based on stored or calculated data.

- Sorting and grouping on the server.
- Ordering records, sort levels.
- Grouping.
 - Ordering and grouping records according to a condition, perhaps with group summary information (counts, totals, averages, max., min.).
 - Group headers and group footers.
- Page breaks
- Sorting/grouping
 - On database fields.
 - On calculated (formula) fields.
 - On running totals.
- Cross-tab objects.
 - Rows, columns and totals in a compact format.

Querying – record selection.

Querying is the heart of the report. The query is the question we ask of the database. This section is where we look at how to select what the user needs. There are several ways to filter the data we wish to retrieve: fixed queries saved with the report, queries with parameters supplied by the user when the report is run, and queries written in Structured Query Language (SQL).

```
SELECT
  INV_IT.INV_PROD,
  INV_IT.ITEM,
  INV_IT.PRICE,
  INV_IT.QUANTITY,
  INV_HD.CUST_REF,
  INV_HD.INV_NUM,
  INV_HD.VAT_RATE,
  MAIN.COMPANY,
  MAIN.ADDRESS11,
  MAIN.ADDRESS12,
  MAIN.ADDRESS13,
  MAIN.POSTCODE
FROM
  INV_IT INV_IT,
  INV_HD INV_HD,
  MAIN MAIN
WHERE
  INV_IT.INV_NO = INV_HD.INV_NUM AND
  INV_HD.CUST_CODE = MAIN.MAINCODE AND INV_HD.INV_NUM >= '00900'
ORDER BY
  INV_HD.INV_NUM ASC
```

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- The composite record.
- Selection formula editor.
- Formula templates
- Parameter fields.
- Efficient queries
 - Pushing the query to the server.
- Stored procedures
 - Parameters.

Formulas - calculated fields

Any information that is stored in the database or that can be calculated from what is stored in the database can be used in an Crystal report. The ability to create calculated fields is one of the most powerful features of any report writer. Crystal has a full set of operators and many built-in functions to help in creating calculated fields. Here we look at how to tap into that power.

- Crystal programming languages.
 - Crystal formula language.
 - Crystal BASIC.
- Operators.
 - Concatenating strings.
 - Arithmetic.
 - Date arithmetic.
 - Logical comparisons.
 - AND
 - OR
 - NOT
- Using built-in Crystal functions to create new fields
- Using IIF() to switch values
- Using Case() to test combinations of values.
- Expressions
 - Literal or using any function, database field or formula field.
- Arithmetic with dates.
- Wild cards in expressions.

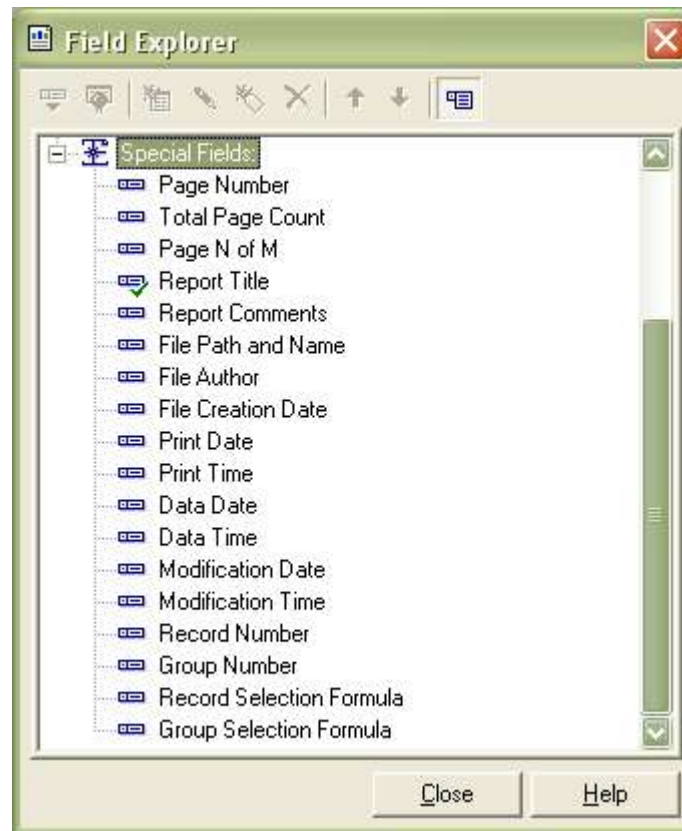
Output

With today's extensive use of email for exchanging information, a report is now much more than just a listing on paper. Crystal can output reports to screen, printer, PDF and a whole range of file formats, as well as to the web. This section looks at how to deliver reports to users in the format that they need.

- Print
- Screen
- File
 - Text – effectively printing to a file, exports all band lines.
 - Data – create .CSV files for opening in other applications. You have to choose just one band line for the export.
- PDF- how to export your reports as PDF documents.
- Mail – exporting to a file and placing it straight into the mail queue.
- HTML

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Special Fields



User-defined functions

If there is no built-in Crystal function that does what we need, we can create our own user-defined function (UDF). We can then make our UDF available to all reports as if it were built in to Crystal. This is another powerful feature than Crystal makes available in an easy-to-use form. Here we look at what's involved in programming Crystal.

- Defining a UDF
 - Choosing a data type
 - Argument list
 - Writing the code
 - Making your functions available for all reports.

Distributing reports

Once we have created our reports we have to make them available to users. Crystal comes with a runtime module that can be installed on workstations or servers so that reports can run anywhere. There are several Crystal utilities that simplify not only the deployment of reports but the capturing of query parameters from users.

Programming constructs

If.. Then.. Else

- Crystal syntax

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```
if {INV_IT.INV_PROD} = "00" then
    "1st"
Else
    "nth"
End if
```

- BASIC syntax

```
if {INV_IT.INV_PROD} = "00" then
    formula = "1st"
Elseif {INV_IT.INV_PROD} = "01" then
    formula = "2nd"
Else
    formula = "nth"
End if
```

- Select Case.
- Crystal syntax

```
select {INV_IT.INV_PROD}
case "00" : "1st"
case "01" : "2nd"
case "02" : "3rd"
default: "nth"
```

- Basic syntax

```
Select Case {INV_IT.INV_PROD}
Case "00"
    formula = "1st"
Case "01"
    Formula = "2nd"
Case "02"
    Formula = "3rd"
Case Else
    formula = "nth"
End Select
```

- Switch

- Crystal syntax

```
Switch ({Orders.Order Amount} > 5000, "large",
        {Orders.Order Amount} > 1000, "medium",
        True, "small")
```

- Choose Choose (index, value1, value2, "valuen)
eg Choose (3, "Poor", "Fair", "Good", "Excellent")
- Using [x to y] and [-x to -y] (start to end | end to start)
 - eg {MAIN.COMPANY} [2 to 6] | "Martin Ward Anderson" = "artin"
- Variables and arrays

```
' Minute quarter useless function
' Declare variables
```

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```
Dim x(4) As String
dim n as number
```

```
'Assign some values to the array.
```

```
x(1) = "1st"
x(2) = "2nd"
x(3) = "3rd"
x(4) = "4th"
```

```
'In which quarter of the minute are we?
```

```
n = int( minute(CurrentTime) /15)
```

```
'Do a little correcting
```

```
if n >0 then
```

```
    n = n + 1
```

```
Else
```

```
    n = 1
```

```
End if
```

```
'Return the result using the mandatory keyword formula.
```

```
formula = x(n)
```

- Cross-tab reports
 - Cross tab wizard.
 - Let's try it.
 - Use of IIF() function.
 - Create IIF({table.field} = "A", 1, 0) for each known value of table.field.
 - Sum them in a group footer.
-

SQL expression fields

SQL expression fields are formula fields that are evaluated on the server and can help speed up reports. For example, fetching a virtual column as the result of a function carried out on the server.

Example: uppercase a column with an SQL expression.

```
{fn UCASE(INV_IT.ITEM)}
```

- Functions
 - LooksLike
 - DOS wildcards.
 - LIKE operator
 - fieldname} like "c?n*"
 - Now
 - Current time – include in a formula field (Crystal creates one by default)
 - YearToDate

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- Tests if a date is within the current year to date
 - eg IIF({orders.ORDER DATE} in YearToDate, “ORDERS.OrderAmount,0)
- NextxDays functions

Iif({orders.ORDER DATE} in Next30Days, {orders.ORDER AMOUNT}, 0)

- Lastxxxx functions()

IIF({orders.ORDER DATE} in Last7Days, {orders.ORDER AMOUNT}, 0)

- IsNull(field_object)
 - Checks for an empty field, test carefully.

More on Report formatting

- Formatting a section.
- Pagination
- Layout in columns
 - Flow.
 - Records across.
- Suppress print formula
 - EG suppress field INV_IT.PRICE printing if the field contains zero (formula must return a boolean)
 - Crystal

```
{INV_IT.PRICE} <= 0
iif({INV_IT.PRICE} <= 0, true, false)
```
 - BASIC

```
if ({INV_IT.PRICE} <= 0) then
    formula = true
else
    formula = false
end if
```

More on Field formatting

- Horizontal alignment
 - Numeric fields – aligned-right by default
- Word wrap - “can grow”

Dictionary

Crystal has a report dictionary system. A dictionary enables us to encapsulate tables, columns, fields and formula, giving them easily-understandable names rather than the often arcane nomenclature of a database schema. This makes it easier for end-users and non-programmers to create reports. Dictionaries have limitations that it's important to understand.

More on SQL Joins

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Left Outer [= (+), *=] join

The result set from a Left Outer join includes all the records in which the linked field value in both tables is an exact match. It also includes a row for every record in the primary (left) table for which the linked field value has no match in the lookup table. For instance, you can use a Left Outer join to view all customers and the orders they have placed, but you also get a row for every customer who has not placed any orders. These customers appear at the end of the list with blanks in the fields that would otherwise hold order information:

Right Outer [(+) =, =*] join

The result set from a Right Outer join includes all the records in which the linked field value in both tables is an exact match. It also includes a row for every record in the lookup (right) table for which the linked field value has no match in the primary table. If you link the Customer table to the Orders table, you get one row in the table for each order a customer has placed, as with an Equal join. You also get a row for every order found that cannot be linked to a customer. Theoretically, this should not happen, but if an inexperienced sales person forgot to assign a customer ID to an order, you can quickly locate that order with a Right Outer join. The resulting table leaves a blank in any of the Customer fields for the order without a customer.

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