from sas® to KNIME®

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This book has been updated for KNIME 3.5.

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Table of Contents

Foreward

OK, I admit to being a 34 year SAS addict – 25 of them working directly for SAS – so when I was first introduced to KNIME Analytics Platform I was skeptical. Open source? Community supported? Everything in graphical workflows? FREE full function desktop Version? VERY different from the SAS I know! To me it sounded more like “bells and whistles” than “solid and robust” and I wondered why the Gartner group gave it “Cool Vendor Status” and what all those pharmaceutical companies saw in it. Now, after using the product myself for several major projects, I can truly say that KNIME is very powerful indeed!

Working with Rosaria Silipo meant that I could climb the software learning curve very quickly – she knows both products well, and her publishing this booklet means that YOU can now get up to speed very quickly.

I appreciate the fact that Rosaria has focused on comparing CORE SAS functionality to KNIME. Any experienced SAS user knows that a SAS application is, at the end of the day, a program that combines data steps, procs, macro language, and a front end – combined with the knowledge of how to USE them in an application created for a specific business area. Looking at core functionalities is how we as SAS users most effectively learn something new.

There are some basic similarities: both SAS and KNIME pull data sensibly into memory and optimize the interplay between I/O and processors and clusters, because both suppliers know that at some point, no matter how fast in-memory manipulation is big data will require loading and processing. Both fundamentally understand that it’s not just about statistics and reports, it’s about accessing data – any data – and manipulating that data to get it back out in a usable form. Both believe that a platform that integrates across desired components is the right way to go.

Both also try to provide as many techniques as possible in the analytics area. But while SAS employs its large, dedicated team of thousands of developers to generate everything possible in its proprietary infrastructure (and only once it’s developed and rolled out is it, in fact, possible), KNIME takes the approach that there will ALWAYS be some unforeseen requirement for an esoteric or specialized technique, so it simply insures that it’s easy to pull that technique directly from another source – whether that be R or Weka or you name it.

Both SAS and KNIME allow beginners to start out small and focused while learning. But once up to speed, you really need the ability to scale up quickly to accommodate many users and a lot of data without having to rewrite programs; the two platforms also have this positive trait in common. But there are a few major philosophical differences that, when understood, will help you get going with KNIME faster.
Most important is probably the paradigm difference: fundamentally, SAS is a line-oriented scripting language. Everything on top of base SAS, including all the specific applications successfully developed in the last several years, generates that line-oriented code at the end of the day.

But let’s focus on actually building a SAS program or a KNIME workflow to achieve a particular task. In SAS, your approach is always effectively iterating through data steps and procs back and forth until you finally have what you need. You manage the programming logic with macros, and can surface that application via a variety of different interfaces. KNIME is a node-workflow oriented approach – for absolutely EVERYTHING. You don’t have to learn an application interface, then the data step language, then the PROC syntax, then a MACRO language for packaging code, and possibly even one of the application languages (Java, .net or proprietary SAS) to build and surface programs to end users – it's ALL done in nodes and workflows. That means in the beginning you may have to search for the correct nodes and combinations thereof to achieve what you need to do, but once you are up and running you can quickly mix and match the different types of nodes as needed.

Another major difference with KNIME: what you program = what you run = what you document = *what you can visualize to your audience*. Once you've built a workflow, it's available for all required purposes – you don't have to jump over to a graphics tool and mock up a flow or draw a picture to explain what's actually going on behind that exotic-looking macro code!

Probably the biggest difference though is in the approach to packaging and expanding your application. The KNIME concept of a metanode – taking a series of linked nodes in a workflow and creating ONE reusable node out of them, with all inputs/outputs automatically defined – is extremely powerful.

Let's be clear what KNIME is not: it is not attempting to be the ultimate in-memory BI reporting packages; rather, KNIME makes sure that, if needed, you can surface everything through *your favorite reporting tool,* whatever that is. KNIME is also not trying to be the end-all in MIS batch reporting, although the open source BIRT platform provided with KNIME will get you started. And while KNIME already has a huge number of business-oriented examples (check out the website!), it doesn't (yet?) strive to make end-to-end, complete applications. What KNIME does do is make it easy to include and reuse other applications, whether that be from the popular R package or your favorite coding language such as Java. You can also easily CALL other applications – even SAS – to build exactly what you require. And one last tip from me: start with this booklet and your favorite SAS dataset. Using the special SASB7DAT node, KNIME will read that data in with just one click – which is not only super-simple and fast but also gives you an edge in allowing you to start learning with data that you already know.

I hope you enjoy using KNIME as much as I do!
And in the interest of total transparency – I am so convinced I have joined the board of KNIME.com.

Phil Winters
Strategic Advisor, Peppers & Rogers Group
CIAgenda

Data and Script Structure

PROC and DATA Steps

SAS Base

A SAS Base analysis is performed by means of a script, which consists mainly of DATA steps and PROC steps.

A number of SAS products use now a more visual approach. However, the graphic layout is translated into the corresponding SAS Base script before execution.

Example:

```
DATA xyz
   set x y z;
RUN;

PROC TABULATE data= xyz;
  class = education, gender;
  var income;
  table gender, education * N;
RUN;
```

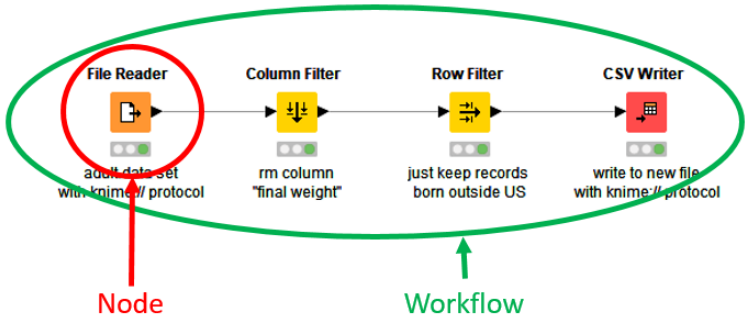
Workflows and Nodes

KNIME Analytics Platform

KNIME Analytics Platform implements **visual** programming. This means that each data analysis step is represented by means of an icon block, called **node**, in a graphical editor.

A sequence of connected nodes is called a **workflow** and is the corresponding concept of a script in SAS Base.

Data is organized through data tables with column headers and row IDs. To visualize the content of a data table, see "PROC PRINT" later on.



Note. Nodes have four possible status displayed by a little traffic light under the node itself:

- Not yet configured -> **red light**
- Configured but not executed -> **yellow light**
- Successfully executed -> **green light**
- Executed with error -> **red light with cross**

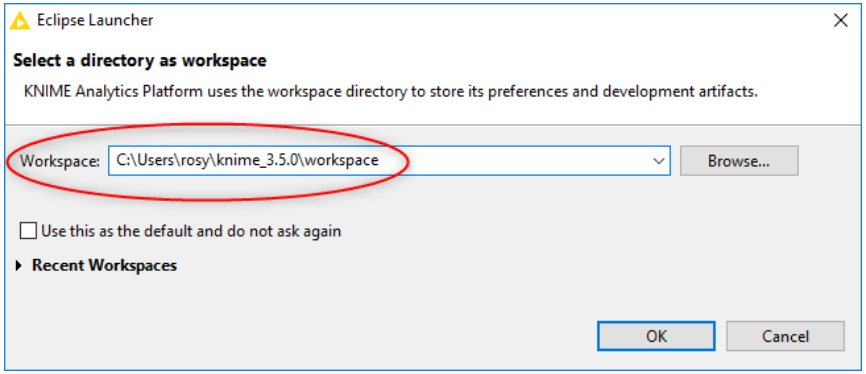
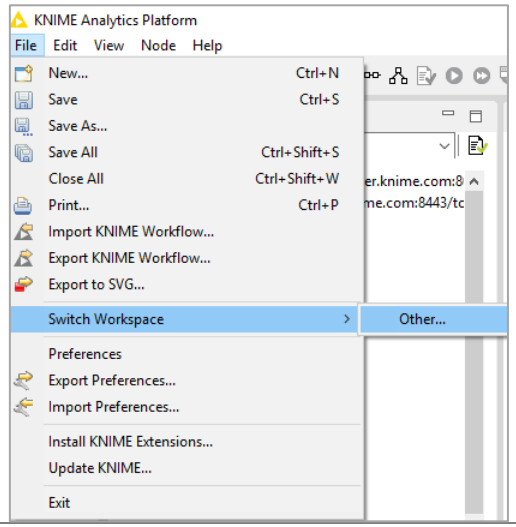
For more details about KNIME Analytics Platform, check:

- *R. Silipo, "KNIME Beginner's Luck", KNIME Press, 2018*
- *R. Silipo, J. Prinz, "KNIME Advanced Luck", KNIME Press, 2018*

LIBNAME

Workspace

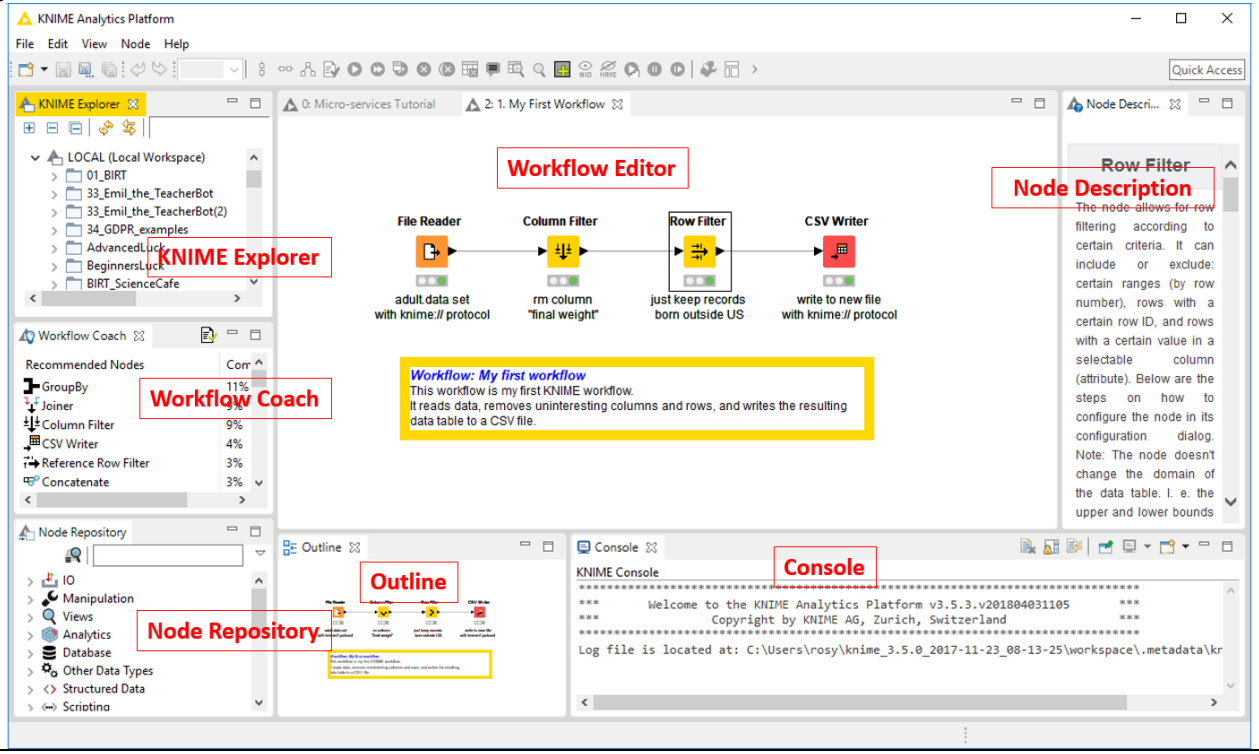
SAS Base	KNIME Analytics Platform

`libname <lib_name> <lib_path>;`
 	
Example:
 	
`libname mylib 'C:\Data\Course';`
	Workspace defines the folder where all workflows and intermediate data are saved. The path to the workspace is selected at the very beginning, after starting *KNIME Analytics Platform*.
	
	 
	
	You can still change the workspace after KNIME has been launched, by selecting “File” in the top menu and then “Switch Workspace”.
	
	 

The KNIME Workbench

Start KNIME Analytics Platform from the desktop or from the installation folder. The KNIME workbench opens, which includes: “Workflow Editor”, “KNIME Explorer”, “Node Repository” , ”Node Description” , “Outline”, and “Console”.
“**KNIME Explorer**” shows the list of currently available workflow for the selected workspace.
“**Node Repository**” panel contains all available nodes. A “**Search**” box is available on top of this panel to search for nodes.
“**Workflow Editor**” in the center allows for the creation and editing of workflows.
“Workflow Coach” offers hints for the next node to insert after the selected one in the Workflow Editor.
“**Node Description**” shows text describing the node task and configuration settings, for the selected node either in the “Workflow Editor” or in the “Node Repository” panel.
The “Outline” panel offers an overview of the workflow and the “Console” panel shows execution messages.

KNIME workflows are **created** by **drag&drop** of nodes from the “Node Repository” panel into the “Workflow Editor”.
Nodes are connected to each other through their input and output ports. Just click the output port of the first node and release on the input port of the second node.
Nodes that have been just created have a red light status: not yet configured. To **configure** a node, right-click the node and select the option “Configure” or alternatively double-click the node. The node “Configuration” window opens. Configure the node. If the configuration is successful, the node status changes to a yellow traffic light. The node is now configured, but not yet executed. To **execute** the node, right-click the node and select the “Execute” option. If the execution is successful, the node changes its status to a green light.



PROC PRINT

display data table at node's output port

SAS Base

```
PROC PRINT
        data=<dataset-name>
        <options>;
run;
```

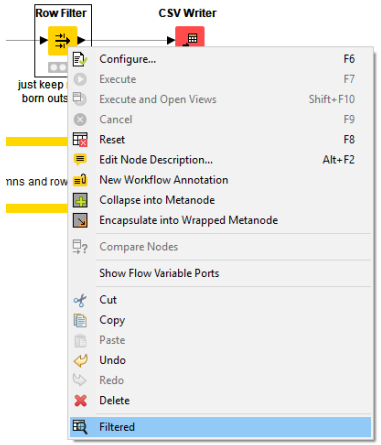
Example:

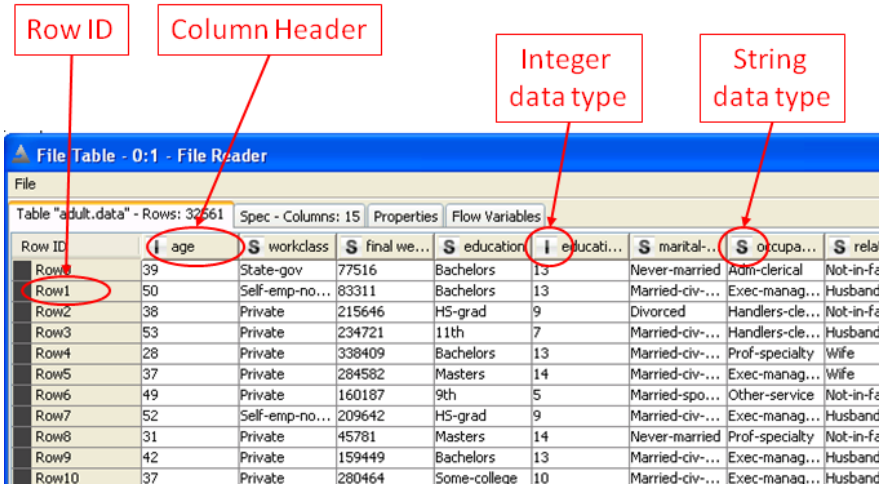
```
PROC PRINT data=xyz;
RUN;
```

KNIME Analytics Platform

The data tables produced after node execution are always available. To see them:

- Right-click the node in the workflow
- Select the last option in the context menu





Row ID	age	workclass	final we...	education	educati...	marital-...	occupa...	rela
Row0	39	State-gov	77516	Bachelors	13	Never-married	Adm-clerical	Not-in-fa
Row1	50	Self-emp-no...	83311	Bachelors	13	Married-civ-...	Exec-manag...	Husband
Row2	38	Private	215646	HS-grad	9	Divorced	Handlers-cle...	Not-in-fa
Row3	53	Private	234721	11th	7	Married-civ-...	Handlers-cle...	Husband
Row4	28	Private	338409	Bachelors	13	Married-civ-...	Prof-specialty	Wife
Row5	37	Private	284582	Masters	14	Married-civ-...	Exec-manag...	Wife
Row6	49	Private	160187	9th	5	Married-spo...	Other-service	Not-in-fa
Row7	52	Self-emp-no...	209642	HS-grad	9	Married-civ-...	Exec-manag...	Husband
Row8	31	Private	45781	Masters	14	Never-married	Prof-specialty	Not-in-fa
Row9	42	Private	159449	Bachelors	13	Married-civ-...	Exec-manag...	Husband
Row10	37	Private	280464	Some-college	10	Married-civ-...	Exec-manag...	Husband

Note. Some nodes, like plotting and modeling nodes, have also a more complex "View" function. The option leading to this "View" is usually displayed in the middle of the context menu.

DELETE

delete data table / increase the heap space

SAS Base	KNIME Analytics Platform

`proc datasets;`
`  delete <dataset-name>;`
`run;`
 	
Example:
 	
`proc datasets;`
`  delete xyz;`
`run;`
	KNIME memory management ensures disposal of tables that are not used anymore, so that no equivalent to the DELETE-command in SAS is needed.
	
	Memory to be used by KNIME Analytics Platform is allocated at installation time. If you wish to increase the memory available to KNIME Analytics Platform just change option ***–Xmx*** in the knime.ini file in the KNIME installation folder.

Input/Output

INFILE

File Reader

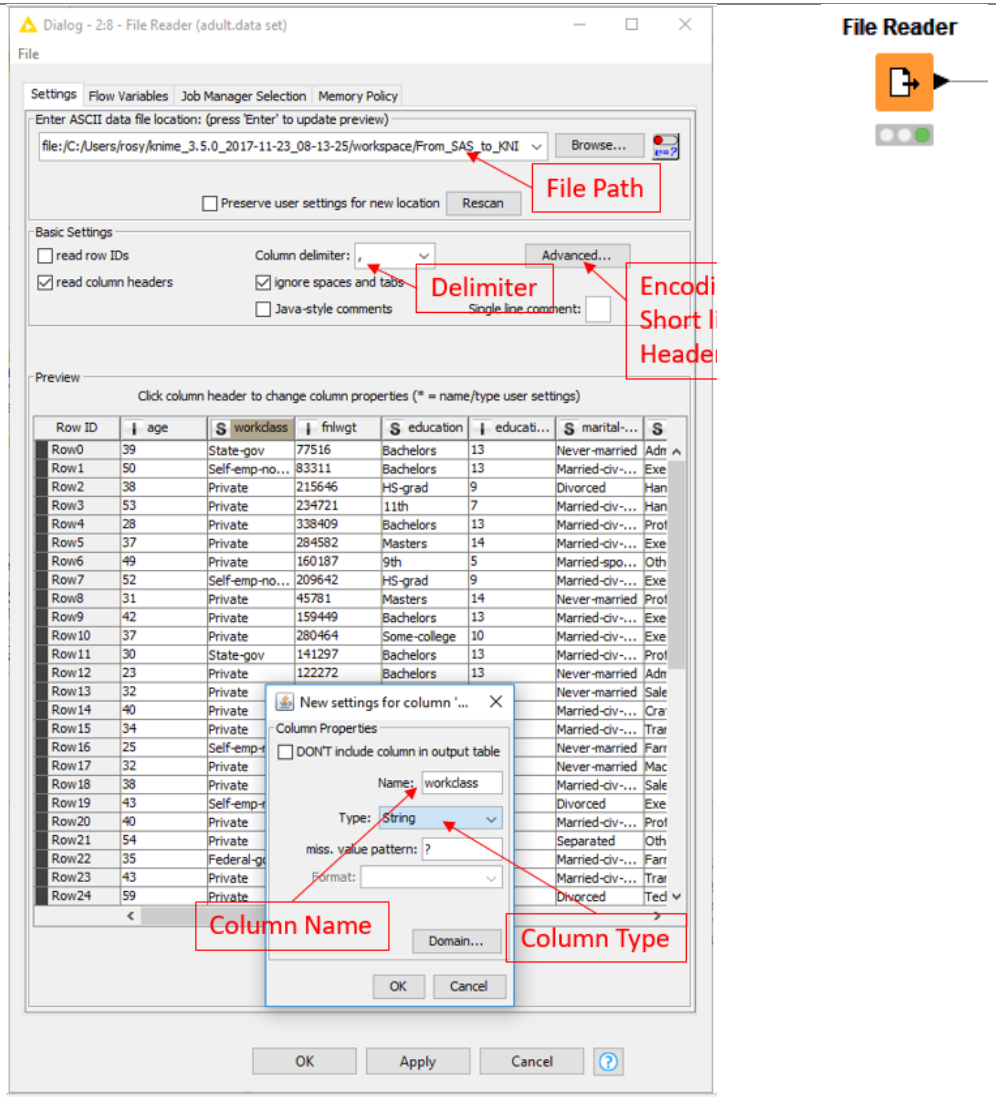
SAS Base

```
data <dataset-name>
infile <filepath> delimiter=<char>;
input <col_1> <col_2> ... <col_n>;
run;
```

Example:

```
data xyz;
   infile 'C:\data\CRM.txt' delimiter=';';
   input CustomerID ContractID date_start date_end
amount;
   format date_start date9.;
   format date_end date9.;
run;
```

KNIME Analytics Platform



Note 1. There are many possible reading formats. Basic formats are: Integer, Double, and String. A date must be read as String and later on converted to Date&Time type with a "String To Date&Time" node.

Note 2. KNIME has also a specific "CSV Reader" node dedicated to reading CSV files.

INPUT … datalines

Table Creator

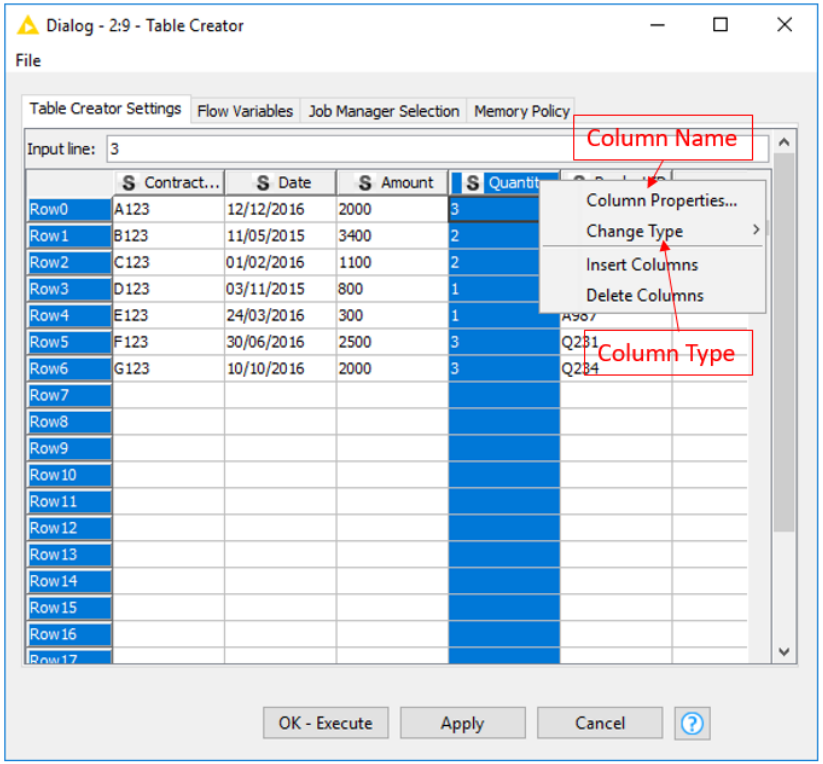
SAS Base

```
data <dataset-name>;
input [position] <col_1> [format]
      [position] <col_2> [format]
      ...
      [position]<col_n> [format];
datalines;
<data>
;
run;
```

Example:

```
data xyz;
   input ContractID $ CustID $ nr
         @17 ReceivedDate date9.
         @27 Price;
   format ReceivedDate date9.;
   datalines;
A123 1ABCR   34  28jul1998 45.00
B123 2ABCDF 98   20jul1997 345.88
C123 3ABCADF 121 19may1999 100.99
D123 4A 43       10aug1999 27.37
E123 5ABC 80     16aug1999 9.65
F123 6ERA 6      18jun1999 19.67
G123 7ABC 383    09jan2000 14.89
H123 8ABC 26     03aug2000 44.50
;
run;
```

KNIME Analytics Platform



Note. There are many possible reading formats. Basic formats are: Integer, Double, and String. A date must be read as String and later on converted to Date&Time type with a “String To Date&Time” node.

connect to /disconnect from

Database Connector\Database Reader\...

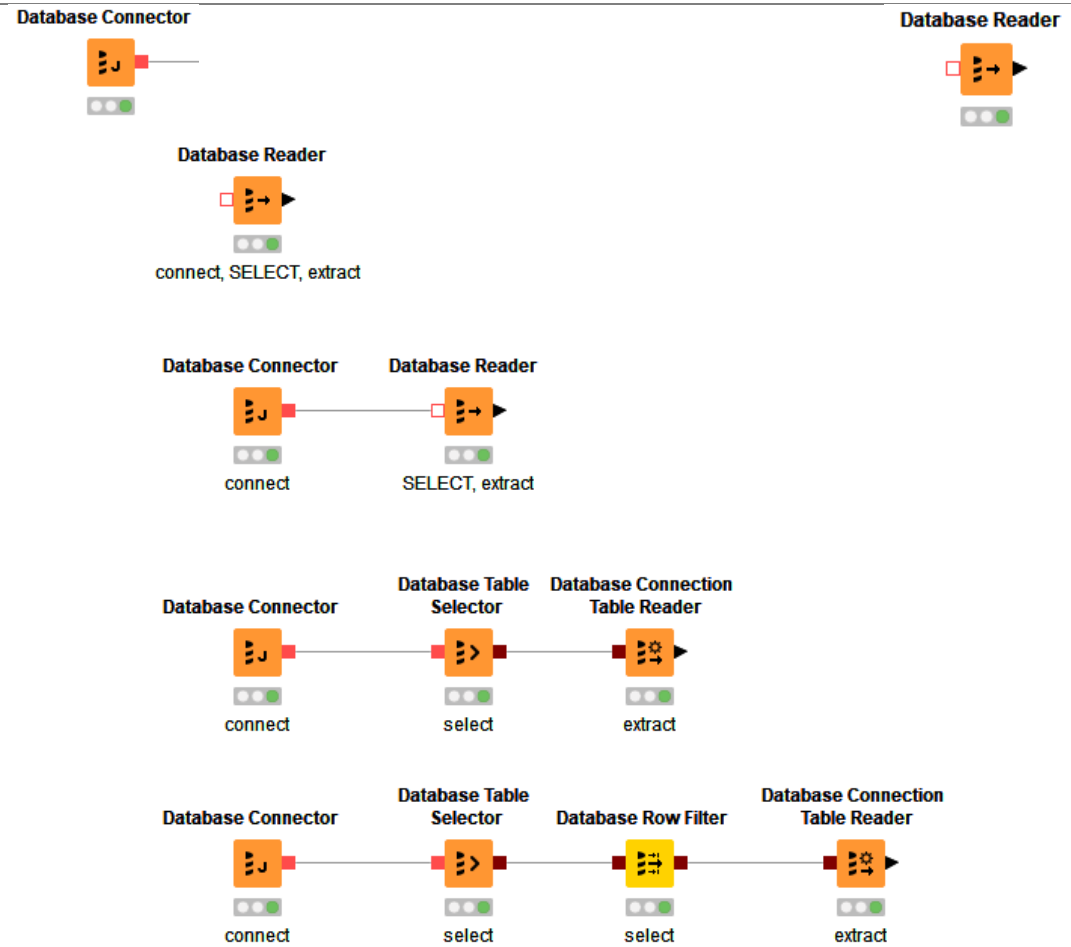
SAS Base

```
proc sql;
   connect to <database-name> as <connection-alias>
             (<connection credentials>);
   create table <table-name> as
   select * from connection to <database-name>
      (<sql statements>);
   disconnect from <connection-alias>;
quit;
```

Example:

```
proc sql;
   connect to oracle as dblink
         (user='xxxx', password='xxxx', path='ORCL');
   create table xyz as
   select * from connection to oracle
      (select * from employees);
   disconnect from dblink;
quit;
```

KNIME Analytics Platform



Note 1. The approach to database reading is modular. The three phases (connect, SELECT, extract) can be run all together in a Database Reader node or built step by step with a Database Connector, a Database Table Selector, and a Database Connection Table Reader node. Other Database nodes are available to help build the SQL query.

Note 2. A "Database Disconnector" node is not necessary. The "Database Reader" node connects to the database, reads the table by means of a SELECT query, and disconnects.

Note 3. Database nodes only builds the SQL query, do not execute it. Only the final node extracting the data executes the SQL query.

PROC IMPORT … DBMS=EXCEL

Excel Reader (XLS)

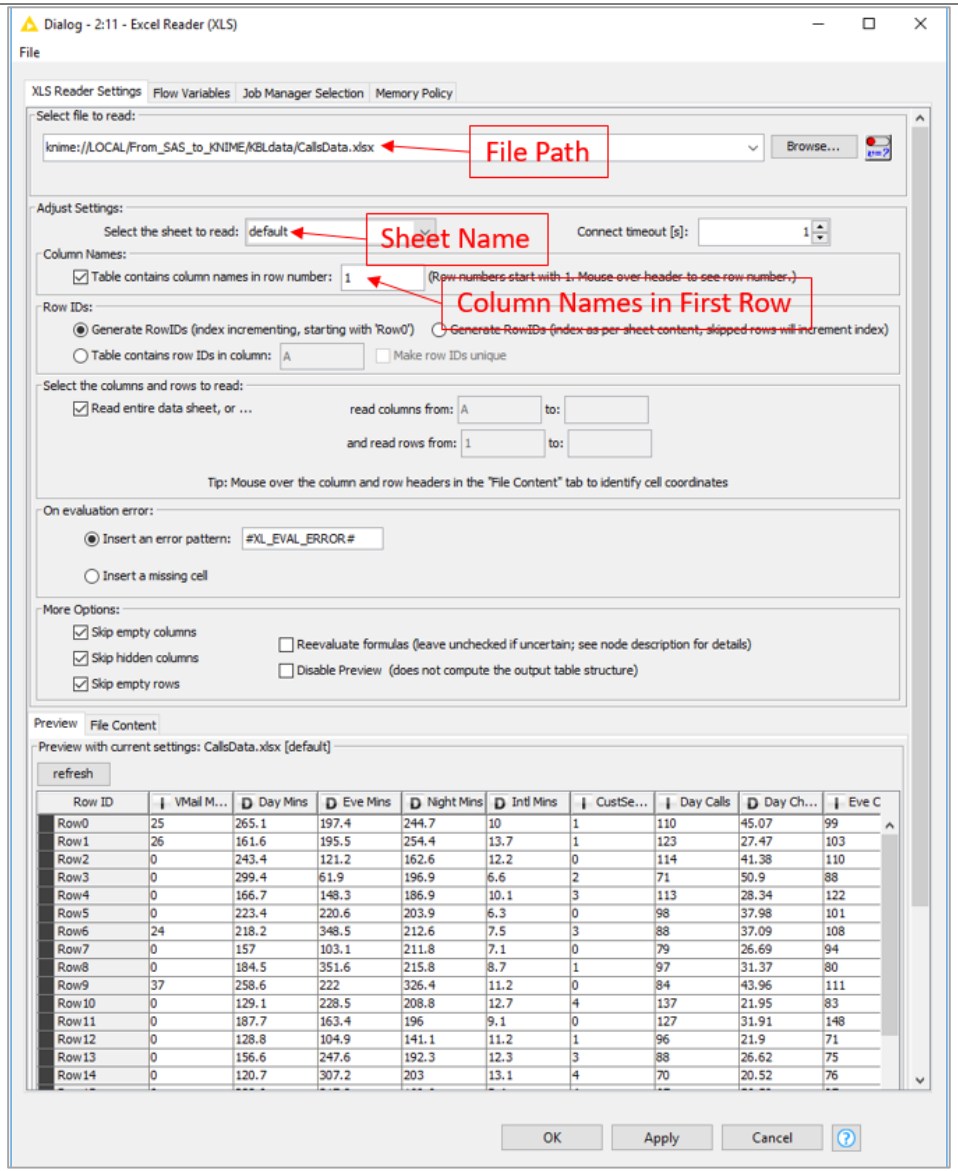
SAS Base

```
PROC IMPORT OUT= <dataset-name>
            DATAFILE= <file path>
            DBMS=EXCEL REPLACE;
     SHEET=<sheet-name>;
     GETNAMES=YES/NO;
     MIXED=YES/NO;
     USEDATE=YES/NO;
     SCANTIME=YES/NO;
RUN;
```

Example:

```
PROC IMPORT OUT= work.data1 1
            DATAFILE= "C:\Months.xls"
            DBMS=EXCEL REPLACE;
     SHEET="Tabelle1";
     GETNAMES=YES;
     MIXED=YES;
     USEDATE=YES;
     SCANTIME=YES;
RUN;
```

KNIME Analytics Platform

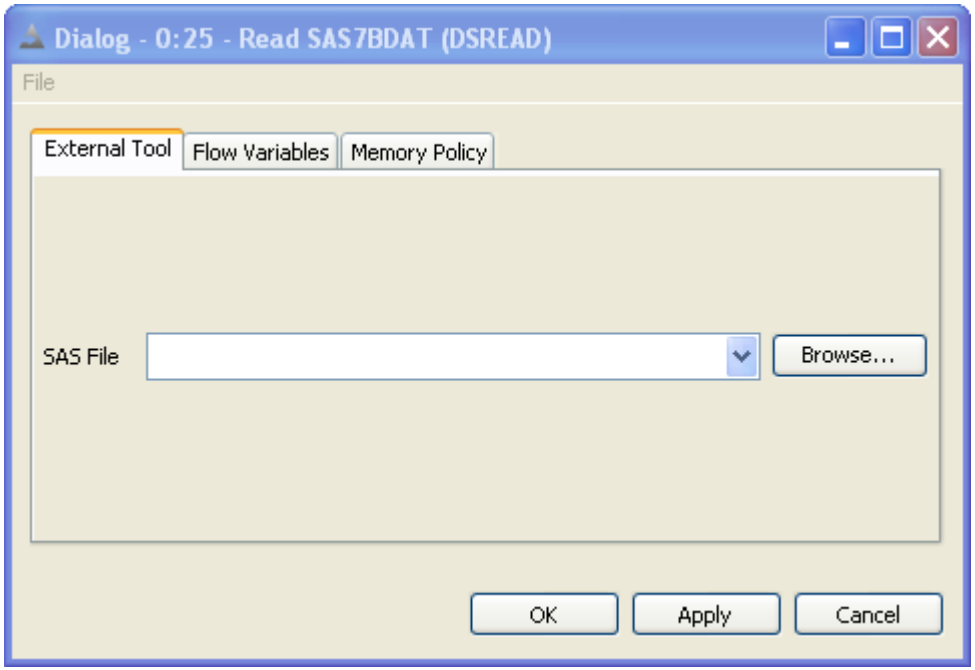


Note. Possible reading formats are: Integer, Double, and String. A date must be read as String and later on converted to Date&Time type with a “String To Date&Time” node.

Read SAS7BDAT (DSREAD)

KNIME Labs has a dedicated node to read SAS datasets, named “SAS7BDAT(DSREAD)”.
To install this extension from the KNIME Labs, in the top menu:

- Click “Help”
- Select “Install New Software …”
- Select the update site
- Open the “KNIME Labs Extensions” category
- Select “KNIME SAS7BDATA Reader (Windows Only)”
- Click “Next” and follow the installation instructions



Grouping / Sorting

PROC SUMMARY/MEANS

GroupBy

SAS Base

```
proc summary data= <dataset-name>;
  class = <col_1>, <col_2>, … <col_n>;
  var <col_x>;
  OUTPUT <OUT=SAS-data-set>;
  <output-statistic-list>
  <statistic(variable)=new-var-name>
  <statistic(variable)=new-var-name>
run;
```

Example:

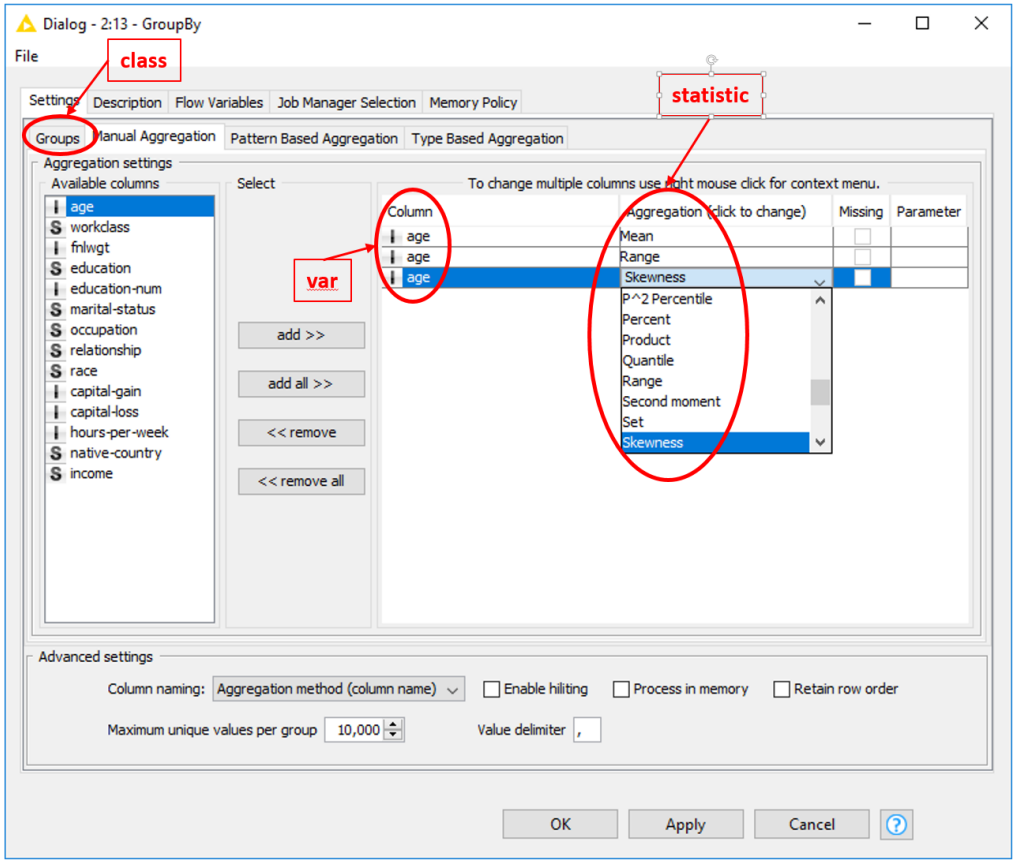
```
PROC SUMMARY DATA= xyz;
CLASS ContractID;
VAR Price;
OUTPUT OUT=example1
SUM(Price) = tot_sales
MEAN(Price) = mean_sales
NMISS(Price) = bad_sales
;
RUN;
```

KNIME Analytics Platform

The "GroupBy" node is configured via two tabs:

- "Groups" defines the group columns
- "Options" defines the aggregation variables and the aggregation methods

Columns selected in tab "**Groups**" correspond to columns selected by "**class**".
Columns selected in tab "**Options**" correspond to columns selected by "**var**".
Aggregation methods selected in tab "**Options**" correspond to:
"<statistic(variable)>".



PROC TABULATE — Pivoting

SAS Base

```
proc tabulate data= <dataset-name> out=<dataset-name>;
  class = <col_1>, <col_2>, … <col_n>;
  var <col_x>;
  table <col_i> *<stat_i>, …, <col_j> * <stat_j>;
run;
```

Example:

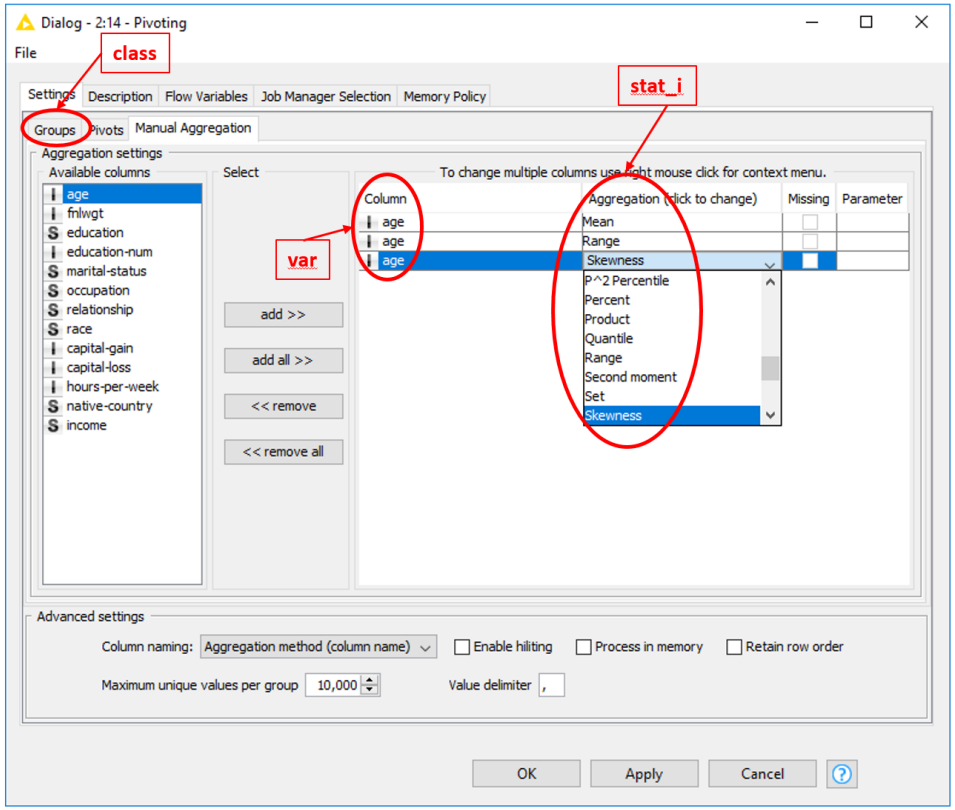
```
proc tabulate data= xyz out=xyz;
  class = education, gender;
  var number;
  table gender, education * N;
run;
```

KNIME Analytics Platform

The "Pivoting" node is configured via three tabs:

- "Groups" defines the group columns (final row IDs)
- "Pivots" defines the pivoting columns (final column headers)
- "Options" defines the aggregation variables and the aggregation methods

Columns selected in "**Groups**" and "**Pivots**" correspond to columns selected by "**class**".
Columns selected in "**Options**" correspond to columns selected by "**var**".
Aggregation methods selected in "**Options**" correspond to **"<stat_i>".**
The "Pivoting" node produces three output tables: the pivot table and the total values for columns and rows.



PROC SORT

Sorter

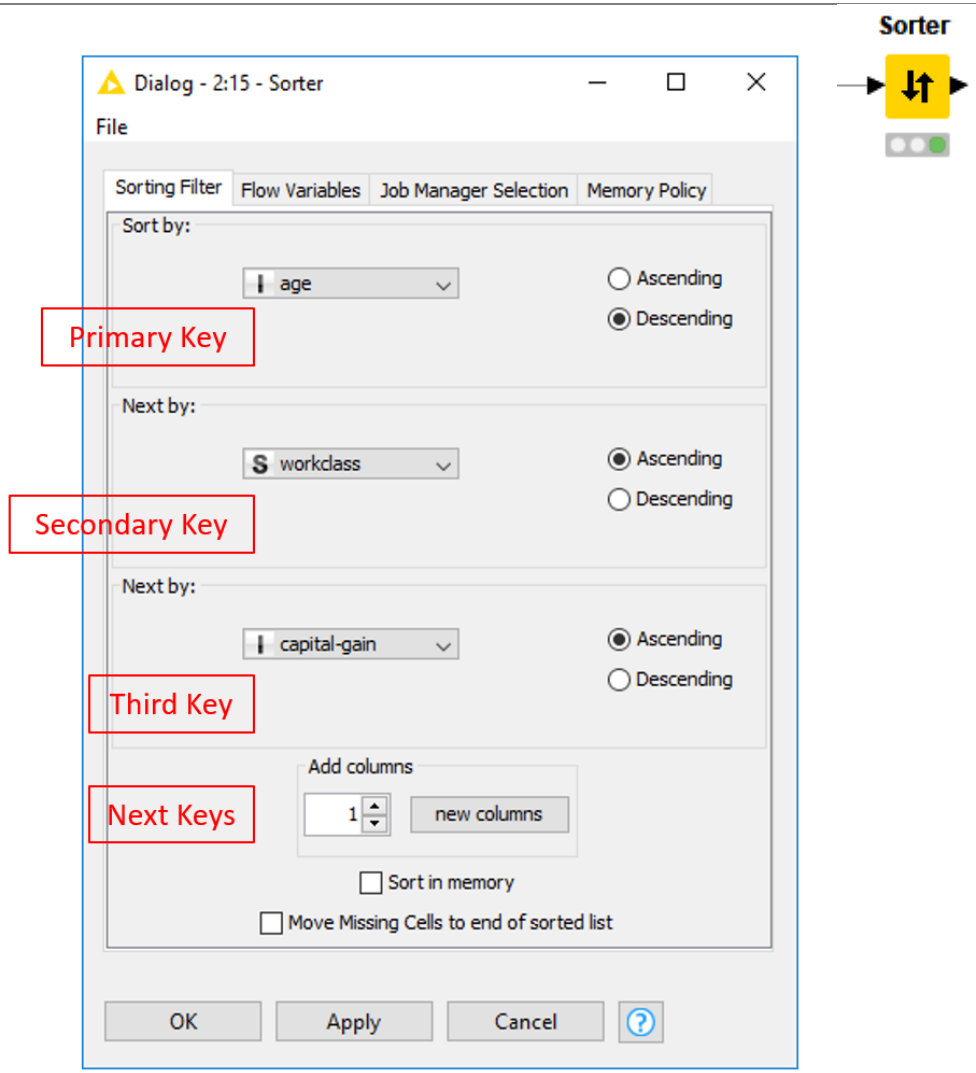
SAS Base

```
PROC SORT DATA=<input-dataset > OUT=<output-dataset >;
  BY <key> ;
RUN ;
```

Example:

```
PROC SORT DATA=xyz OUT=xyz2 ;
  BY CustID, ContractID, DateReceived ;
RUN ;
```

KNIME Analytics Platform



Note. The “Sorter” node has no option to filter out duplicates. To filter out duplicates you need to use a “RowID”, a “Joiner” node, or a “GroupBy” node.

PROC SORT nodup

GroupBy node with First/Last as aggregation method

SAS Base

```
PROC SORT nodup DATA=<input-dataset> OUT=<output-dataset
>;
  BY <key> ;
RUN ;
```

Example:

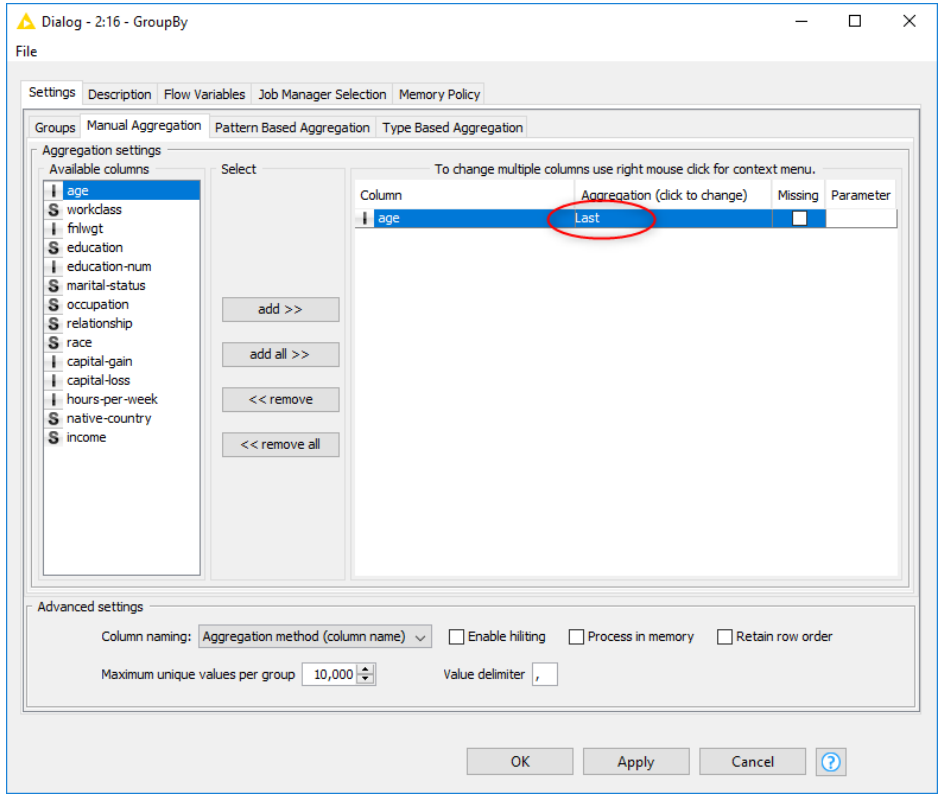
```
PROC SORT nodup DATA=xyz OUT=xyz2 ;
  BY sex;
RUN ;
```

KNIME Analytics Platform

The "GroupBy" node is configured via two tabs:

- "Groups" defines the group columns
- "Options" defines the aggregation variables and the aggregation methods

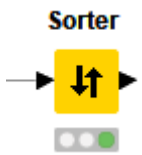
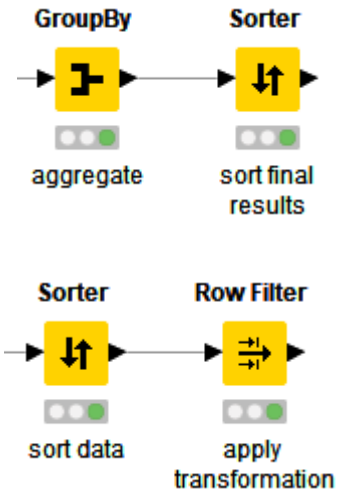
Aggregation method „First" or „Last" keeps only the first or last value of the selected column for the defined group. All other values for the group are removed. As a result the group is represented by one row only with the first or last value for the selected variable.



BY

Sorter

SAS Base	KNIME Analytics Platform

`data <dataset-name>;`
`  set <dataset-name>;`
`  by <col_1> <col_2> … <col_n>;`
`run;`
 	
Example:
`data data1;`
`  set xyz;`
`  by class gender;`
`run;`
	GroupBy / Sorter
	 
	
	Aggregation nodes, like “GroupBy” or “Pivoting”, sort the output data by group in alphabetical order.
	
	If you need a different kind of sorting for the output data or if you need any operation to run on groups in a certain order, you will need to use a “Sorter” node after or before the desired node.
	
	 

count

enumeration variable as ROWINDEX

SAS Base

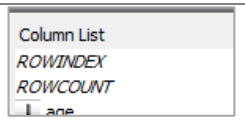
```
data <dataset-name>;
  set <dataset-name>;
  count + 1;
run;
```

Example:

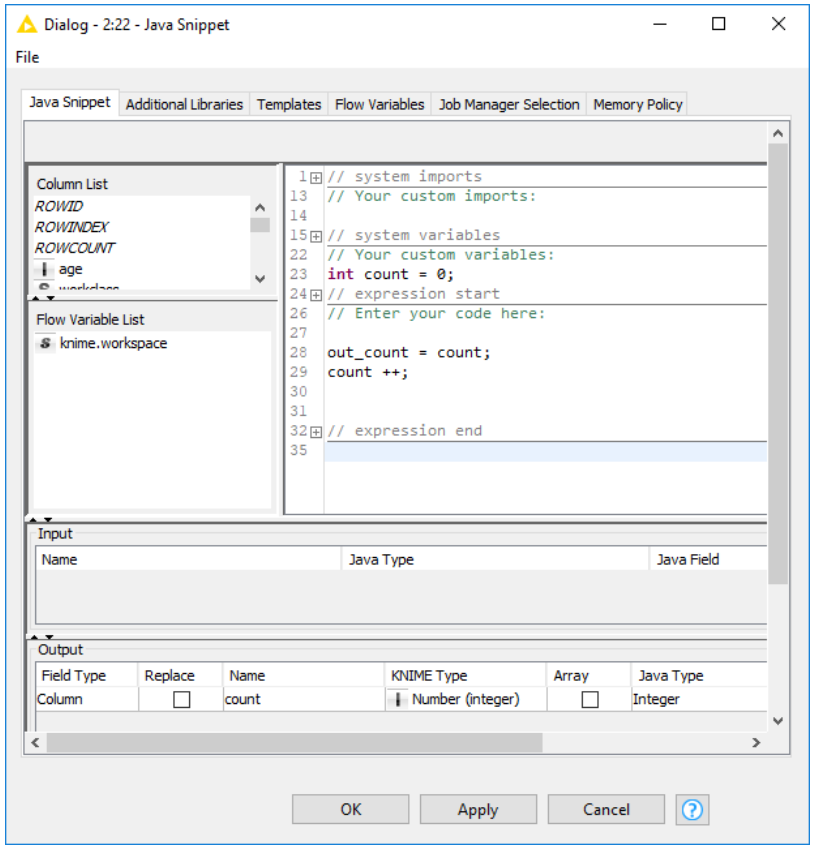
```
data xyz;
  set xyz;
  count + 1;
run;
```

KNIME Analytics Platform

To just count the number of rows in a value group, the "Value Counter" node or the "GroupBy" node with aggregation method "count" would be enough.



Besides that, every node has a flow variable named "ROWINDEX" available. This flow variable contains the number of the current row. "ROWINDEX" can be used for example in a "Math Formula" node to create the enumeration column.
A similar flow variable is "ROWCOUNT" and contains the total number of rows of the input data table.
An enumeration variable can also be obtained with a "Java Snippet" node.



first.<variable> finding the first row meeting a condition in a row group

SAS Base

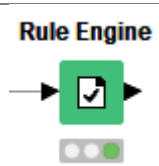
```
data <dataset-name>;
  set <dataset-name>;
  count + 1;
  by <col_1> <col_2> … <col_n>;
  if <condition> then count = 1;
run;
```

Example:

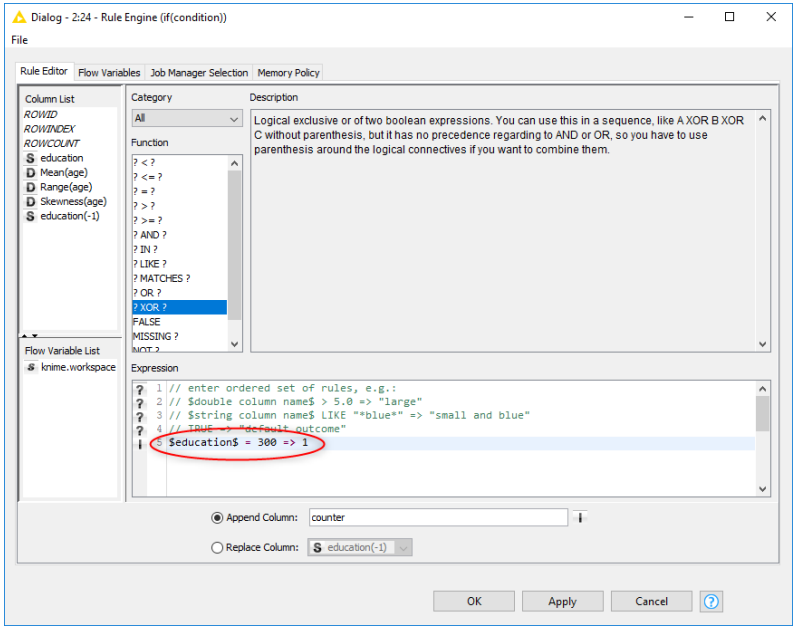
```
data xyz;
  set xyz;
  count + 1;
  by sex;
  if first.sex then count = 0;
run;
```

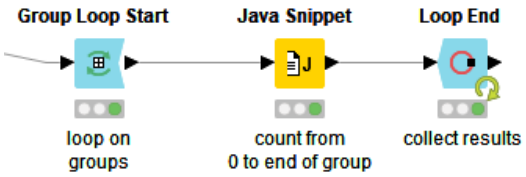
KNIME Analytics Platform

To find the first row meeting a condition, we can use a "Rule Engine" node. The "Rule Engine" node evaluates a condition on each row and produces a consequent output value. If input data have been previously sorted, the counter=1 will happen at the beginning of each group.



If we want to get an enumeration inside each group, we need a group loop cycle, starting with a "Group loop Start" node and ending with a "Loop End" node.





nmiss() count missing values in a row

SAS Base

```
data <dataset-name>;
      set <dataset-name>;
      <new_column> = nmiss(<col_1>, <col_2>, …, <col_n>);
run;
```

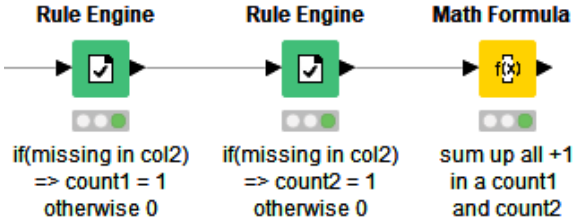
Example:

```
data xyz;
      set data1;
      nr_missing = nmiss(sex, CustID, ContractID);
run;
```

KNIME Analytics Platform

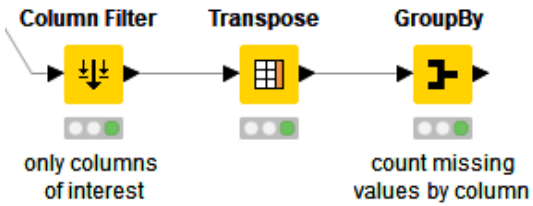
This can be obtained in many ways.

- "Rule Engine" with MISSING($col1$) => +1 and TRUE => 0 for all involved columns. Then "Math Formula" node for summing up all +1 in the resulting columns.



Note. Similarly, you can use a "Missing Value" node to assign a special value to missing values and then count them with a "Rule Engine" and a "Math Formula" node.

- "For small data sets, we could use a "Transpose" node + "GroupBy" node with "Missing value count" as aggregation method.



Note. If you are working on many columns, in tab "Groups" you should use "Pattern Based Aggregation" with regex ".*" or "Type Based Aggregation" including all types. It would be too tedious to add all columns manually in the "Manual Aggregation" tab.

Join/Concatenate

SET

Concatenate and Concatenate (Optional in)

SAS Base

```
data <dataset-name>;
   set <dataset1> <dataset2>;
run;
```

Example:

```
data xyz
   set x y z;
run;
```

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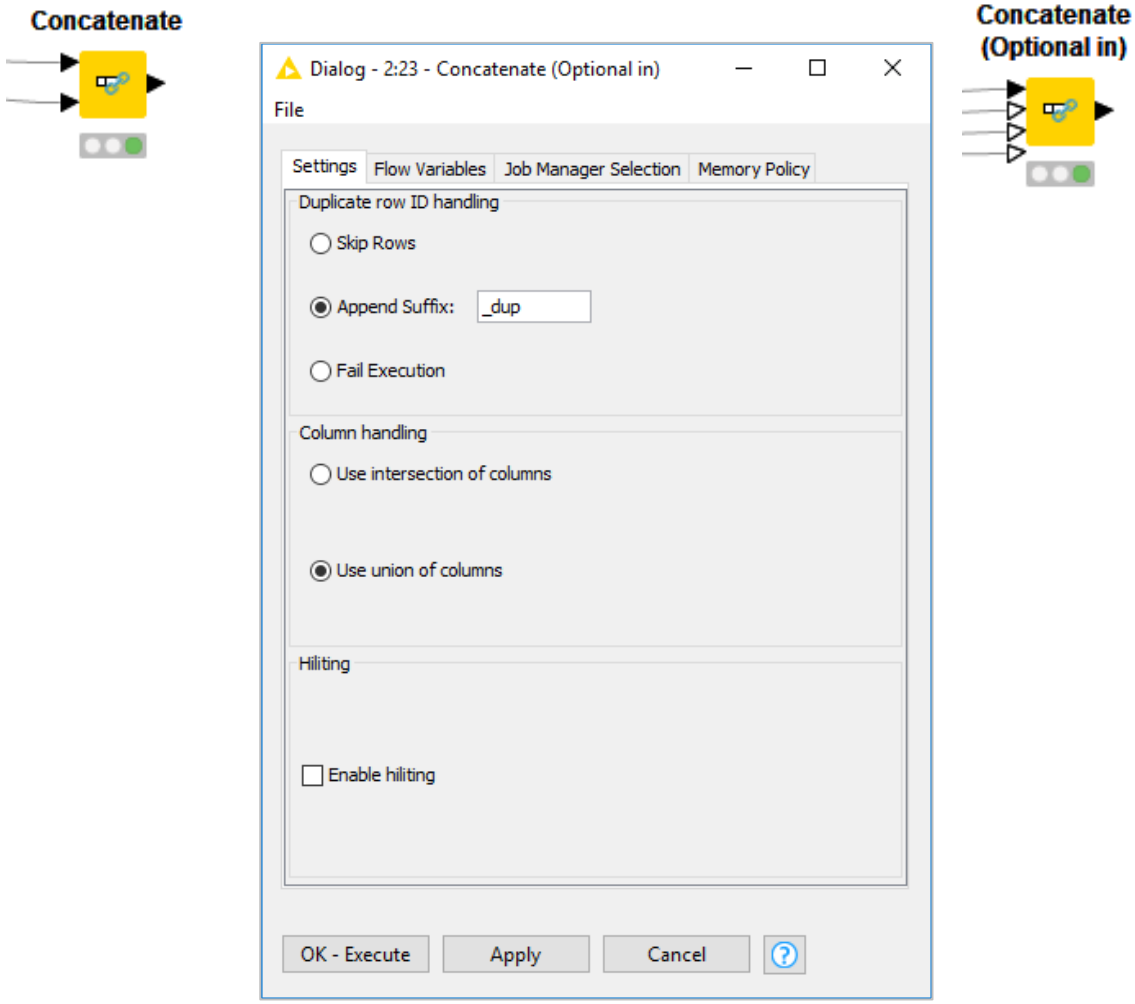


Note 1. The “Concatenate (Optional in)” node has a maximum of 4 input. If we need to concatenate more than four data sets, we need to use more “Concatenate (Optional in)” nodes.
Note 2. The simpler “Concatenate” node has only two input ports and can concatenate only two data tables.

MERGE

Joiner

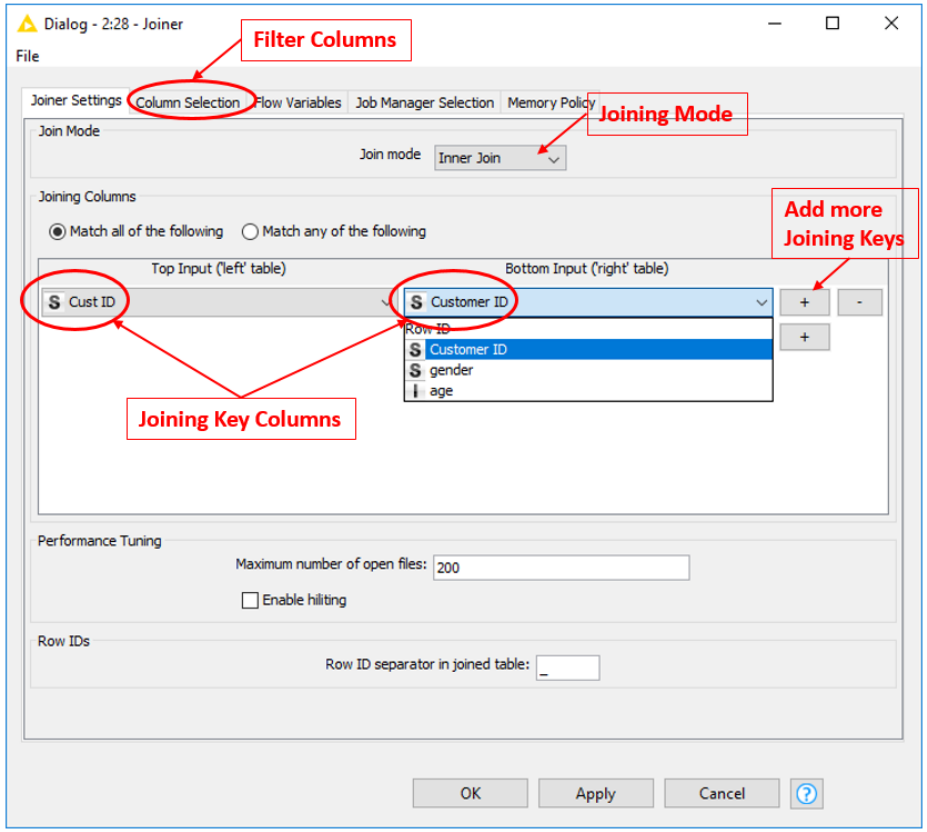
SAS Base

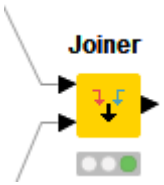
```
data <dataset-name>;
  merge <dataset1>( in=<label1> )
        <dataset2>( in=<label2> );
  by <column-name>;
run;
```

Example:

```
data xyz;
  merge sales( in=a )
        contracts( in=b );
  by id;
run;
```

KNIME Analytics Platform





Note 1. "Duplicate Column Handling" is defined in the "Column Selection" tab. Here you can choose between: skip duplicate columns, stop the node execution if a column with the same name is found in both tables, or append a suffix to the name of duplicate columns.

Note 2. There is no merging option in handling duplicate columns. That is: unlike "merge" in SAS, the "Joiner" node in KNIME does not fill the missing values in one column in one table with the non-missing values from the column with the same name in the other table. To merge values from two columns in the joined data table, you will need to use the "Column Merger" or the "Rule Engine" node.

WHERE

Row Filter

SAS Base

```
proc …  data=<dataset-name>
  …
  where <condition>;
run;


data <dataset-name>
  set <dataset-name>;
  where <condition>;
run;
```

Example:

```
proc means data=xyz;
  where x<5 and y>3;
run;


data xyz;
   set xyz;
   where ContractID=123;
run;
```

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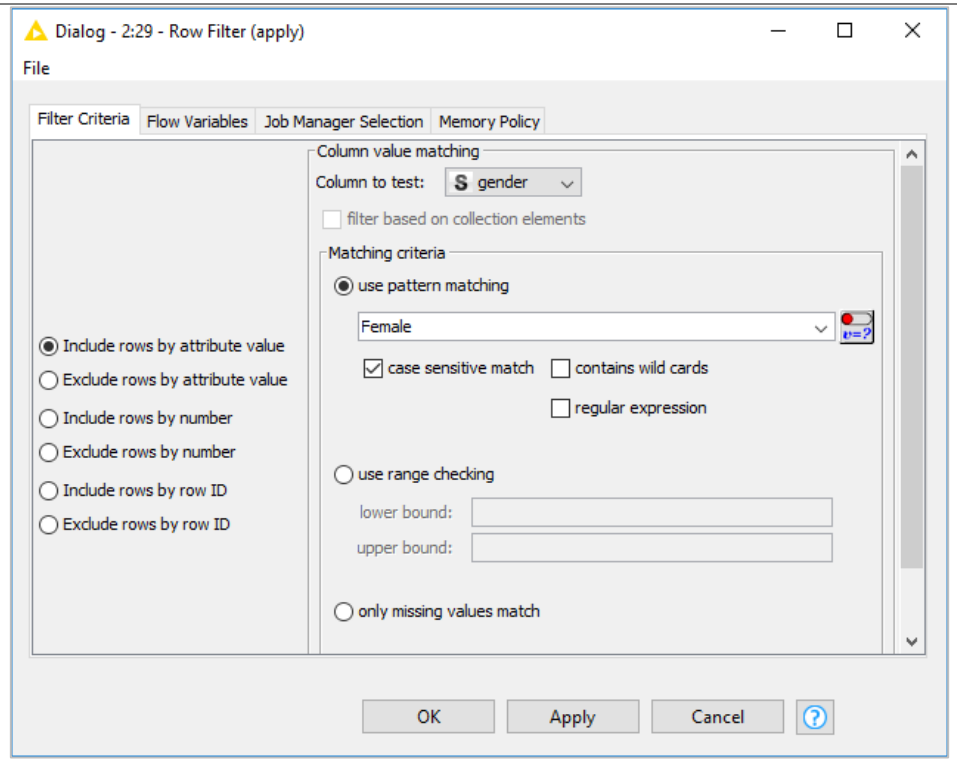
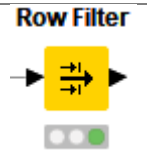




Note. You need to build the <where> condition in the configuration window of the "Row Filter" node. Notice that it is also possible to EXCLUDE the rows matching the pattern (right side of the node configuration window).

KEEP/DROP

Column Filter

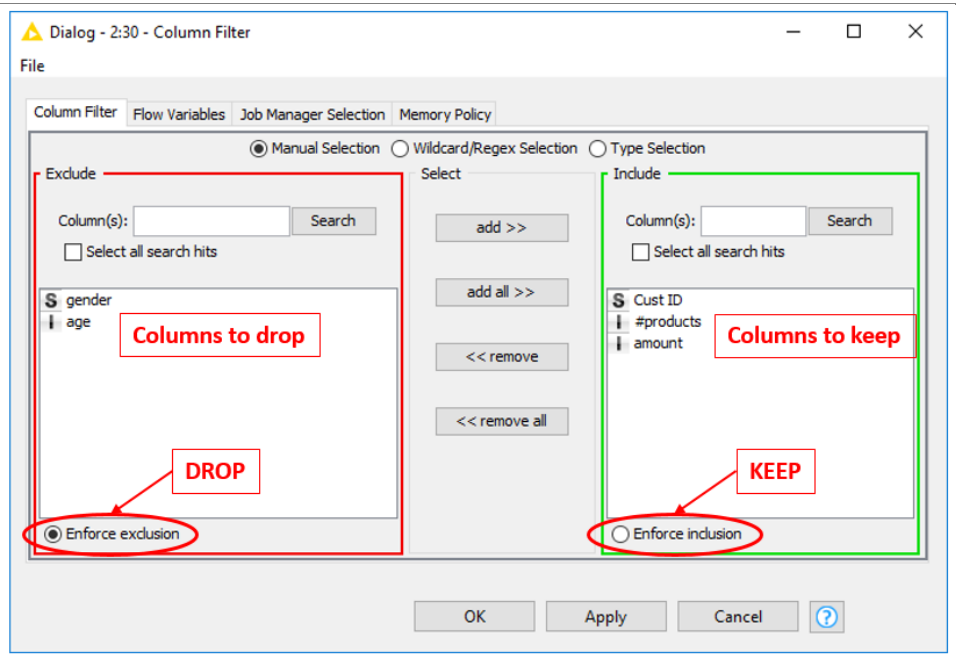
SAS Base

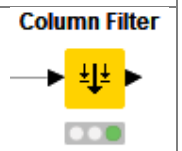
```
proc …  data=<dataset-name>
  …
  keep <col1> <col2> … <coln>;
 [drop <col1> <col2> … <coln>;]
run;


data <dataset-name>
  set <dataset-name>
  keep <col1> <col2> … <coln>;
 [drop <col1> <col2> … <coln>;]
run;
```

Example:

```
proc means data=xyz;
  keep x, y;
 [drop z;]
run;


data xyz;
   set xyz;
   keep ContractID, CustID, Price;
  [drop nr,DateReceived;]
run;
```

KNIME Analytics Platform





String Manipulation

right()

String Manipulation – stripEnd($column_name$)

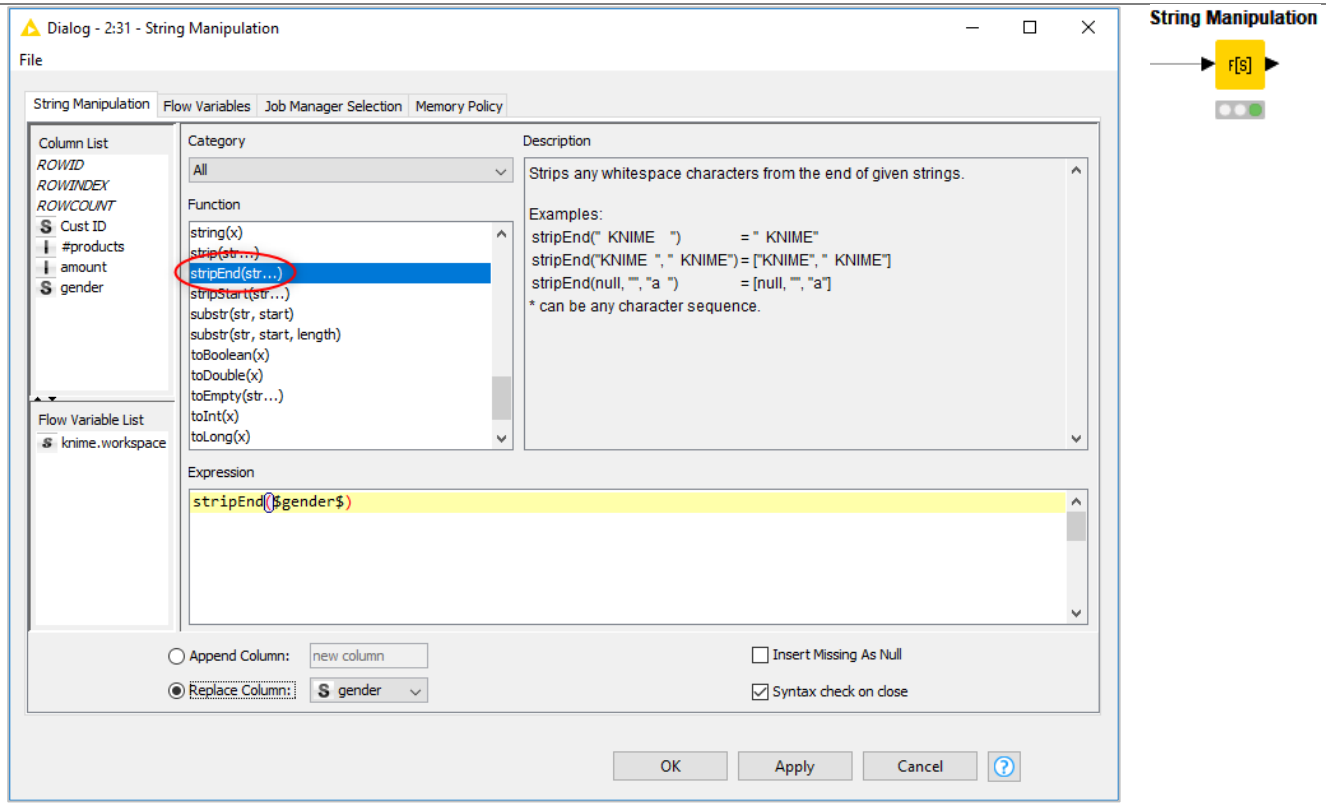
SAS Base

```
data <dataset-name>;
  set <dataset-name>;
  <new column> = right(<column-name>);
run;
```

Example:

```
data xyz;
  set data1;
  CustID = right(CustID);
run;
```

KNIME Analytics Platform



Note. Argument of the function can be more than one column, if separated by commas.

left()

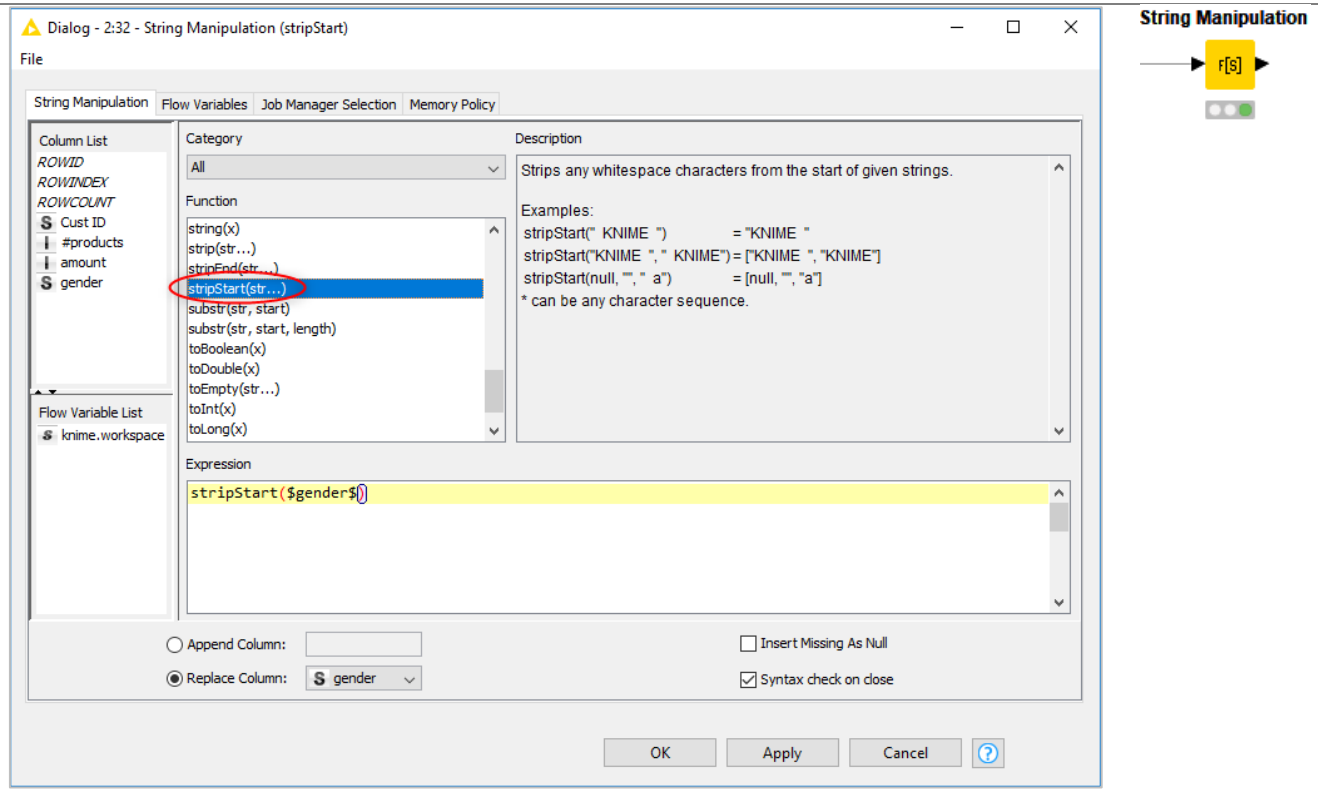
String Manipulation – stripStart($column_name$)

SAS Base	KNIME Analytics Platform

```
data <dataset-name>;
  set <dataset-name>;
  <new column> = left(<column-name>);
run;
```

Example:

```
data xyz;
  set data1;
  CustID = left(CustID);
run;
```

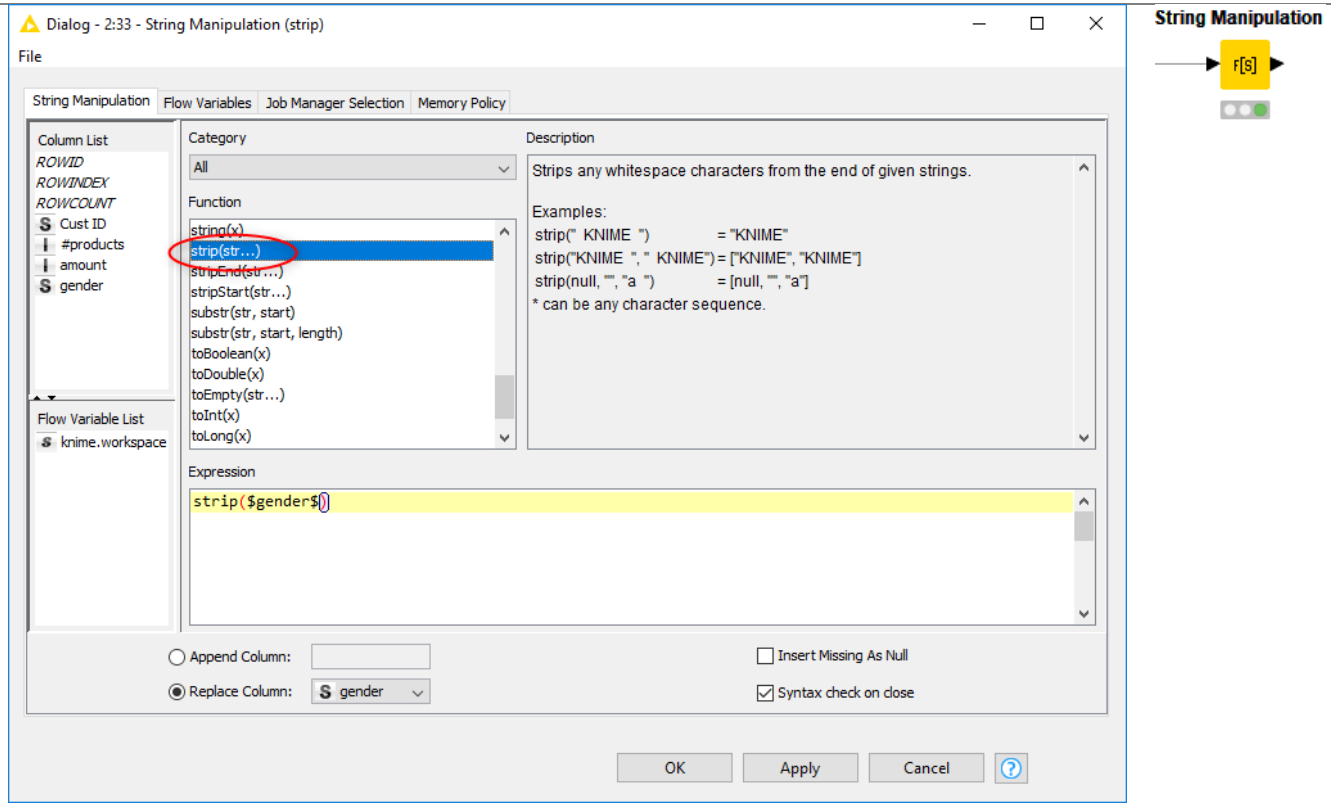


Note. Argument of the function can be more than one column, if separated by commas.

trim()

String Manipulation – strip($column_name$)

SAS Base	KNIME Analytics Platform

`data <dataset-name>;`
`  set <dataset-name>;`
`  <new column> = trim(<column-name>);`
`run;`
 	
Example:
 	
`data xyz;`
`  set data1;`
`  CustID = trim(CustID);`
`run;`
	
	
	Note. Argument of the function can be more than one column, if separated by commas.

strip() — String Manipulation – replace($column_name$, " ", "")

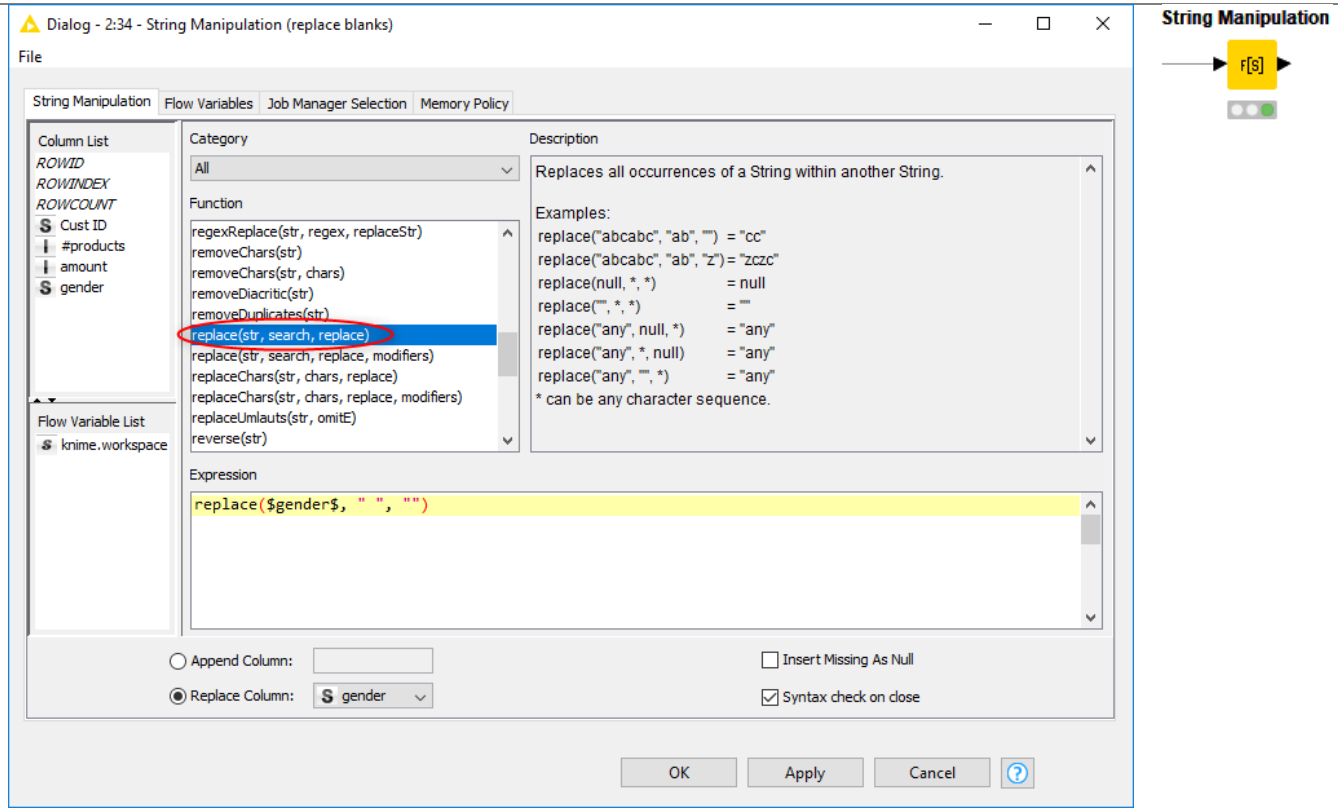
SAS Base

```
data <dataset-name>;
  set <dataset-name>;
  <new column> = strip(<column-name>);
run;
```

Example:

```
data xyz;
  set data1;
  CustID = strip(CustID);
run;
```

KNIME Analytics Platform



Note. SAS function "strip()" is a particular instance of KNIME function "replace()". In particular it is the instance where all blank spaces are replaced by nothing.

upcase()/lowcase()/propcase()

String Manipulation – lowerCase(col), upperCase(col), capitalize(col)

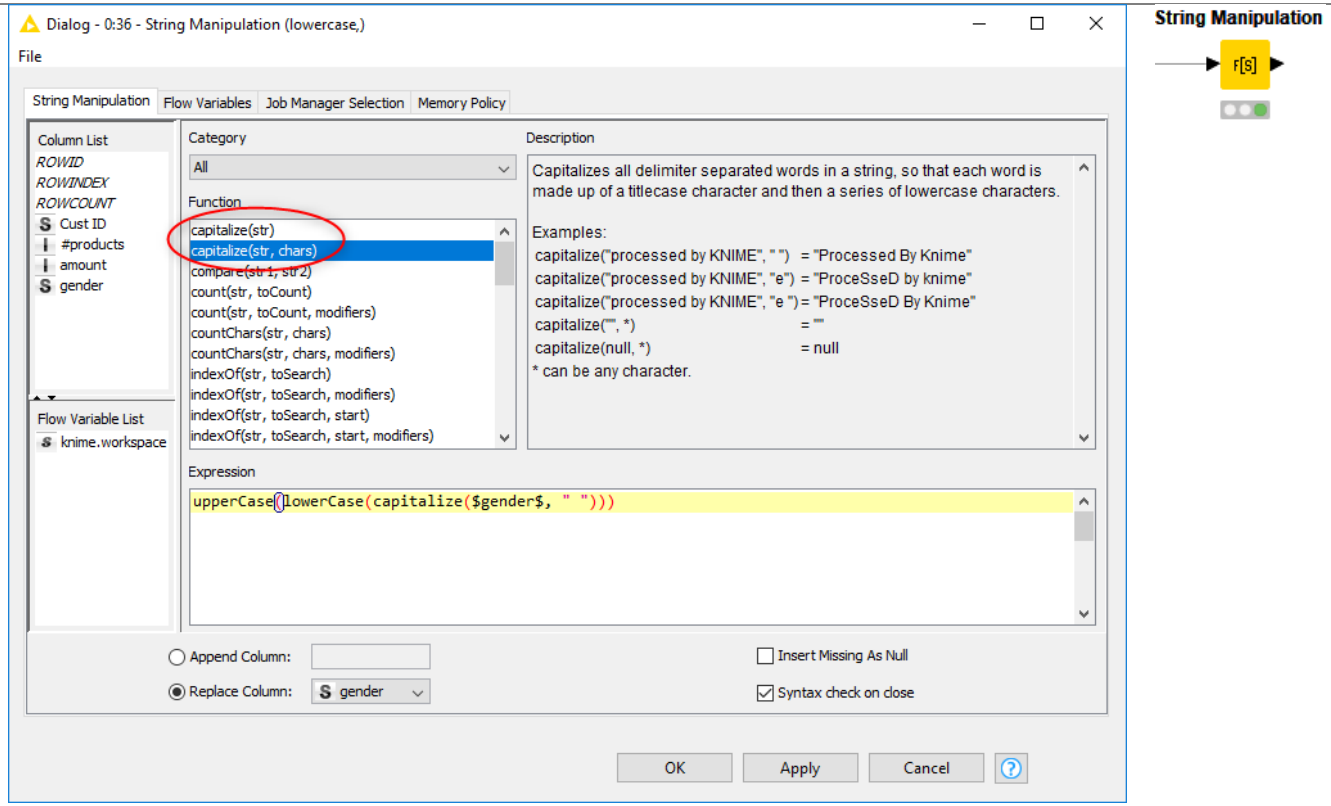
SAS Base

```
data <dataset-name>;
  <new column> = upcase(<column-name>);
  <new column> = lowcase(<column-name>);
  <new column> = propcase(<column-name>);
run;
```

Example:

```
data xyz;
  ContractID = upcase(ContractID);
  ContractID = lowcase(ContractID);
  ContractID = propcase(ContractID);
run;
```

KNIME Analytics Platform



SAS Base

1. **substr**(*<string>, <position>,<length>*) = *characters-to-replace*

OR

2. *<variable>* = **substr**(*<string>, <position>,<length>*)

Example:

1. a='KNIME';
   substr(a,4,1)='F';

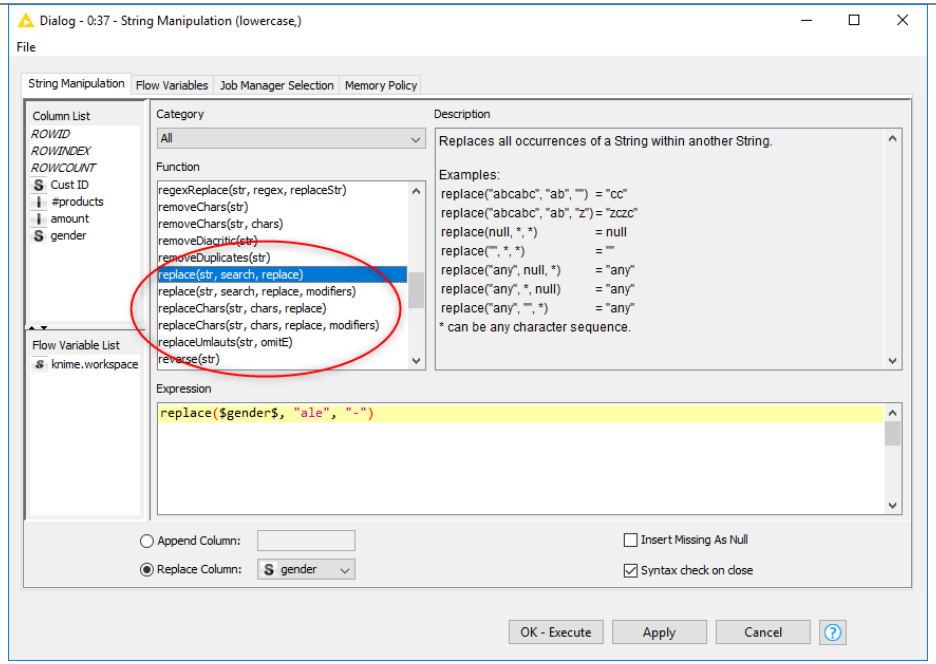
   RESULT: a = "KNIFE"

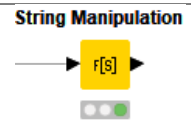
OR

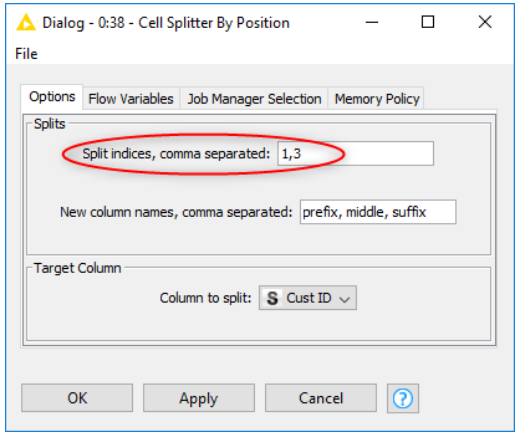
2. newStr='Information Mining';
   newStr1=**substr**(newStr,1,4);
   newStr2=**substr**(newStr,12,6);

   RESULT: newStr1 = "Info" newStr2 = "Mining"

KNIME Analytics Platform







Note. KNIME has 3 "Cell Splitter" nodes: "Cell Splitter by Position" based on indices, "Cell Splitter" based on delimiter matching, and "Regex Split" based on Regular Expression matching.

scan()

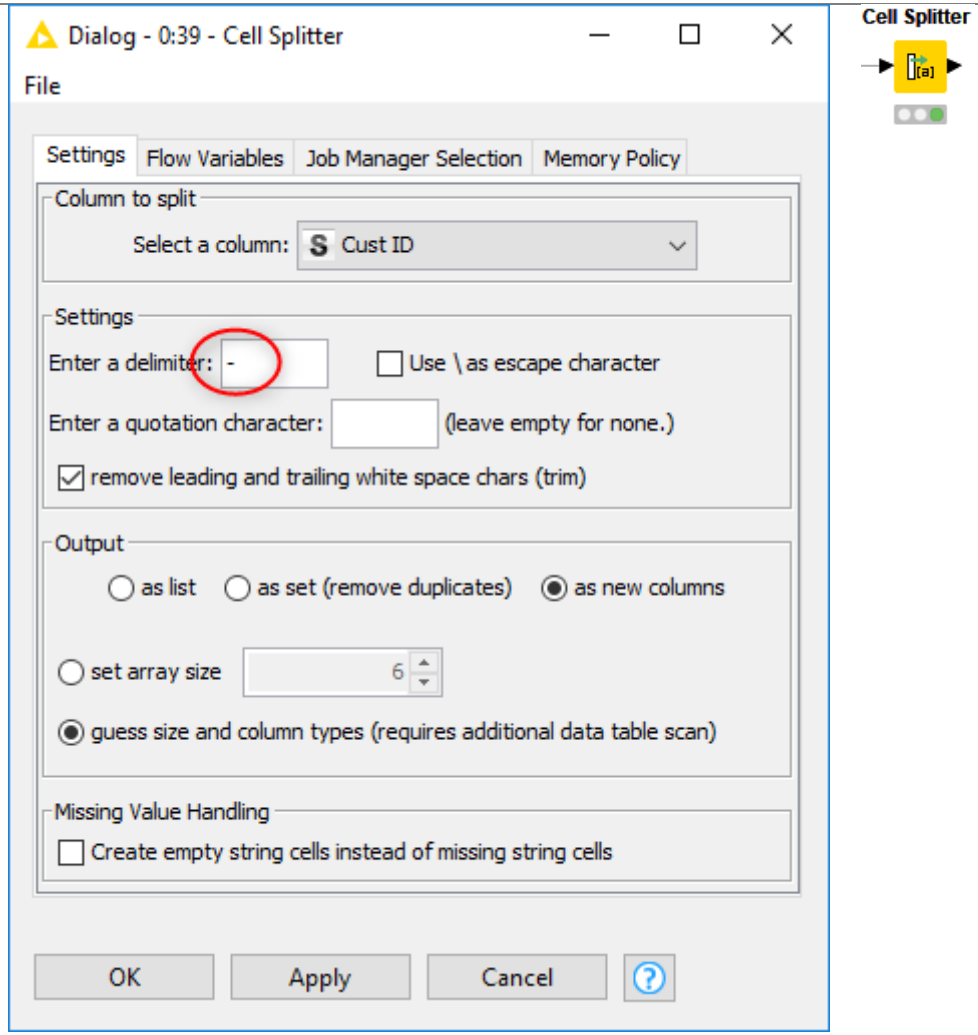
Cell Splitter

SAS Base	KNIME Analytics Platform

```
data <dataset-name>;
  set <database-name>;
  <word_string> = scan(<string>, <int>, <delimiter>,
<modifier>);
   end;
run;
```

Example:

```
data xyz;
  set data1;
  delim = ',';
  modif = 'mo';
  nwords = countw(string, delim, modif);
   do count = 1 to nwords;
      word = scan(string, count, delim, modif);
      output;
   end;
run;
```



countw()

String Manipulation – count(col, “String”)

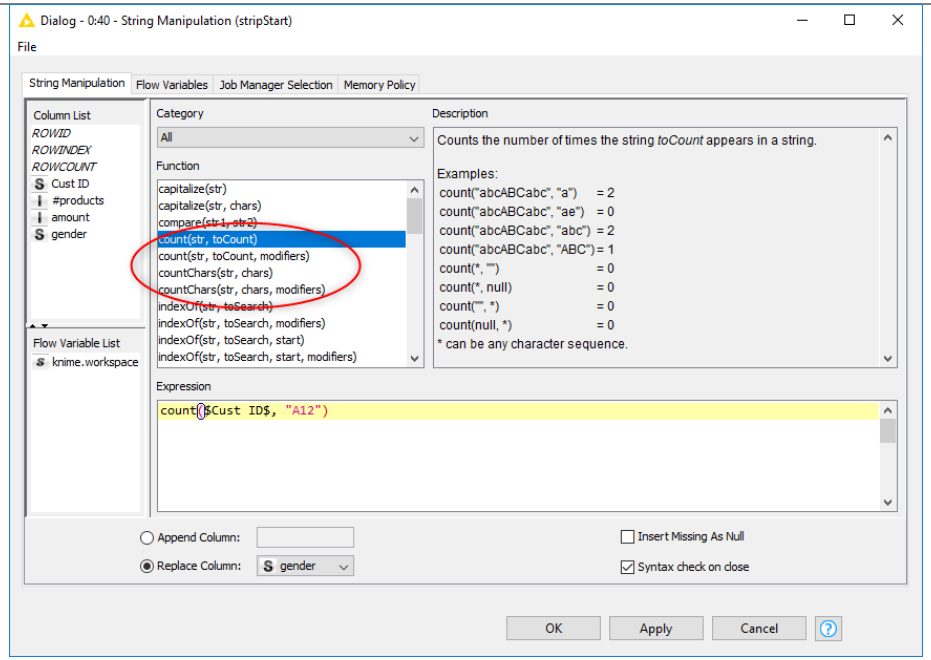
SAS Base

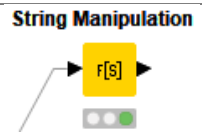
```
data <dataset-name>;
  set <database-name>;
  <int> = countw(<string>, <delimiter>,
<modifier>);
<modifier>);
   end;
run;
```

Example:

```
data xyz;
  set data1;
  delim = ',';
  modif = '';
  nwords = countw(custID, delim, modif);
   do count = 1 to nwords;
      word = scan(string, count, delim, modif);
      output;
   end;
run;
```

KNIME Analytics Platform





index ()/indexw()

String Manipulation – indexOf(col, “String”)

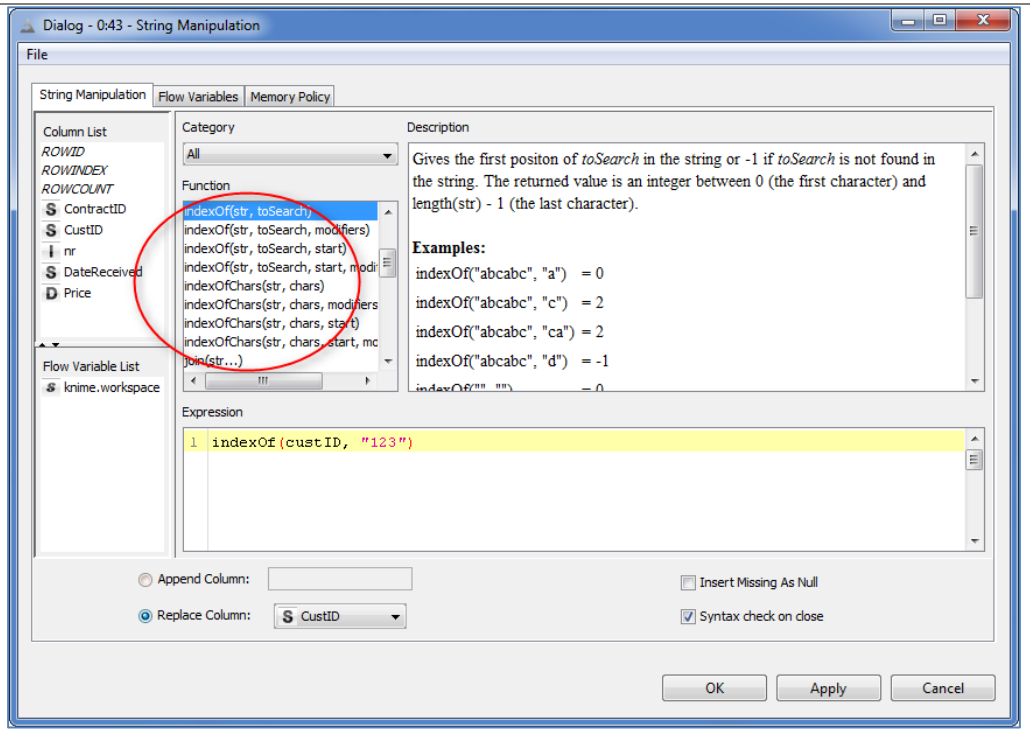
SAS Base

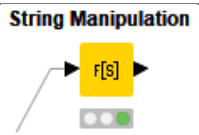
```
data <dataset-name>;
  set <dataset-name>;
  <new column int> = index(<column-name>,<string>);
  <new column int> = indexw(<column-name>,<string>,<del>);
run;
```

Example:

```
data xyz;
  set data1;
  found = index(custID, “123”);
  found = indexw(custID, “123”, “%”);
run;
```

KNIME Analytics Platform





put()

Column Rename & other nodes

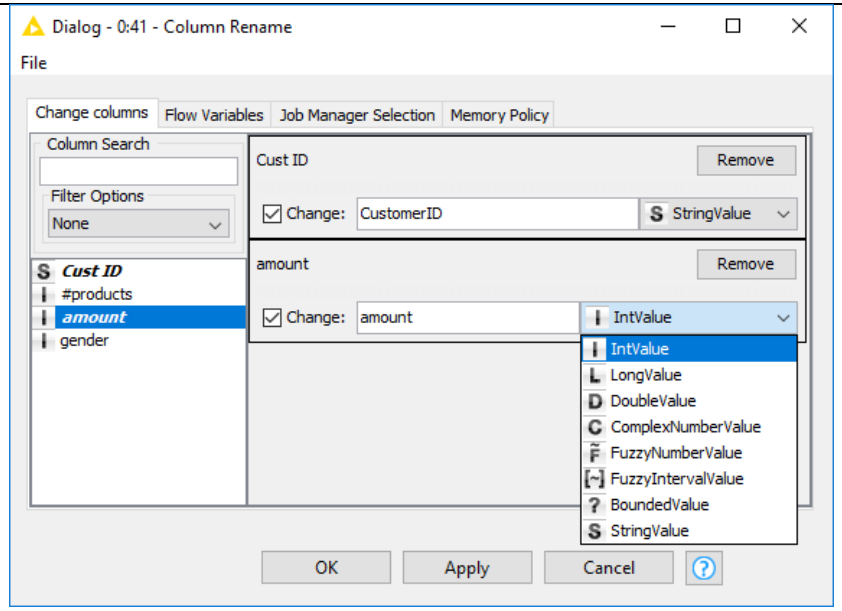
SAS Base

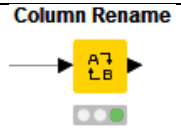
```
…
put()
source = <value>;
ff = <format>;
<output> = put(source, format);
…
```

Example:

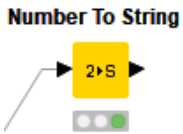
```
…
source = "12.01.2011";
ff= date8.;
source_date = put(source, date8.);
…
```

KNIME Analytics Platform

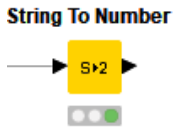




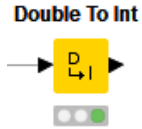
For more specific type conversions you can use one of the following nodes:

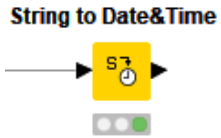


Number To String
String To Number

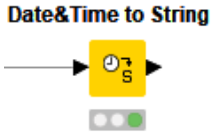


Double To Int





String To Date&Time
Time To String



Note. String Manipulation node functions toInt(), to Double(), string() perform the same conversion resp. from String to Integer, from String to Double, from Number to String.

SAS Base

```
proc format library=<library-name>;

  value <column-name>  [range1]='text1'
                       [range2]='text2'
                       [range3]='text3' ;
  value $<column-name>  <valuesList1>='text4'
                        <valuesList2>='text5' ;

…
run;
```

Example:

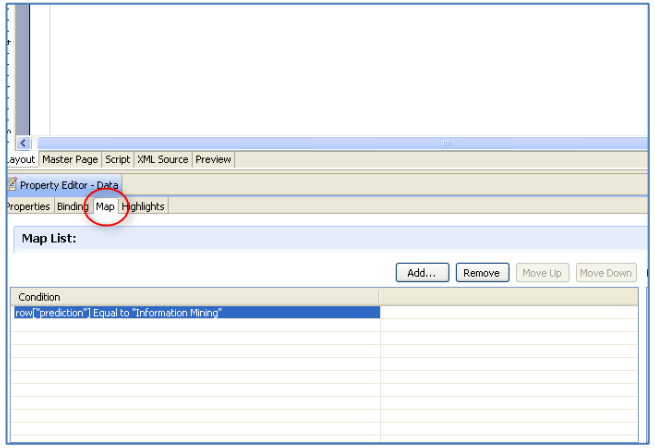
```
proc format library=my;

  value education  1-11 = 'till High School'
                     12 = 'High School'
               12<-high = 'above High School' ;
  value $sex  'M','m' = 'Male'
              'F','f' = 'Female' ;
run;
```

KNIME Analytics Platform

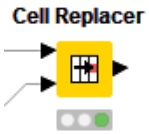
In BIRT (via Report Designer Extension):

In Tab „Property Editor" (panel under the Report Layout editor):

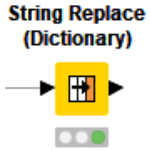
- select Tab "Map" to display values or ranges as text strings



In workflow to replace String from Dictionary:

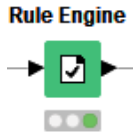


Cell Replacer
String Replace (Dictionary)



In workflow to replace String according to rule map:

Rule Engine



Logical Operations

if - then

Rule Engine

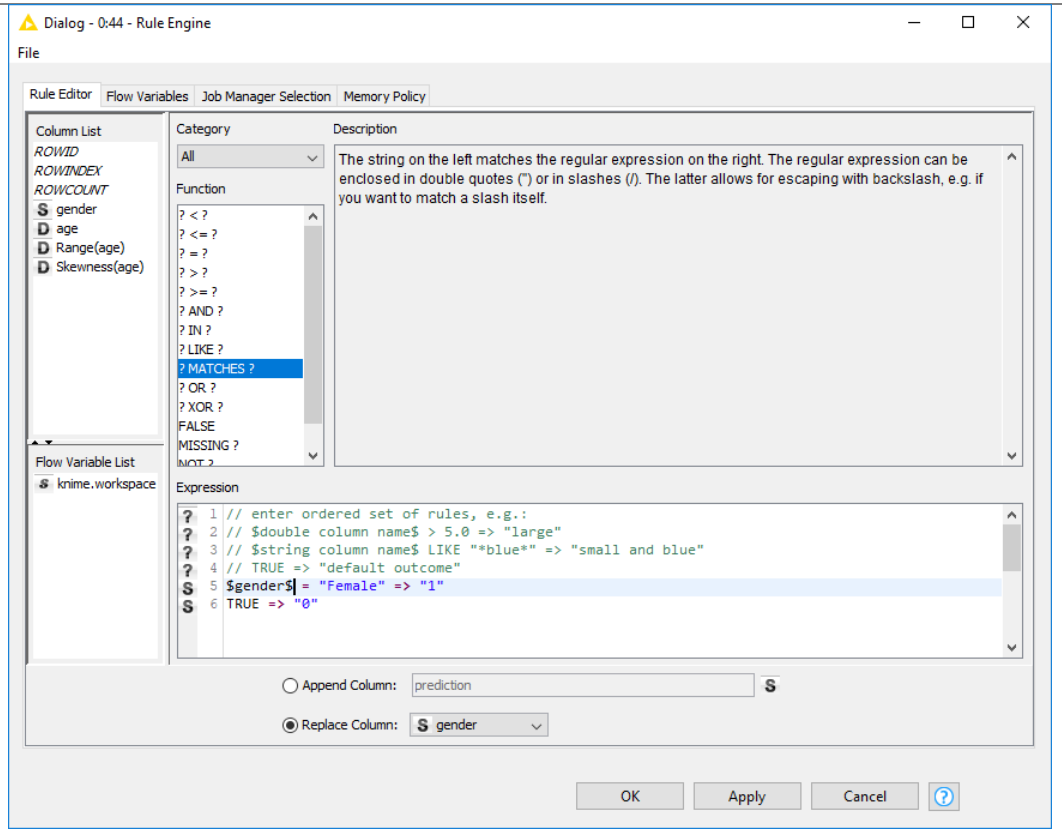
SAS Base

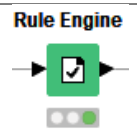
```
data <dataset-name>;
  set <dataset-name>;
  if <condition1> then <consequence1>;
  if <condition2> then <consequence2>;
  else <default-consequence>;

.....
run;
```

Example:

```
data xyz;

  set xyz;

  if      Price < 50 then label='discounted';
  else if Price > 200 then label =
'overpriced';
  else    label='normal priced';

.....
run;
```

KNIME Analytics Platform





Note. Column values can be inserted in the rule editor by double-click in the “Column List” panel.

in()

Rule Engine – IN(...)

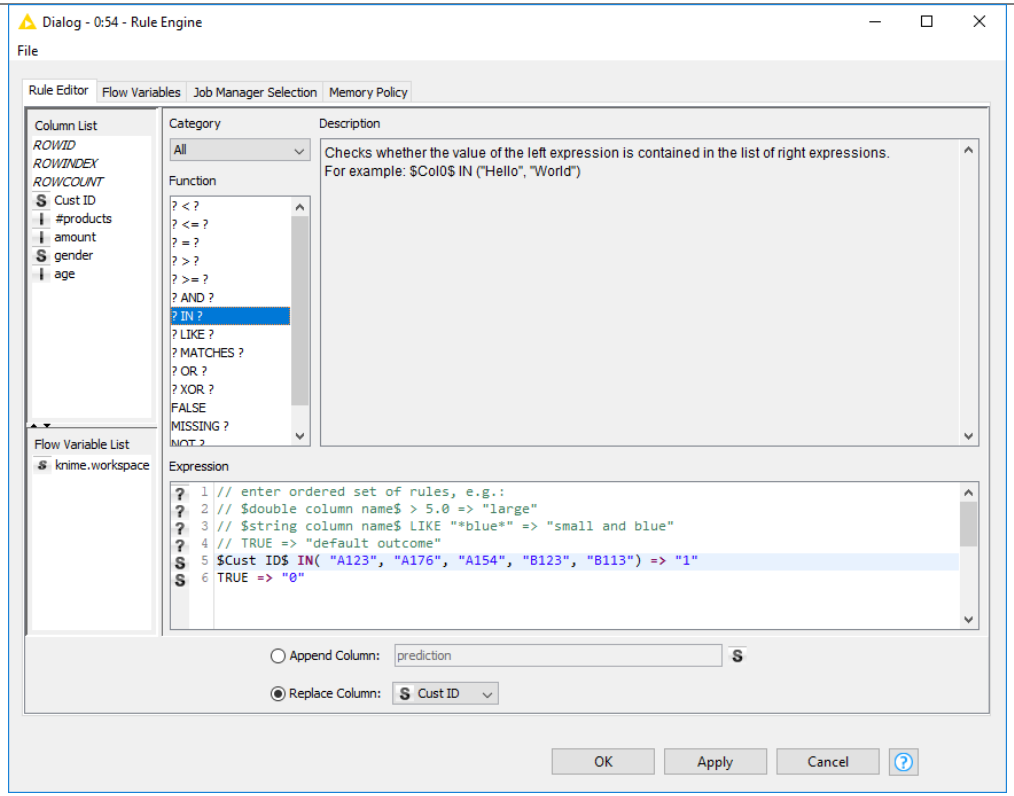
SAS Base

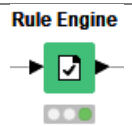
```
data <dataset-name>;
  set <dataset-name>;
  if/where <col-name> in(<list-of-values>)
        [then <consequence>];
run;
```

Example:

```
data xyz;
  set xyz;
  if class in
        ('A','B','C')
        then prediction = 'Y';
run;
```

KNIME Analytics Platform





missing()

Rule Engine - MISSING and Missing Value

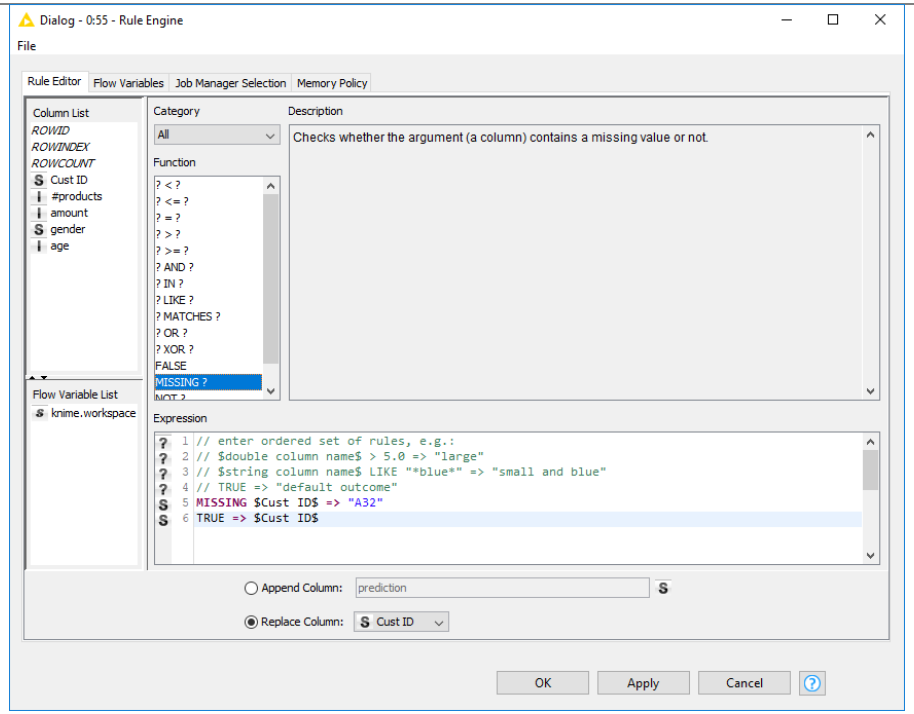
SAS Base

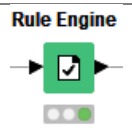
```
data <dataset-name>;
      set <dataset-name>;
      if missing(<column-name>) then <condition>;
run;
```

Example:

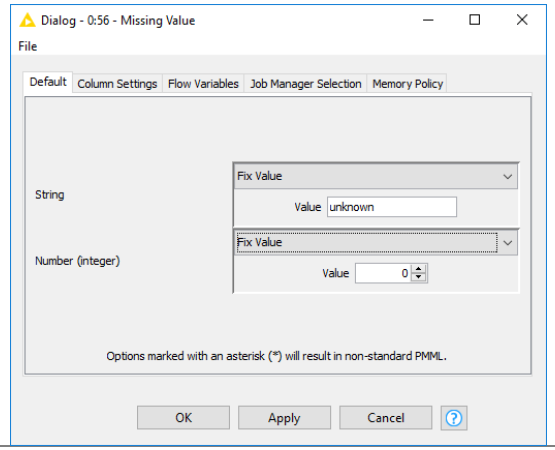
```
data xyz;
      set data1;
      if missing(ContractID) then label=CustID;
      else label=ContractID;
run;
```

KNIME Analytics Platform





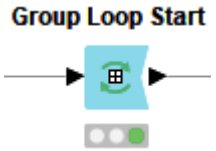
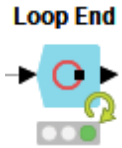
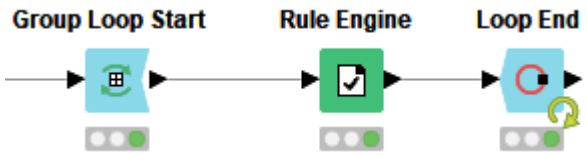
To impute missing values:



do … end

Loops

SAS Base	KNIME Analytics Platform

`data <dataset-name>`
`  do <condition>`
`  …`
`  end;`
`run;`
 	
Example:
 	
`data iris;`
`  do species=1 to 3;`
`  …`
`  end;`
`run;`
	
	… Loop Start / … Loop End
	 
	
	In the „Flow Control“ -> „Loop Support” category, KNIME offers a number of different loop nodes to start and to end a loop. All loops in KNIME start with a “<name> Loop Start” node and end with a “<name> Loop End” node. All nodes between the loop start node and the loop end node make the loop body.
	
	- **Cycle “for” with a fixed number of iterations**. The “**Counting Loop Start**” and the “**Interval Loop Start**” node, in combination with a “**Loop End**” node, implement a “for” cycle.
	- **Cycle “while”**. The “**Generic Loop Start**”, in combination with a “**Variable Condition Loop (End)**”, implements a “while” cycle.
	- **Looping on a list of values**. The “**TableRow To Variable Loop Start**” node, together with a “**Loop End**” node, loops across all rows of a table and transforms each row into a flow variable. This is particularly useful, for example, to loop on a list of unique values.
	- **Looping on groups/chunks of data rows.** The “**Group/Chunk Loop Start**” loops across groups/chunks of the input rows.
	- **Loop with memory.** Notice that all previous loops act at each iteration on the original input data set. The only loop using the processed dataset from the previous iteration is the Recursive loop (“**Recursive Loop Start**” node – “**Recursive Loop End**” node)
	- **Note.** Loop End nodes benefits form a number of extra options in their context menu to start, stop, resume, and execute step by step the loop cycle.
	
	 

macro

Metanode

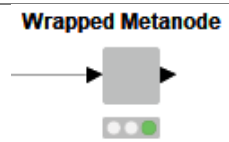
SAS Base

```
%macro <macro-name>(par1=value1, par2=value2);
 …
Code
 …
%mend <macro-name>;
```

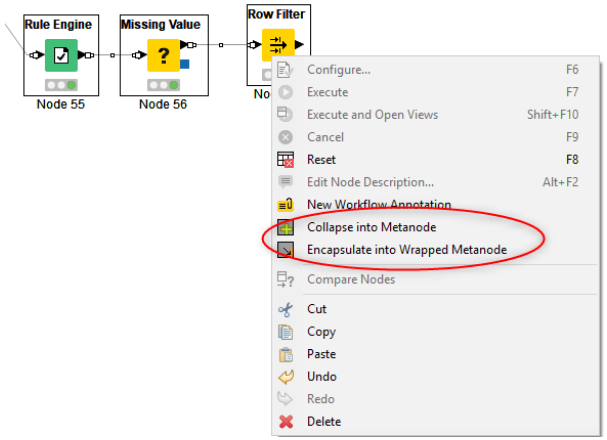
Example:

```
%macro finance(yvar=expenses,xvar=division);
   proc plot data=yearend;
      plot &yvar*&xvar;
   run;
%mend finance;
```

KNIME Analytics Platform



KNIME nodes can be grouped together inside a meta-node like code lines inside a macro.
Just select the meta-nodes, right-click and select “Collapse into Meta Node” or “Encapsulate into Wrapped Metanode”.



Alternatively you can create a meta-node from scratch by clicking the “Add Meta Node Wizard” button in the top bar and following the meta-node wizard instructions.

Input parameters can be introduced in a meta-node by means of “Quick Form” nodes.

Note. The same meta-node can be stored centrally and called by different workflows, workspaces, and even users. This is a metanode template. The metanode instance calling to the metanode template is a linked metanode. This is available in KNIME Analytics Platform (the free open-source version) as well as in KNIME Server.

Date&Time Manipulation

day() / year() / month()

SAS Base

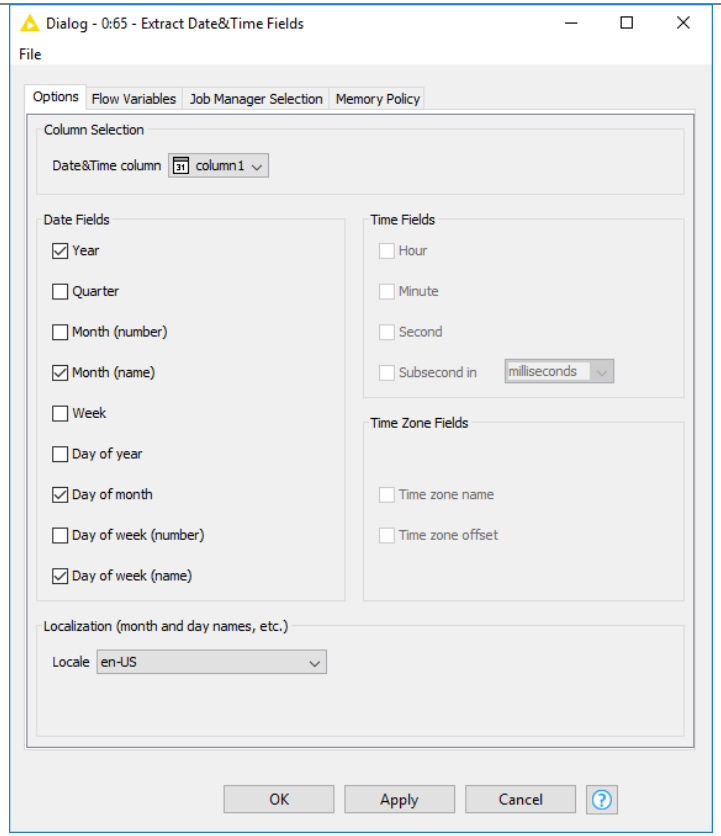
```
DATA <dataset-name>;
   INPUT        <var-name> <format>
          <pos> <datetime-name> <date-format>;
    M    = MONTH(<datetime-name>);
    D    = DAY(<datetime-name>) ;
    Y    = YEAR(<datetime-name>);
    wk_d= WEEKDAY(<datetime-name>);
    q    = QTR(<datetime-name>);
…
;
RUN;
```

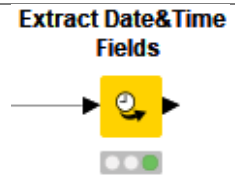
Example:

```
DATA dates;
   INPUT  name $ 1-4 @6 bday mmddyy11.;
    M    = MONTH(bday);
    D    = DAY(bday) ;
    Y    = YEAR(bday);
    wk_d= WEEKDAY(bday);
    q    = QTR(bday);
…
;
RUN;
```

Extract Date&Time Fields

KNIME Analytics Platform





Note. The “Extract Date&Time Fields” node works on Date&Time data type. Since a date is always read as a String, it has to be converted to the Date&Time type before the “Extract Date&Time Fields” node is applied. For the conversion, use a “String to Date&Time” node.

today()

Create Date&Time Range

SAS Base

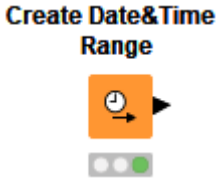
```
data <dataset-name>;
   <column-name> = today();
run;
```

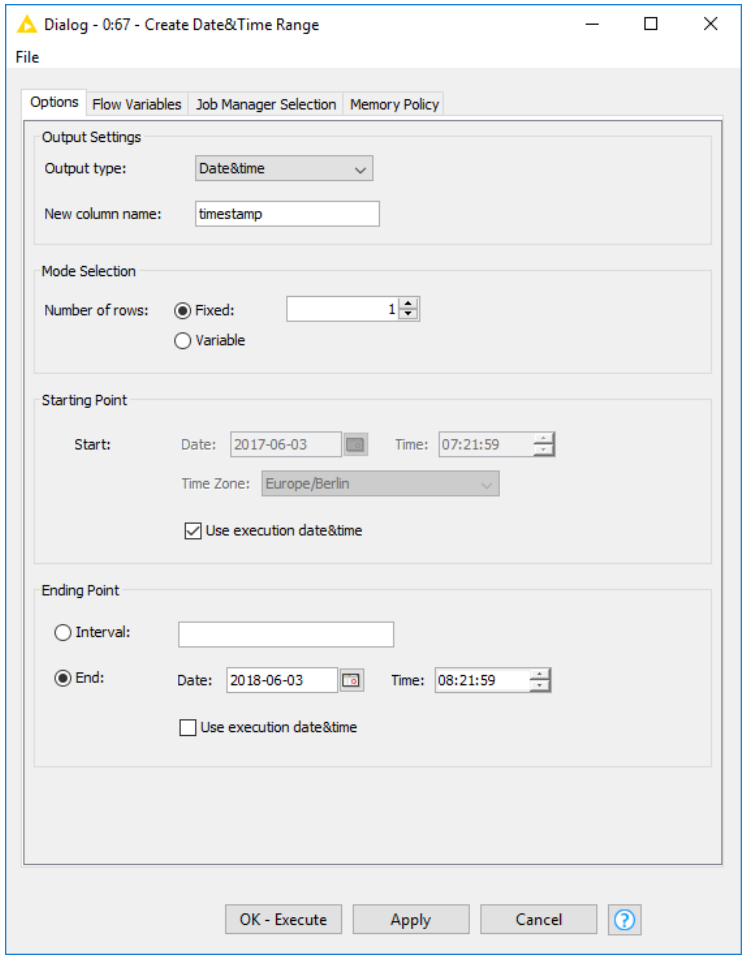
Example:

```
data _null_;
   current_date = today();
   if (current_date - datedue) > 30 then
      do;
         put 'As of ' current_date date9.
             ' the payment of invoice #'
             Invoice_nr 'is expired.';
      end;
run;
```

KNIME Analytics Platform

Generate 1 Date&Time value with “Use execution date&time” as Starting Point.

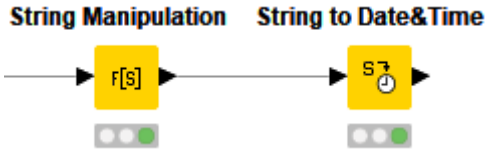




mdy()

String Manipulation – join() and String to Date&Time

SAS Base	KNIME Analytics Platform

`data <dataset-name>;`
`  set <database-name>;`
`  <date> = mdy(<month>,<day>,<year>);`
`run;`
 	
Example:
 	
`data xyz;`
`  set data1;`
`  birthday = mdy(11, 13, 1965);`
`run;`
	
	Starting from 3 columns „day“, „month”, and “year”, combine them with the “String MAnipulation” node using the join function.
	Use a “String To Date&Time” node to convert the combined String to a Date&Time type.
	
	Note. The Date&Time format in the menu of the “String To Date&Time” node is editable. If you do not find the format that you need, you can always edit one.
	
	Note. For a conversion to Date&Time you need day and month in a two-char format, like “03” for March. If you start from day and month as Integer, the “Number To String” node does not supply a fixed format with zero-padding for the conversion. So, Integer “3” becomes String “3” while you need “03” for a conversion to Date&Time.

Math Operations

int()/ceil()/round()/floor()

Math Formula – round(), ceil(), floor()

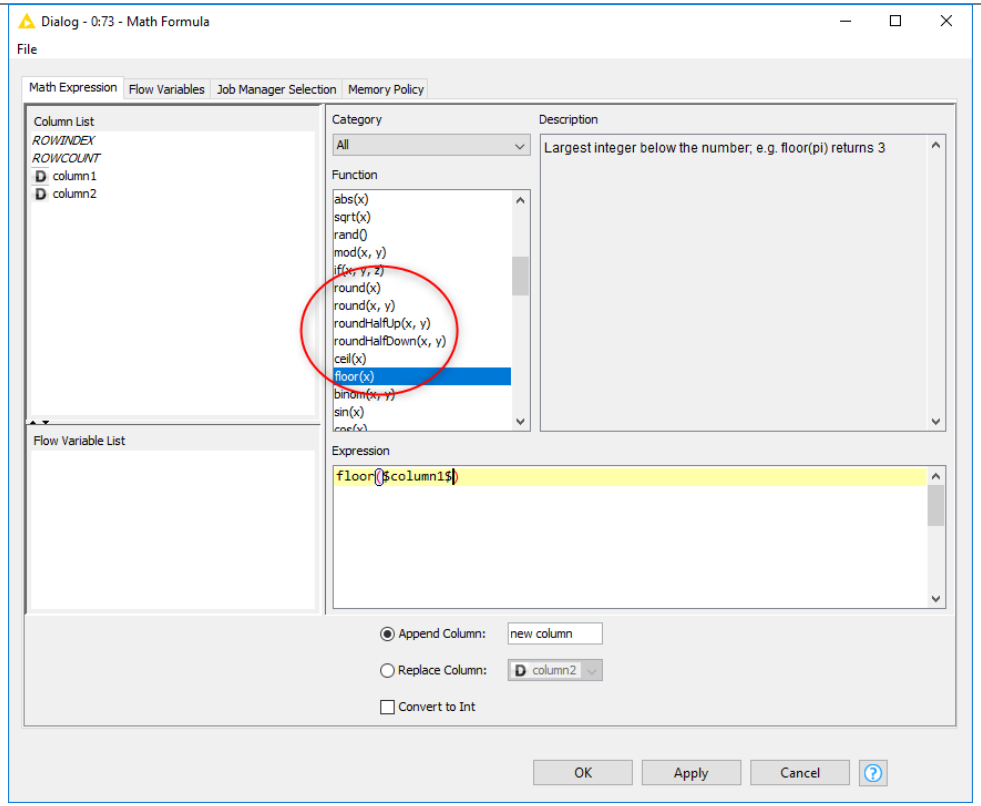
SAS Base

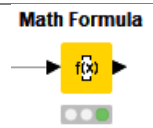
```
data <dataset-name>;
  set <dataset-name>
  <matrix1> = int(<matrix>);
  <matrix2> = round(<matrix>);
  <matrix3> = floor(<matrix>);
  <matrix4> = ceil(<matrix>);
run;
```

Example:

```
data xyz;
  set data1;

  Price = int(Price);
  Price = round(Price);
  Price = floor(Price);
  Price = ceil(Price);
run;
```

KNIME Analytics Platform

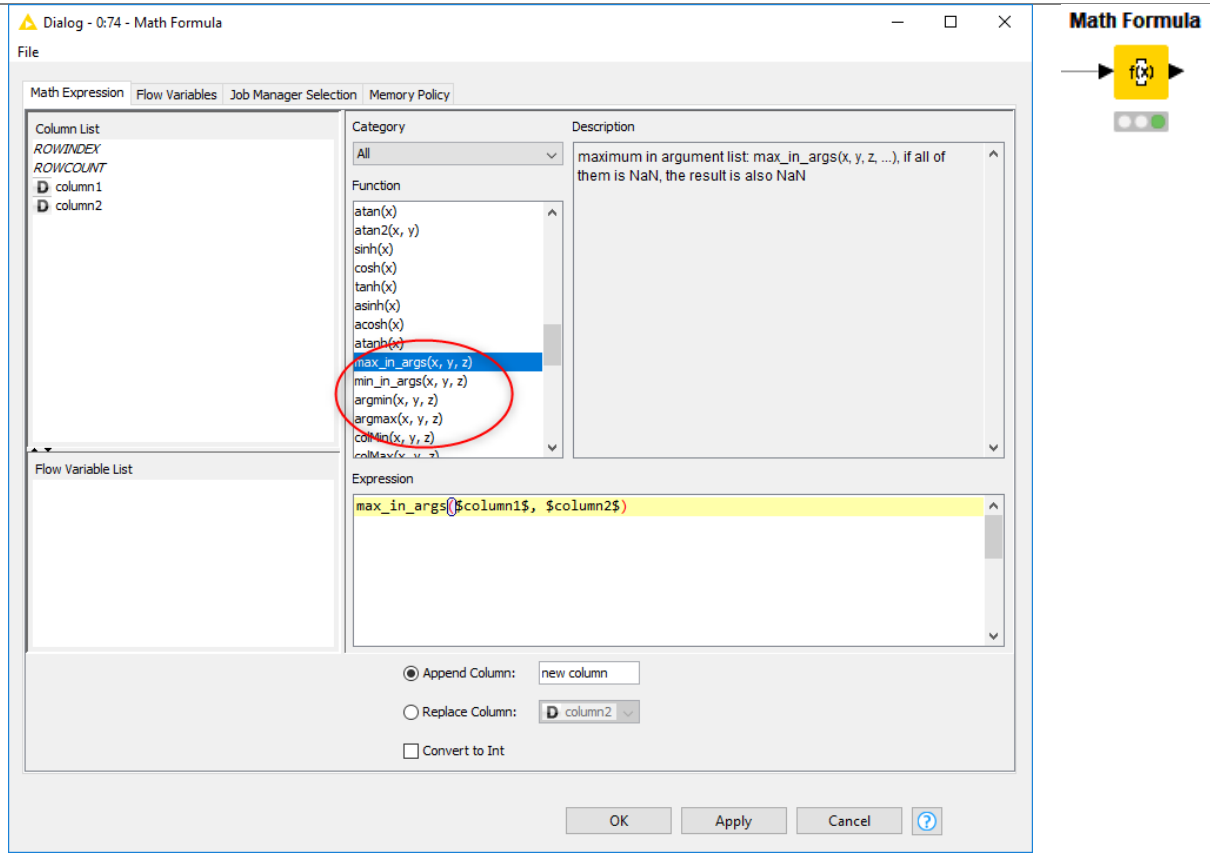




max()/min()

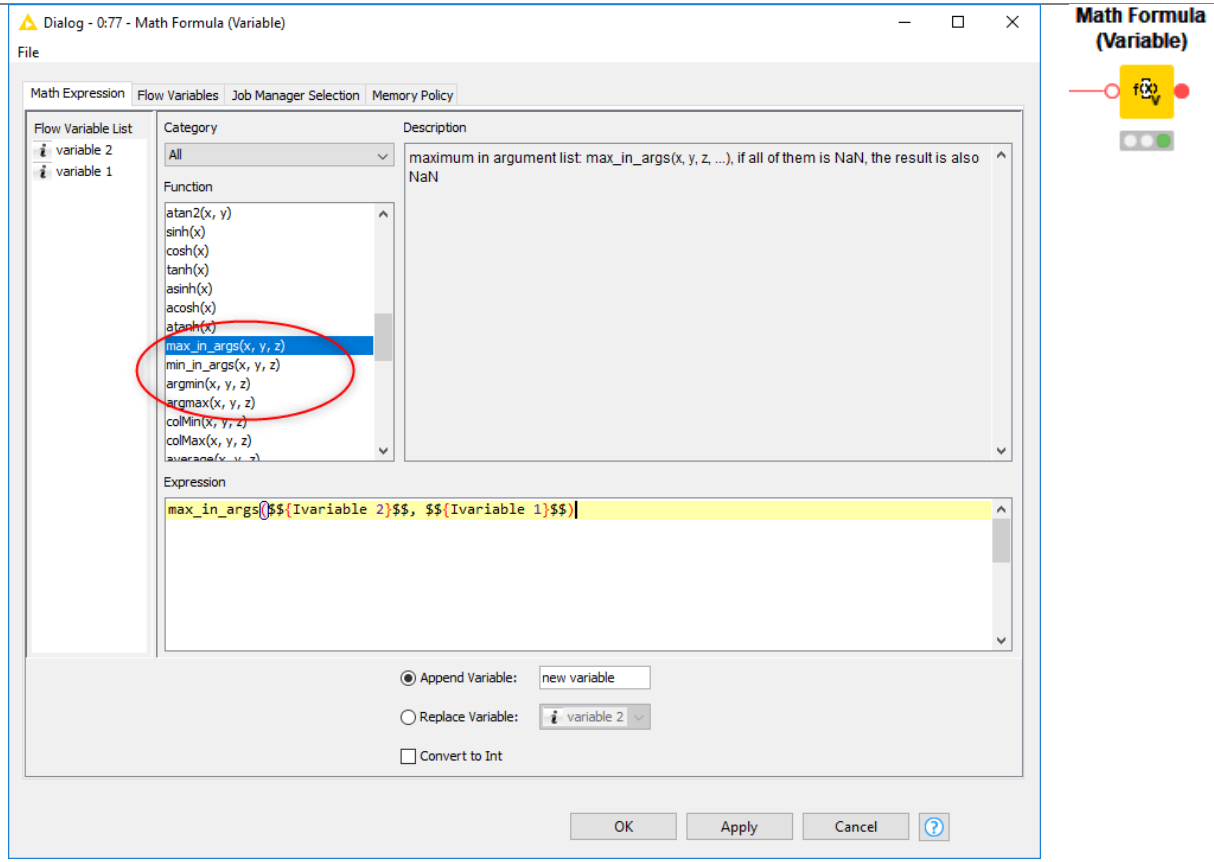
Math Formula – max_in_args() min_in_args()

SAS Base	KNIME Analytics Platform

`data <dataset-name>;`
`  set <database-name>;`
`  <variable-name> =`
`  max/min(<matrix_1>, …, <matrix_n>);`
`run;`
 	
Example:
 	
`data xyz;`
`  set data1;`
`  y = max(nr, Price);`
`run;`
	

max()/min() Math Formula (Variable)

SAS Base	KNIME Analytics Platform

`data <dataset-name>;`
`  set <database-name>;`
`  <variable-name> =`
`  max/min(<matrix_1>, …, <matrix_n>);`
`run;`
 	
Example:
 	
`data xyz;`
`  set data1;`
`  y = max(x1, x2, x3);`
`run;`
	

mean()/sum()

Math Formula – mean() and +

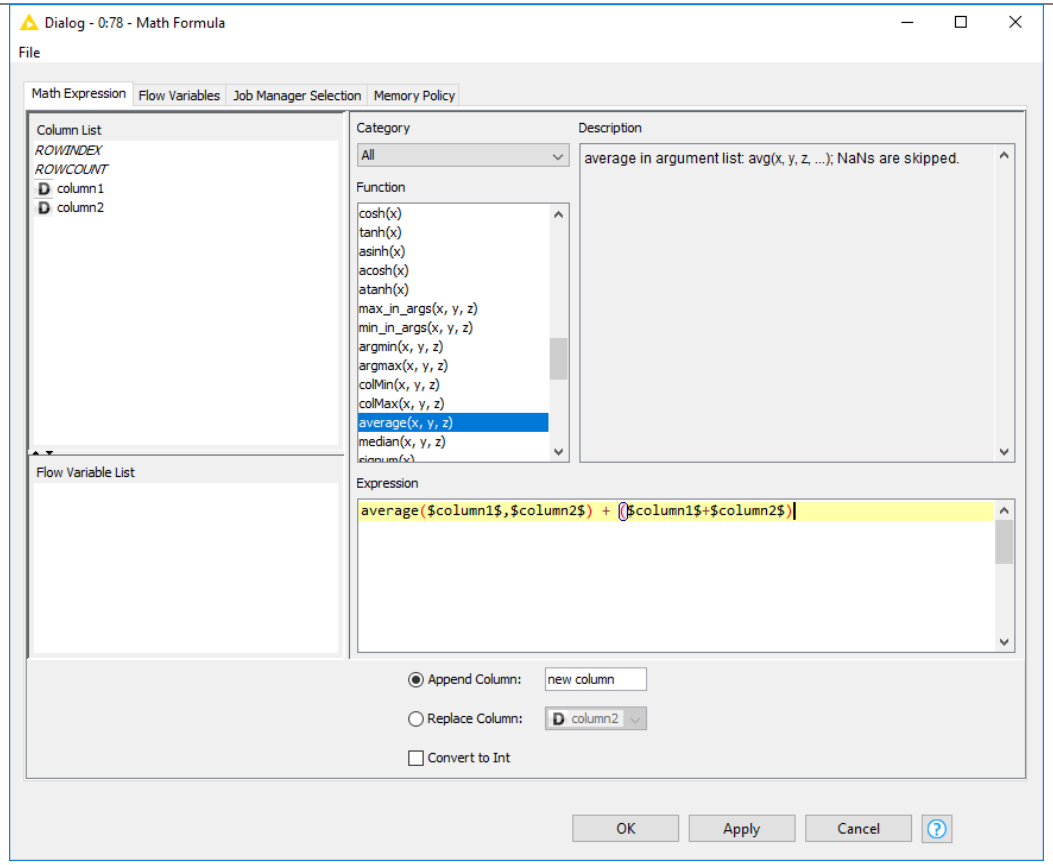
SAS Base

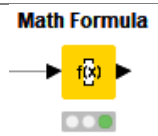
```
data <dataset-name>;
  set <database-name>;
  <new column> = mean/sum(col_1, col_2, …,
col_n);
  <new column>  = mean/sum(of col1-coln);
  <new column>  = mean/sum(of col_1, col_2,
… col_n);
run;
```

Example:

```
data xyz;
  set xyz;
  avg = mean(x, y, z);
  avg = mean(of x1-x10);
  avg = mean(of x, y, z);
run;
```

KNIME Analytics Platform

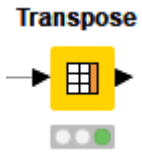




TRANSPOSE

Transpose

SAS Base	KNIME Analytics Platform

`proc transpose`
`  data=<dataset-name> out=<dataset-name>;`
`  [by <grouping-column>;]`
`run;`
 	
Example:
 	
`proc transpose data=indata out=outdata;`
`  by location date;`
`run;`
	
	
	Note. The “Transpose” node performs a simple transposition (that is, without the “BY” statement) of the input data table. It has no configuration settings, besides a few memory options.

Basic Statistics

PROC FREQ — Crosstab and Statistics

SAS Base

```
proc freq data = <dataset-name>;
  tables <col_1>*<col_2> / <option>;
run;
```

Example:

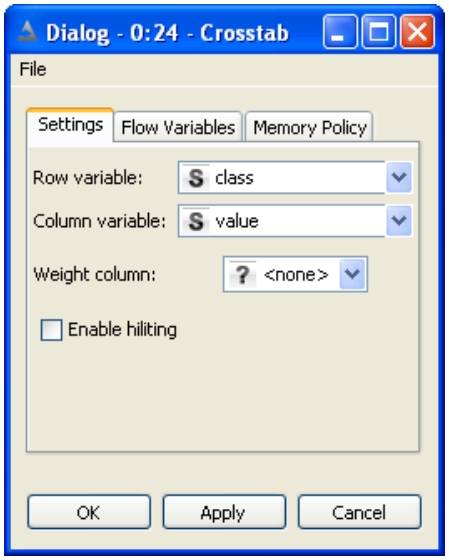
```
proc freq data = xyz;
  tables class*value / chisq;
  TITLE 'Simple Example of PROC FREQ';
run;
```

Default freq calculations:N, %, cumulative N, cumulative %

The **"chisq"** option to the tables statement performs the standard Pearson chi-square test on the table(s) requested.
The **"expected"** option prints the expected number of observations in each cell under the null hypothesis.
The **"exact"** option requests Fisher's exact test for the table(s). This is automatically computed for 2 x 2 tables.

KNIME Analytics Platform

The default freq calculations and the statistics of the proc freq can be found in the "Crosstab" node.
The"Crosstab" node analyzes the relation of two columns with categorical data by displaying the frequency distribution (N, %, deviation, cell chisquare, etc…) of the categorical variables in one of the output tables.
The "Crosstab" node also provides chi-square test statistics and, in case of a cross tabulation of dimension 2x2, the Fisher's exact test. The results of these tests are displayed in the second output table.



Statistics

The node "Statistics" also calculates a number of statistics variables for the input data table columns.

Reporting

PROC REPORT

Data to Report and Report Designer (BIRT)

SAS Base

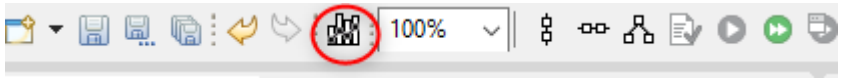
```
proc report data=<dataset-name>;
 column <column-names>;
 define <column-name> / <stat> <format>;
 <options>;
run;
```

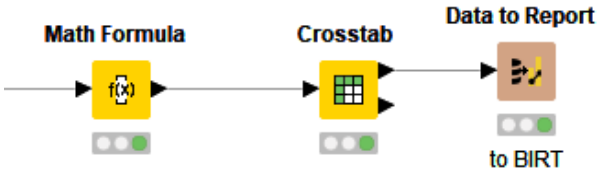
Example:

```
proc report data=xyz nowindows;

   column x y z;

   define x / group format=$xfmt.;
   define y  / analysis sum
                  format=dollar9.2;
   define z / group format=$zfmt.;

   ….
run;
```

KNIME Analytics Platform

- In the workflow connect a “Data to Report” node to the data to be displayed in the report.
- Click the “Reporting” button in the tool bar on the top
- The KNIME Reporting Designer (which is BIRT) opens.
- Create your report.





Include other script languages

PROC SQL

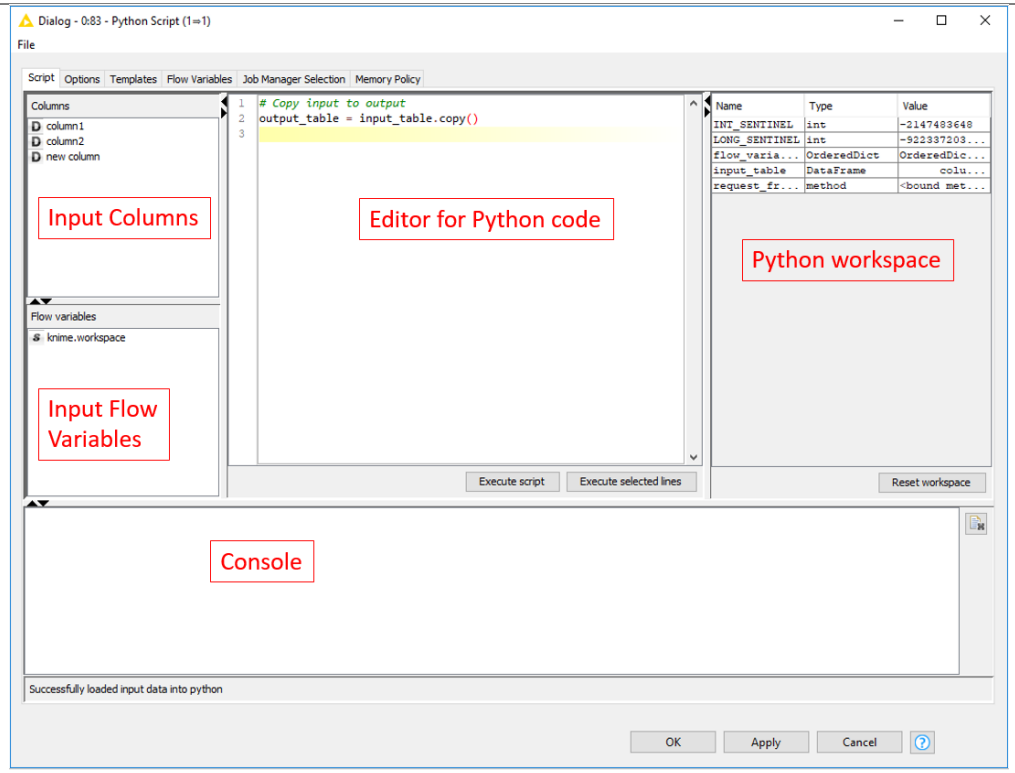
Database Query and Java, R, and Python Snippet

SAS Base	KNIME Analytics Platform

```
proc sql;
  create table <table-name> as
    select <column-name>
      from <dataset-name>
      where <condition>
      order by <grouping-column>;
quit;
```

Example:

```
proc sql;
  create table Filter as
    select Price
      from xyz
      where nr > 13
      order by CustID;
quit;
```



KNIME offers a SQL editor in the Database Query node and a few Snippet nodes to write and execute pieces of Java, R, Python, and Perl code.

The KNIME Booklet for SAS Users

From a personal experience, I know how difficult it can be to switch from one software tool to another. Even though both tools provide the same functionalities, a change of mind set is needed to discover where and how such functionalities are implemented in the new software tool.

This book is a quick guide on how to use KNIME for users coming from the SAS experience. It is not an introduction to KNIME, since it is assumed that the user is already familiar with the basic concepts of data manipulation, analysis, and reporting in KNIME. It is more a map of the most commonly used SAS functions and techniques into their KNIME equivalents.

For a complete introduction to KNIME, please refer to my book "KNIME Beginner's Luck" available from KNIME Press under https://www.knime.com/knimepress

About the Author

***Dr Rosaria Silipo** has been mining data since her master degree in 1992. She kept mining data throughout all her doctoral program, her postdoctoral program, and most of her following job positions. She has many years of experience in data analysis, reporting, business intelligence, training, and writing. In the last few years she has been using KNIME for her consulting work, till she started working for KNIME as a Principal Data Scientist in 2013.*

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