Enunciado Prático nº 7

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16 de dezembro de 2020

1 Parte 1

1.1 Exercício 1

Para obter todas as cidades portuguesas atualmente disponibilizadas pela Open AQ utilizou-se o nodo *GET request*.

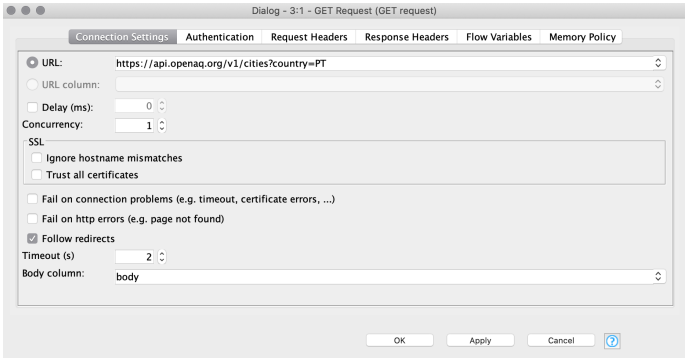


Figure 1: *GET Request*

1.2 Exercício 2

Tranformação do JSON obtido no exercício anterior, garantindo a expansão dos arrays JSON para colunas, e o parâmetro *children expansion* até ao nível 2.

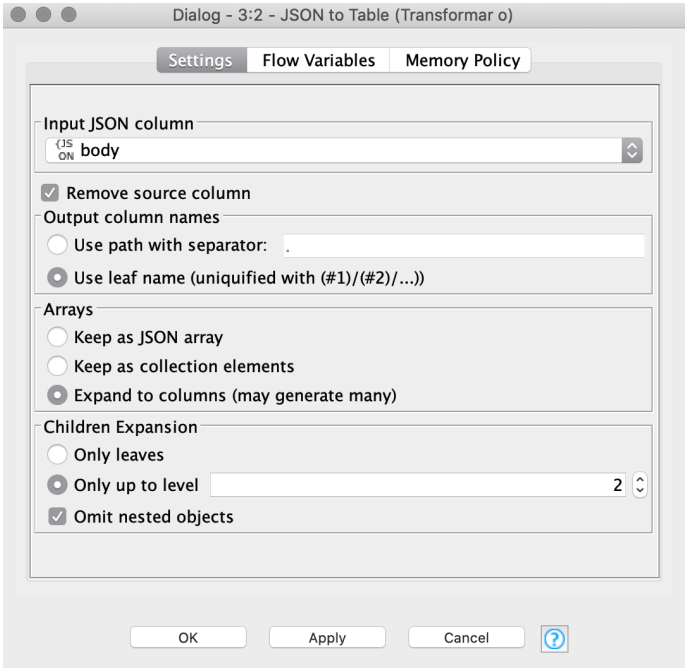


Figure 2: *JSON to Table*

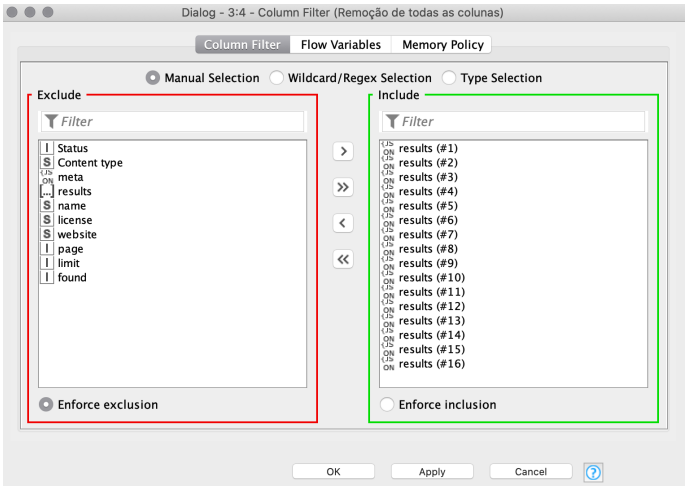


Figure 3: Remoção todas as colunas exceto resultados

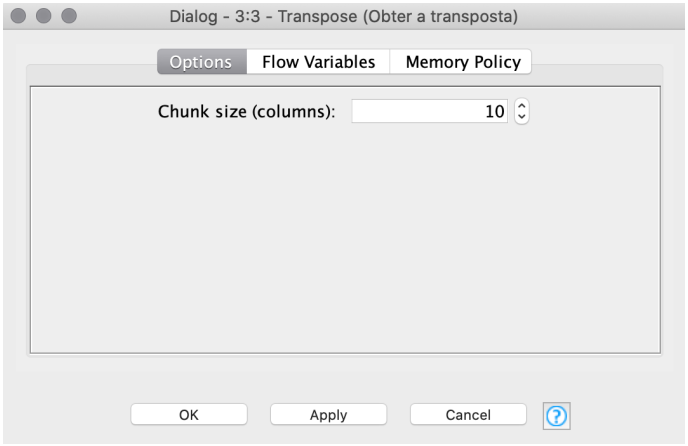


Figure 4: Transposta da tabela

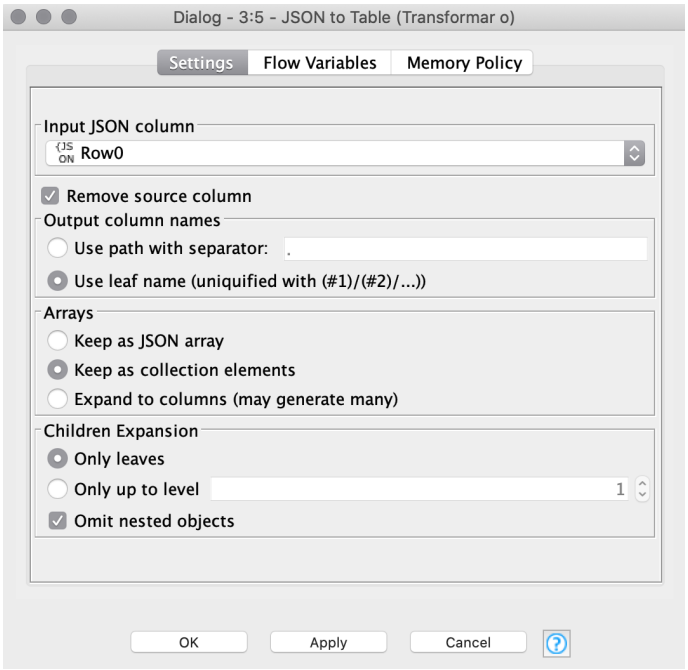


Figure 5: *JSON to Table*

Row ID	country	name	city	count	locations
results (#1)	PT	Aveiro	Aveiro	374356	4
results (#2)	PT	Braga	Braga	146922	3
results (#3)	PT	Castelo Branco	Castelo Branco	118875	1
results (#4)	PT	Coimbra	Coimbra	173288	3
results (#5)	PT	Évora	Évora	126089	1
results (#6)	PT	Faro	Faro	367187	4
results (#7)	PT	Ilha da Madeira	Ilha da Madeira	310065	3
results (#8)	PT	Ilha do Faial	Ilha do Faial	139499	1
results (#9)	PT	Leiria	Leiria	132490	1
results (#10)	PT	Lisboa	Lisboa	1259717	15
results (#11)	PT	Porto	Porto	895499	15
results (#12)	PT	Santarém	Santarém	110873	1
results (#13)	PT	Setúbal	Setúbal	1187860	12
results (#14)	PT	Viana do Castelo	Viana do Castelo	71592	1
results (#15)	PT	Vila Real	Vila Real	106098	1
results (#16)	PT	Viseu	Viseu	80670	1

Figure 6: Tabela obtida

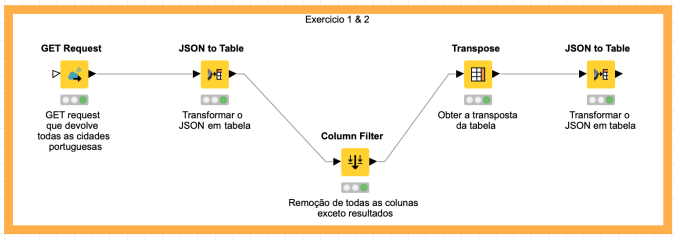


Figure 7: Fluxo após a resolução dos dois primeiros exercícios

1.3 Exercício 3

Para obter os dados mais recentes sobre o nível de ozono de cada cidade portuguesa recorreu-se ao nodo *Get Request*.
Aplicando-se o url: https://api.openaq.org/v1/latest?country=PTparamerter=o3

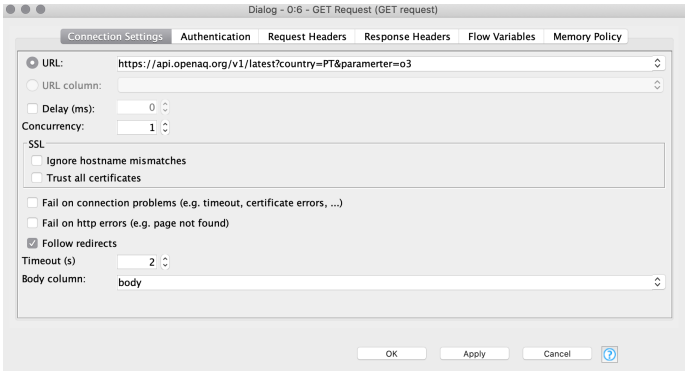


Figure 8: *Get Request*

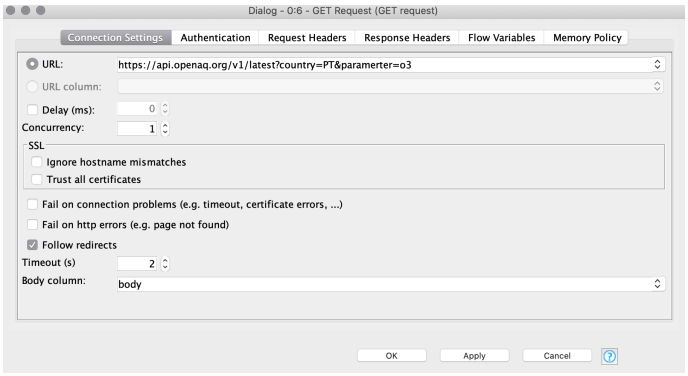


Figure 9: Fluxo de tratamento do JSON

De seguida foram filtradas as filas cujo *parameter* não é referente ao nível de ozono através de um *Row Filter*. Com o intuito de obter apenas um registo para cada cidade aplicou-se o nodo *Sorter* para organizar os dados em função da *feature lastUpdated* e de seguida foi aplicado um *Column Filter*.

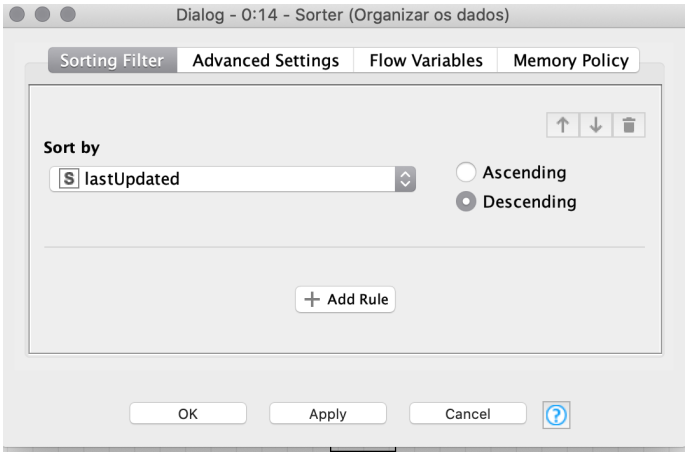


Figure 10: *Sorter*

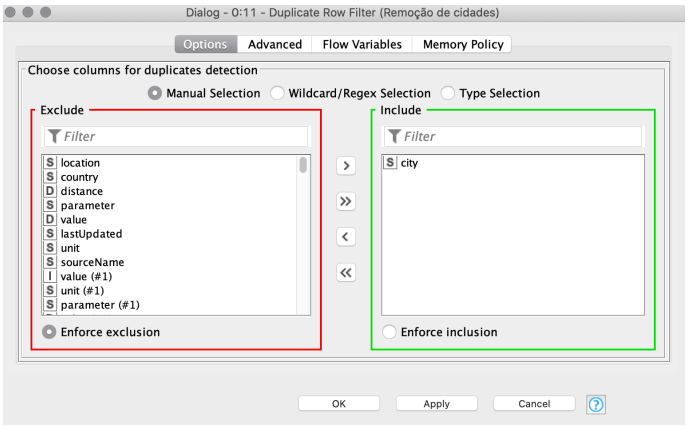


Figure 11: *Column Filter*

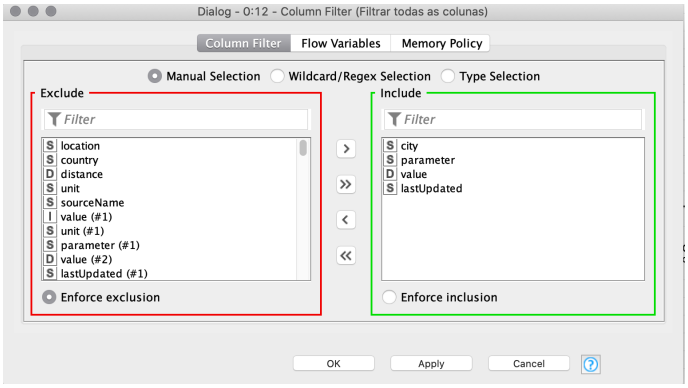


Figure 12: Filtrar todas as colunas exceto a city, parameter, value e lastUpdated

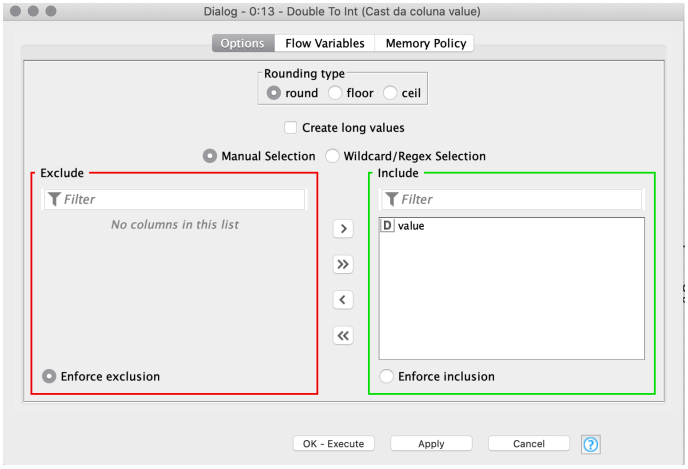


Figure 13: Cast da coluna value de double para inteiro

Row ID	city	parameter	value	lastUpdated
results (#29)	Viseu	o3	87	2020-12-03T03:00:00.000Z
results (#40)	Lisboa	o3	43	2020-12-03T03:00:00.000Z
results (#47)	Santarém	o3	66	2020-12-03T03:00:00.000Z
results (#8)	Porto	o3	16	2020-12-03T02:00:00.000Z
results (#55)	Setúbal	o3	61	2020-02-19T15:00:00.000Z

Figure 14: Tabela obtida no final do exercício

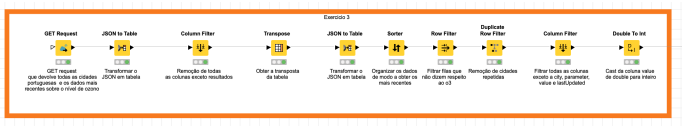


Figure 15: Fluxo após a resolução do terceiro exercício

1.4 Exercício 4

Apresenta-se na seguinte figura as definições aplicadas ao nodo *Sorter* com o obejtivo de ordenar os registos de cada cidade por nível de ozono.

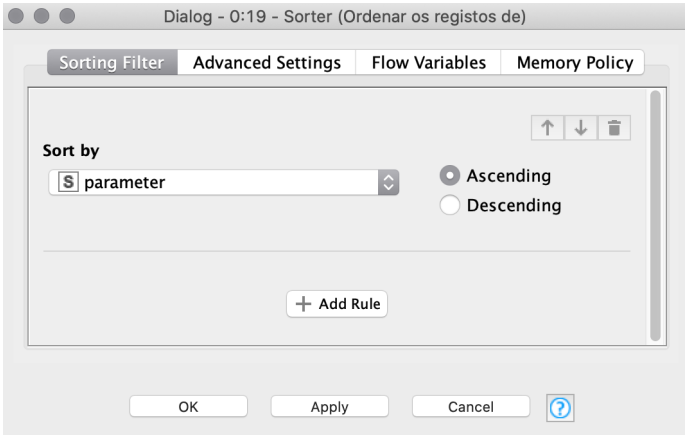


Figure 16: Ordenar os registos de cada cidade por nível de ozono

As técnicas de visualização de dados numa vista web aplicadas apresentam-se de seguida:

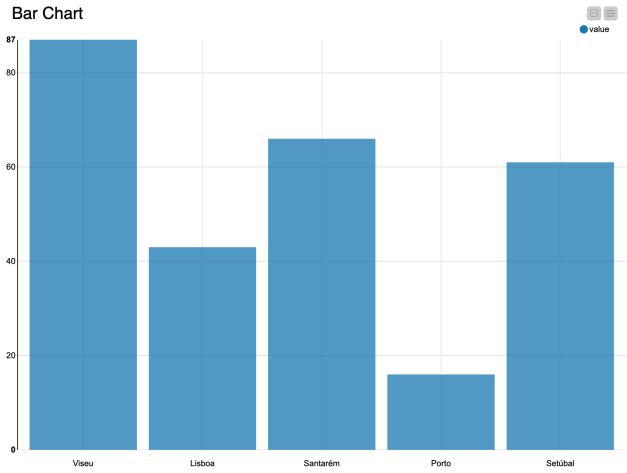


Figure 17: *Barchart* da média do *value* por cidade

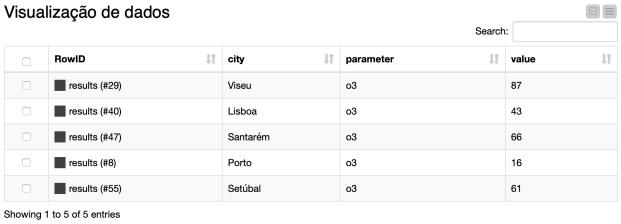


Figure 18: *Table View*

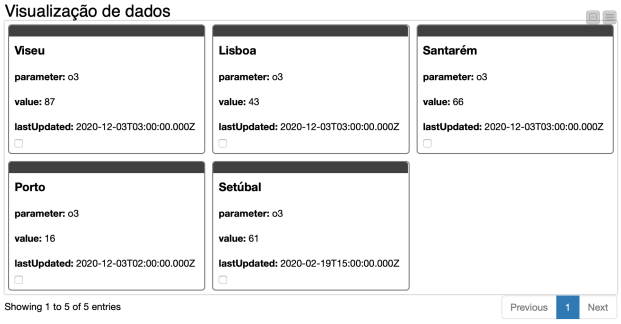


Figure 19: *Tile View*

Para observar dados referentes a outros parâmetros ambientais, após obter os dados em forma de tabela ordenados através da *feature lastUpdated*, no exercicio 3, aplicou-se o nodo *Duplicate Row Filter* de modo a remover registos de cidades repetidos para o mesmo parâmetro.

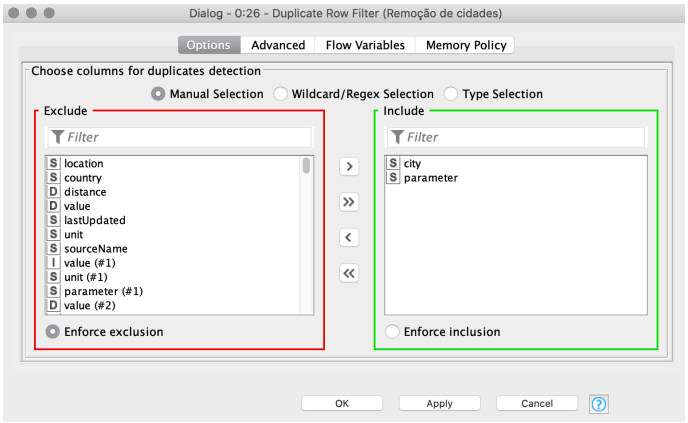


Figure 20: *Duplicate Row Filter*

Após a filtragem de algumas colunas cujos valores não são tão interessantes

e aplicação do nodo *Tile View* pode observar-se na figura seguinte os dados de vários parâmetros para as várias cidades portuguesas.

Figure 21: *Tile View* de todos os parâmetros ambientais existentes

1.5 Exercício 5

Para utilizar a *OpenWeatherMaps* é necessário aplicar a API key ao url a inserir no nodo *GET Request*. O url inserido permite obter o estado meteorologico atual da cidade de Braga.

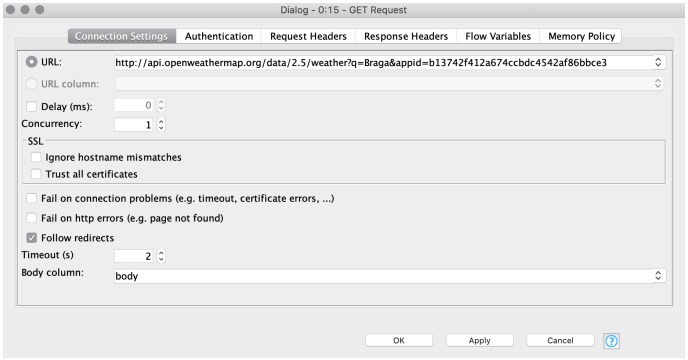


Figure 22: *GET Request*

Row ID	Row0
name	Braga
cod	200
lon	-8.42
lat	41.55
temp	280.93
feels_like	279.78
temp_min	280.93
temp_max	280.93
pressure	1013
humidity	91
speed	0.45
deg	244
gust	3.58
all	100
type	3
country	PT

Figure 23: Condições meteorológicas na cidade de Braga

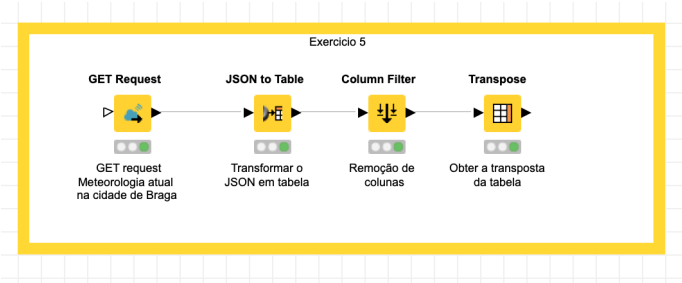


Figure 24: Fluxo do exercício 5

2 Parte 2

2.1 Exercicio 6

O conjunto de dados escolhido contém dados sobre mais de 1700 barras de chocolate diferentes, tal como a sua classificação, a sua região de origem, percentagem de cacao, entre outros valores que podem ser observados na figura 25.

S Company ...	S Specific Bean Origin or Bar Name	I REF	I Review Date	S Cocoa Percent	D Rating	S Company Location	S Bean Type	S Broad Bean Origin
A. Morin	Agua Grande	1876	2016	63%	3.75	France		Sao Tome
A. Morin	Kpime	1676	2015	70%	2.75	France		Togo
A. Morin	Panama	1011	2013	70%	2.75	France		Panama
Arete	Kokoa Kamili	1724	2016	70%	3.75	U.S.A.		Tanzania
Madre	Criollo, Hawaii	995	2012	70%	3.25	U.S.A.	Criollo	Hawaii
Madre	Kaua'i	995	2012	70%	3.5	U.S.A.		Hawaii
Madre	Dominican	672	2011	70%	2.5	U.S.A.		Dominican Republic
Madre	Upala	693	2011	70%	2.75	U.S.A.		Costa Rica
Madre	Chiapas, Triple Cacao	607	2010	72%	2.75	U.S.A.		Mexico
Maglio	Africa	300	2008	75%	2	Italy		Tanzania
Maglio	Ecuador	308	2008	70%	3	Italy	Forastero (Na...	Ecuador
Maglio	Cuba	308	2008	70%	3.25	Italy	Criollo	Cuba
Maglio	Santo Domingo	308	2008	70%	3.75	Italy	Blend-Foraste...	Dominican Republic

Figure 25: Excerto do conjunto de dados a tratar

Verificou-se, através do nodo *Statistics* que as colunas *Bean Type* e *Broad Bean Origin* apresentam alguns valores em falta, posto isto, aplicou-se o nodo *Missing Values* com o objetivo de preencher como desconhecido (*Unknown*) as células com valores em falta.

2.2 Exercício 7

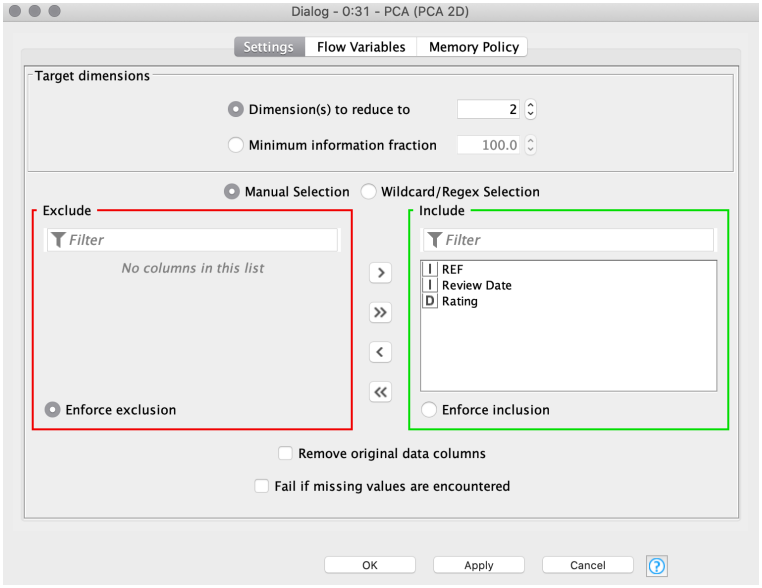


Figure 26: Análise de Componentes Principais (PCA)

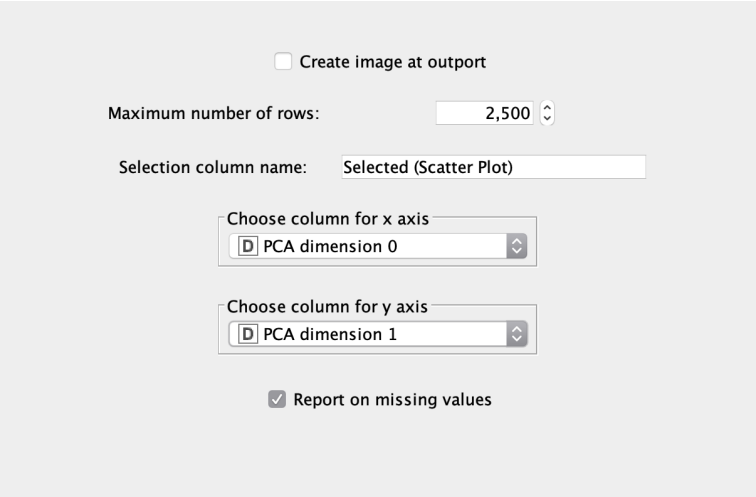


Figure 27: Definições aplicadas ao nodo *Scatter plot*

Através do *Scatter plot* conseguimos identificar (figura 28), 12 clusters presentes no *dataset*.

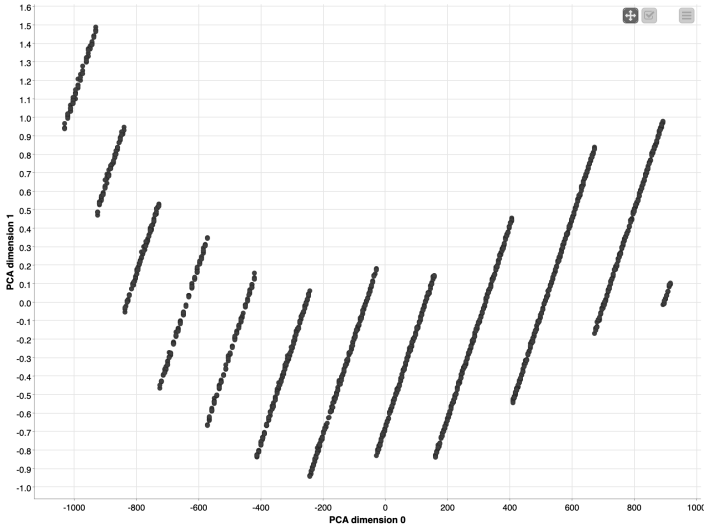


Figure 28: *Scatter plot*

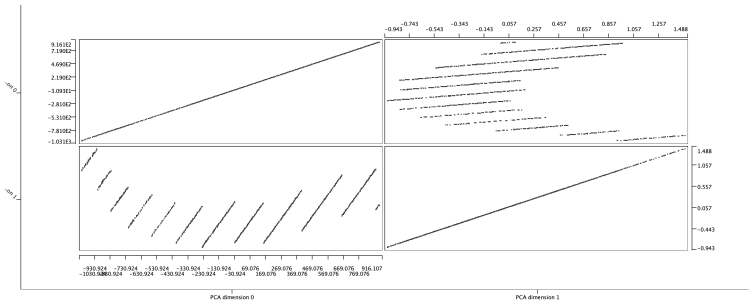


Figure 29: *Scatter Matrix*

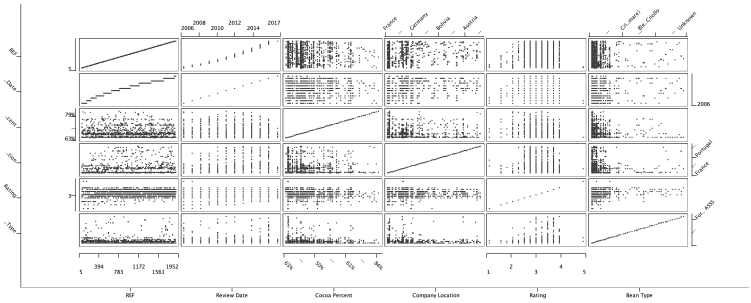


Figure 30: *Scatter Matrix*

2.3 Exercício 8

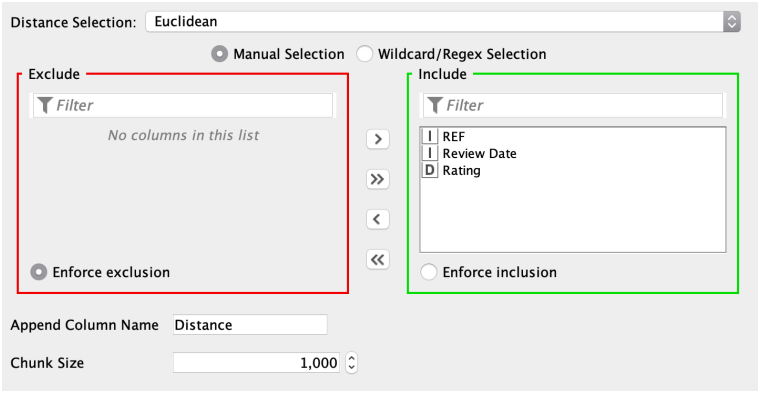


Figure 31: Definições aplicadas à matriz de distancia

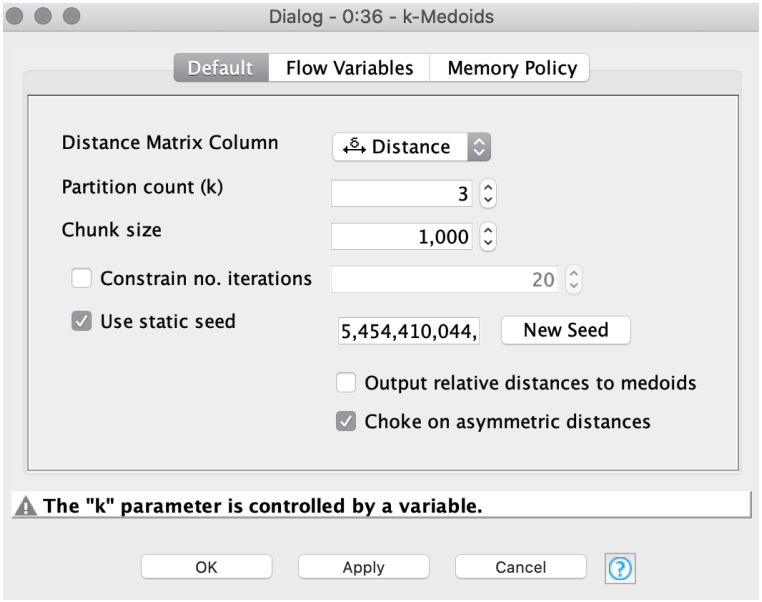


Figure 32: Definições aplicadas ao nodo *K-medoids*

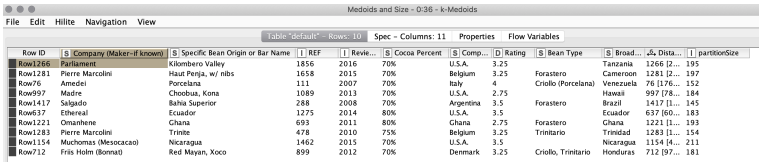


Figure 33: *Medoids and size*

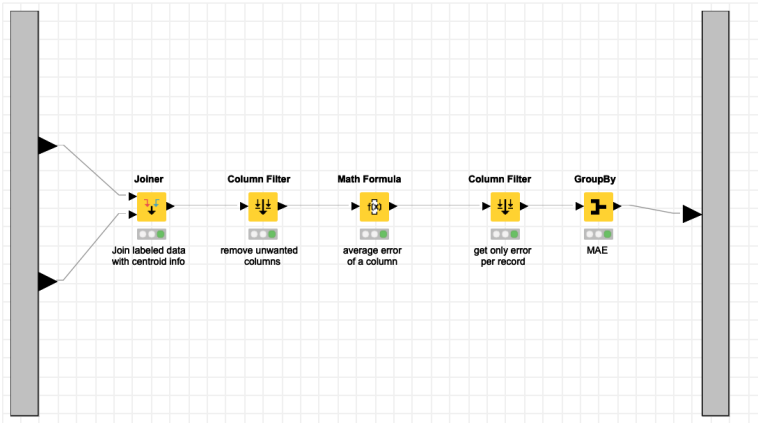


Figure 34: Metanodo *MAE*

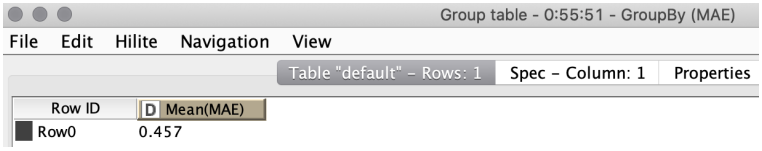


Figure 35: Mean Average Error (MAE)

Row ID	D MAE	I k	I Iteration
Row0#0	0.376	1	0
Row0#1	0.376	2	1
Row0#2	0.391	3	2
Row0#3	0.392	4	3
Row0#4	0.379	5	4
Row0#5	0.388	6	5
Row0#6	0.388	7	6
Row0#7	0.376	8	7
Row0#8	0.401	9	8
Row0#9	0.457	10	9

Figure 36: MAE de cada cluster

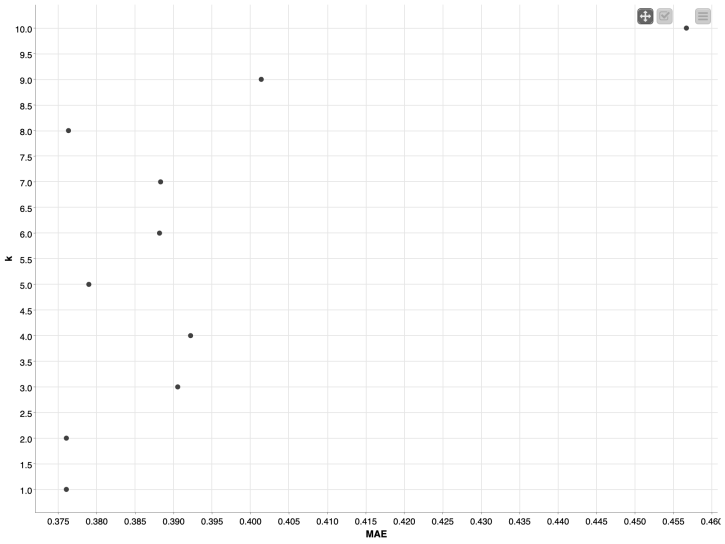


Figure 37: *Scatter Plot*

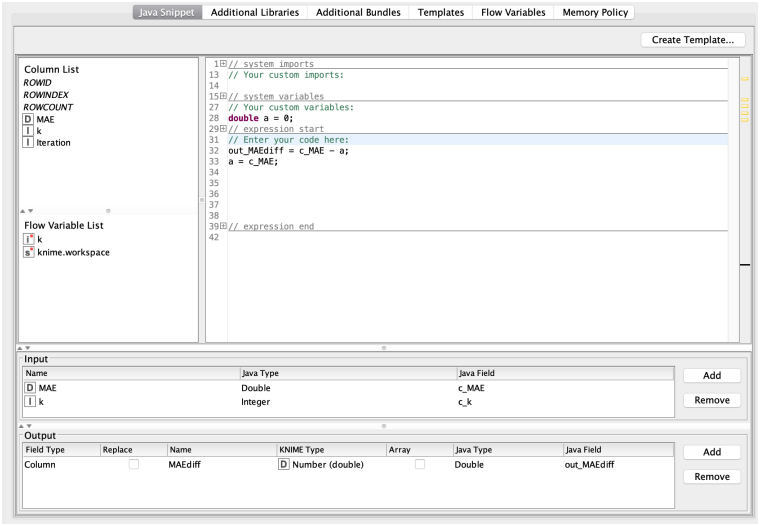
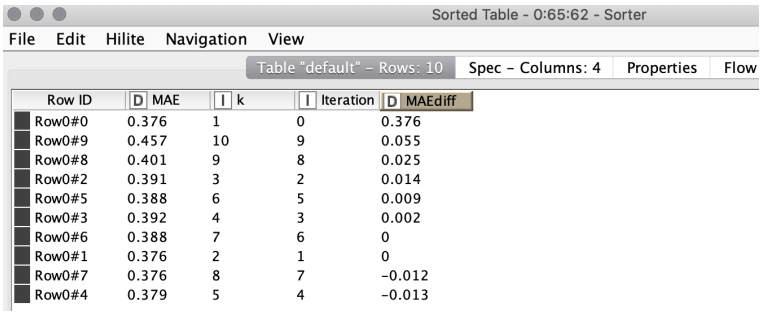
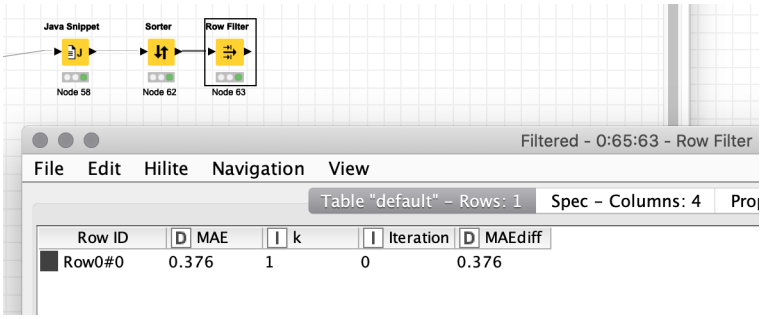


Figure 38: *Java Snippet para o calculo do MAE de cada cluster*



Row ID	MAE	k	Iteration	MAEdiff
Row0#0	0.376	1	0	0.376
Row0#9	0.457	10	9	0.055
Row0#8	0.401	9	8	0.025
Row0#2	0.391	3	2	0.014
Row0#5	0.388	6	5	0.009
Row0#3	0.392	4	3	0.002
Row0#6	0.388	7	6	0
Row0#1	0.376	2	1	0
Row0#7	0.376	8	7	-0.012
Row0#4	0.379	5	4	-0.013

Figure 39



Row ID	MAE	k	Iteration	MAEdiff
Row0#0	0.376	1	0	0.376

Figure 40: MAE

Após esta análise podemos concluir que o número óptimo de clusters é 3.

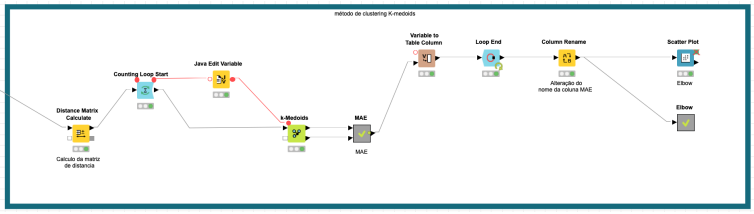


Figure 41: Fluxo final do exercício 8

2.4 Exercício 9

Para que um utilizador consiga analisar os gráficos gerados pelo método do cotovelo aplicou-se um *Scatter plot*.

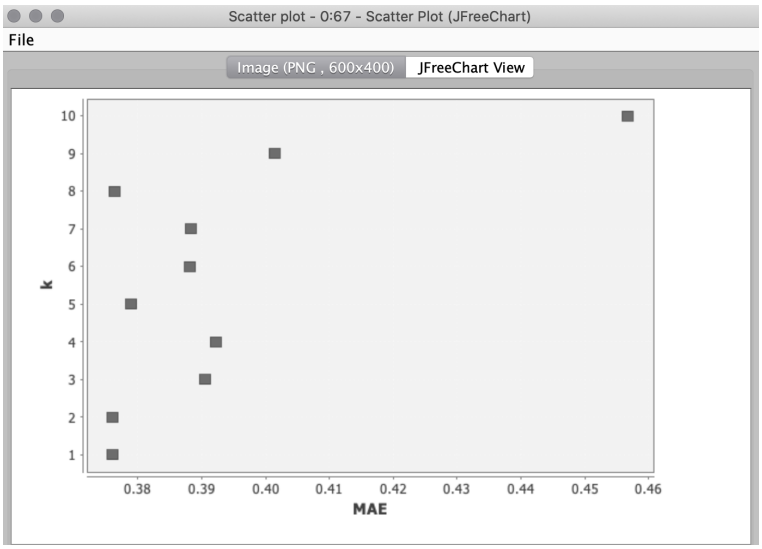


Figure 42: Scatter Plot

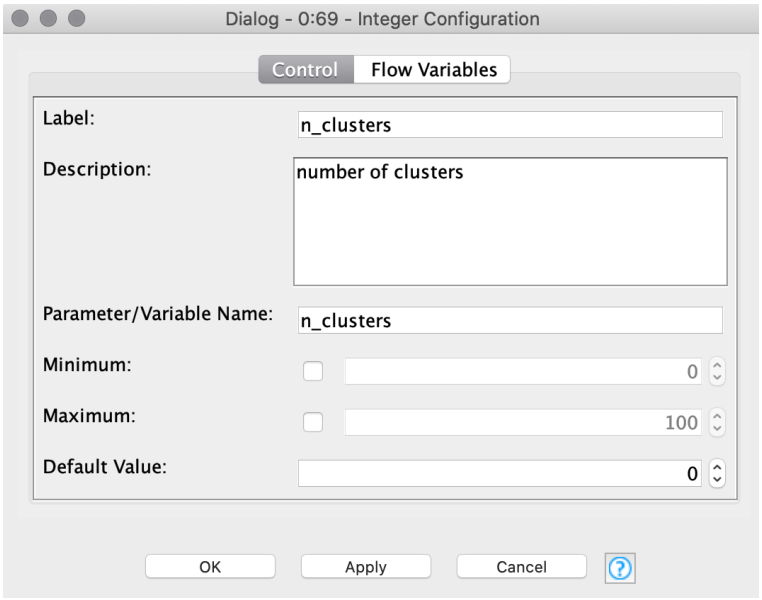


Figure 43: Widget para definir o número de clusters a utilizar

2.5 Exercício 10

Row ID	REF	Review Date	Rating
cluster_0	1,735.114	2,015.671	3.154
cluster_1	1,428.822	2,014.454	3.224
cluster_2	1,063.978	2,012.801	3.218
cluster_3	138.144	2,006.906	3.084
cluster_4	1,584	2,015	3.283
cluster_5	389.569	2,009.005	3.105
cluster_6	862.408	2,011.827	3.175
cluster_7	1,250.326	2,013.807	3.157
cluster_8	1,881.51	2,016.168	3.306
cluster_9	645.817	2,010.653	3.205

Figure 44: Clusters obtidos após a aplicação do nodo *K-means*

Row ID	Mean(MAE)
Row0	0.375

Figure 45: Mean Average Error (MAE)

Row ID	MAE	k	Iteration
Row0#0	0.384	1	0
Row0#1	0.38	2	1
Row0#2	0.377	3	2
Row0#3	0.376	4	3
Row0#4	0.376	5	4
Row0#5	0.375	6	5
Row0#6	0.376	7	6
Row0#7	0.374	8	7
Row0#8	0.376	9	8
Row0#9	0.375	10	9

Figure 46: MAE para cada cluster no final do ciclo

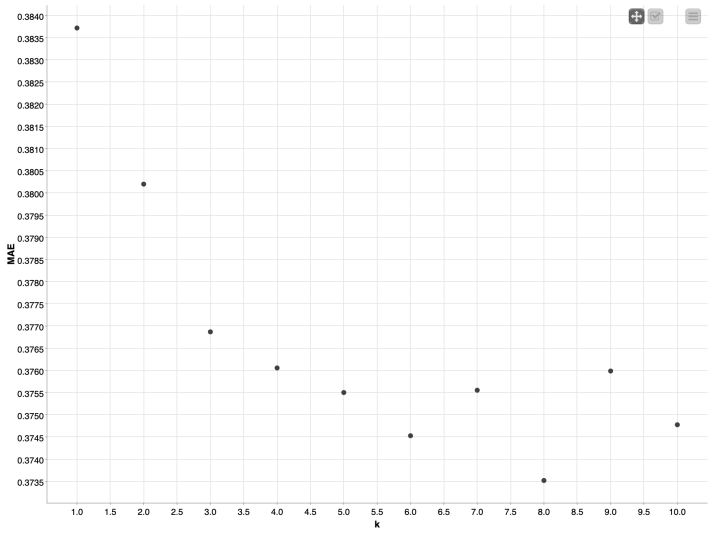


Figure 47: *Scatter Plot*

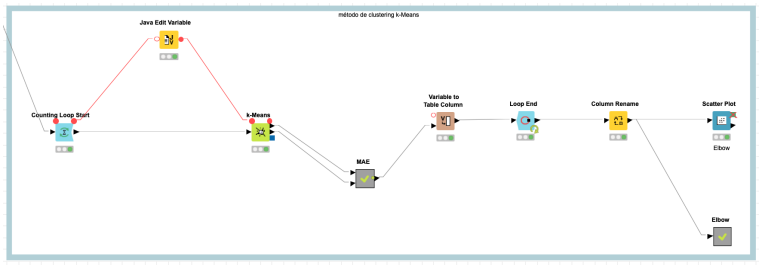


Figure 48: Fluxo final do exercício 10

Após a análise dos dois métodos conclui-se que ambos têm um número de clusters otimo igual a 3, contudo a métrica utilizada como medida de qualidade, MAE, apresenta um valor ligeiramente mais baixo utilizando k-means.