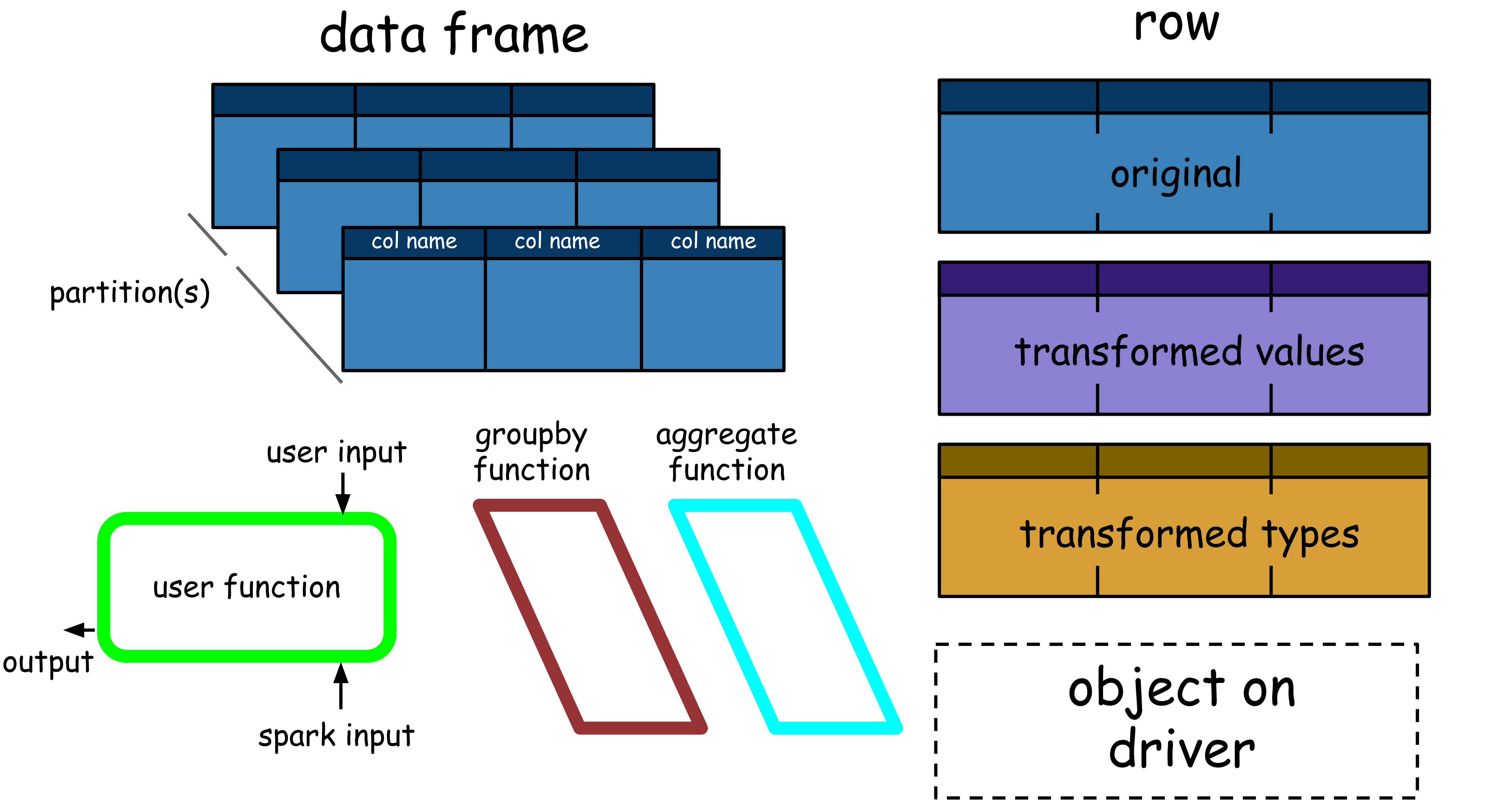
# pyspark-pictures data frames

Learn the pyspark API through pictures and simple examples

https://github.com/jkthompson/pyspark-pictures



data frame

col name

col name

col name

partition(s)

row

original

transformed values

transformed types

object on driver

user input

user function

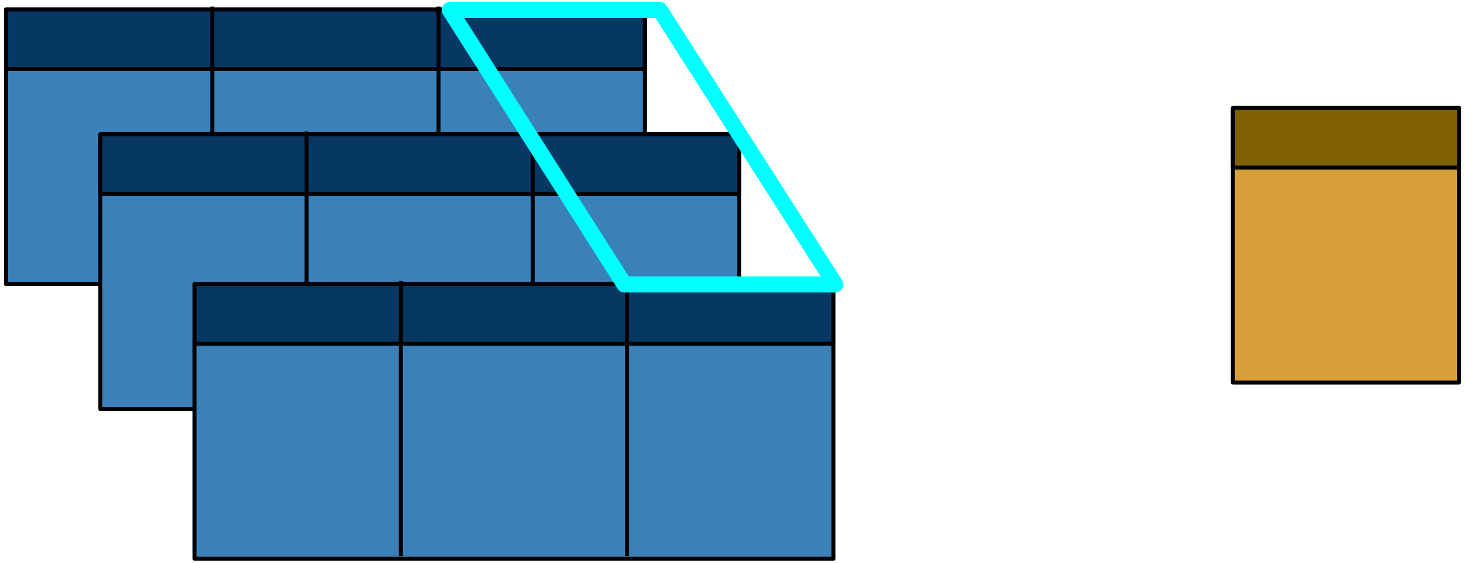
output

spark input

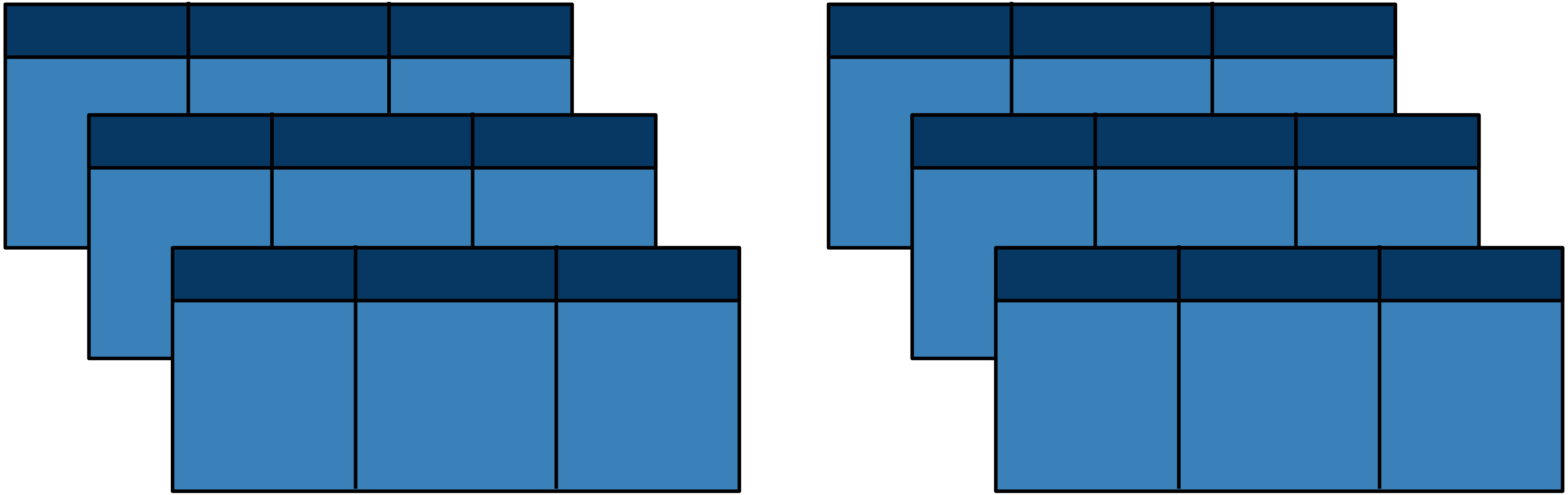
groupby function

aggregate function

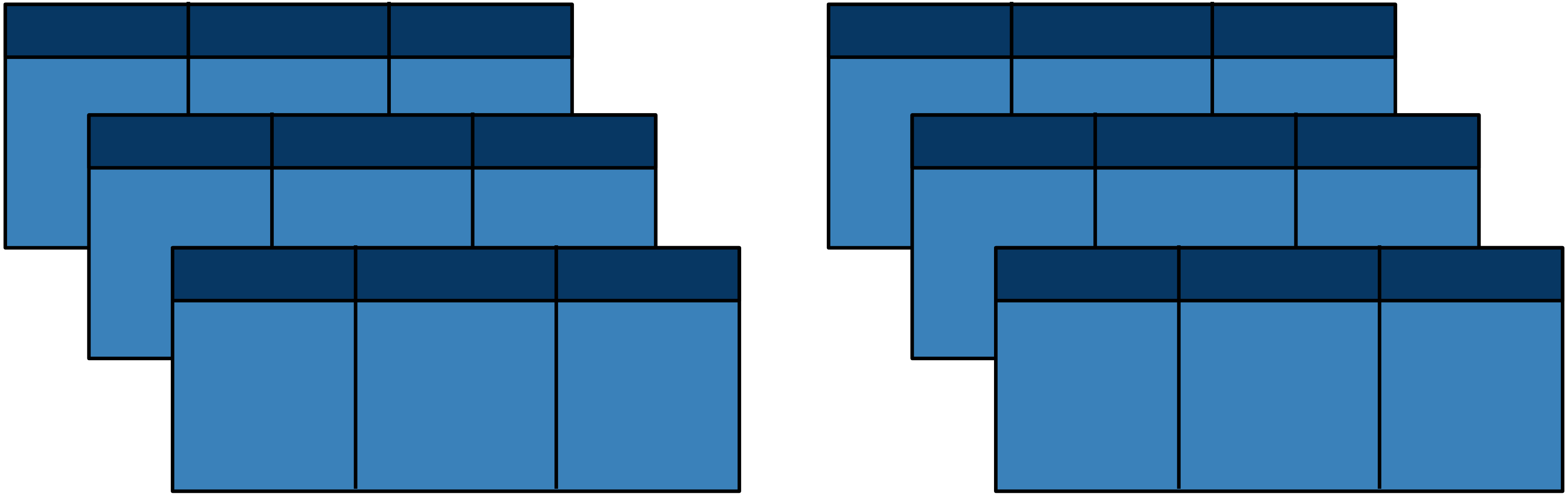
# agg



# alias

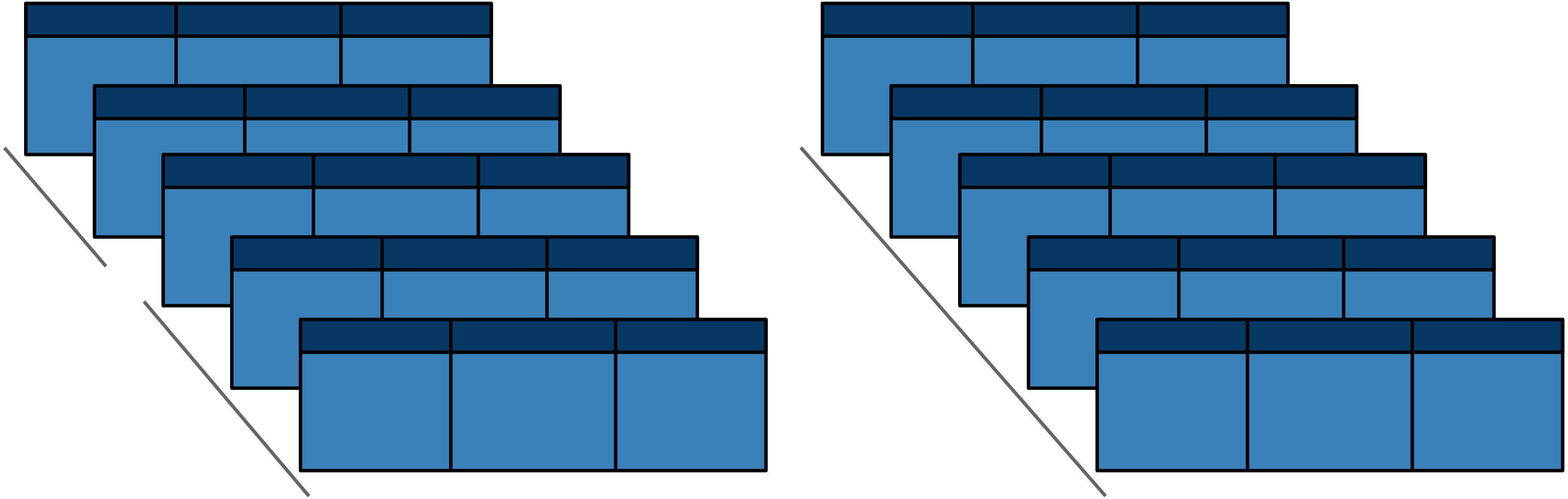


# cache

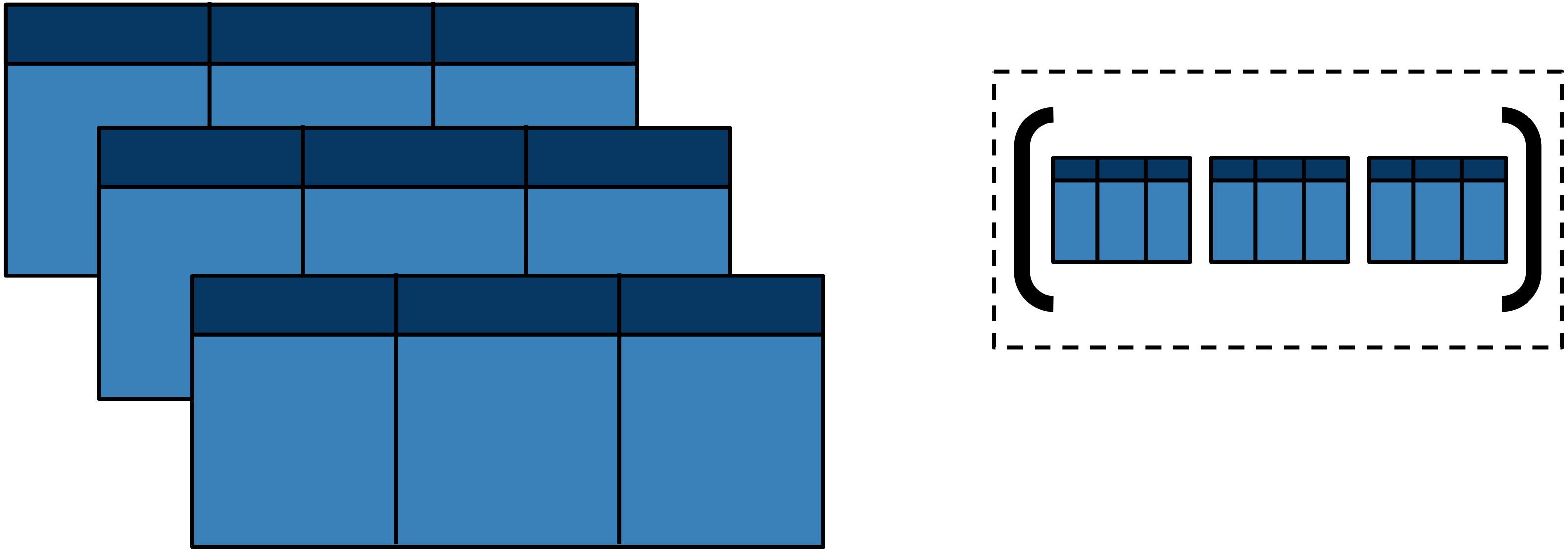


# coalesce

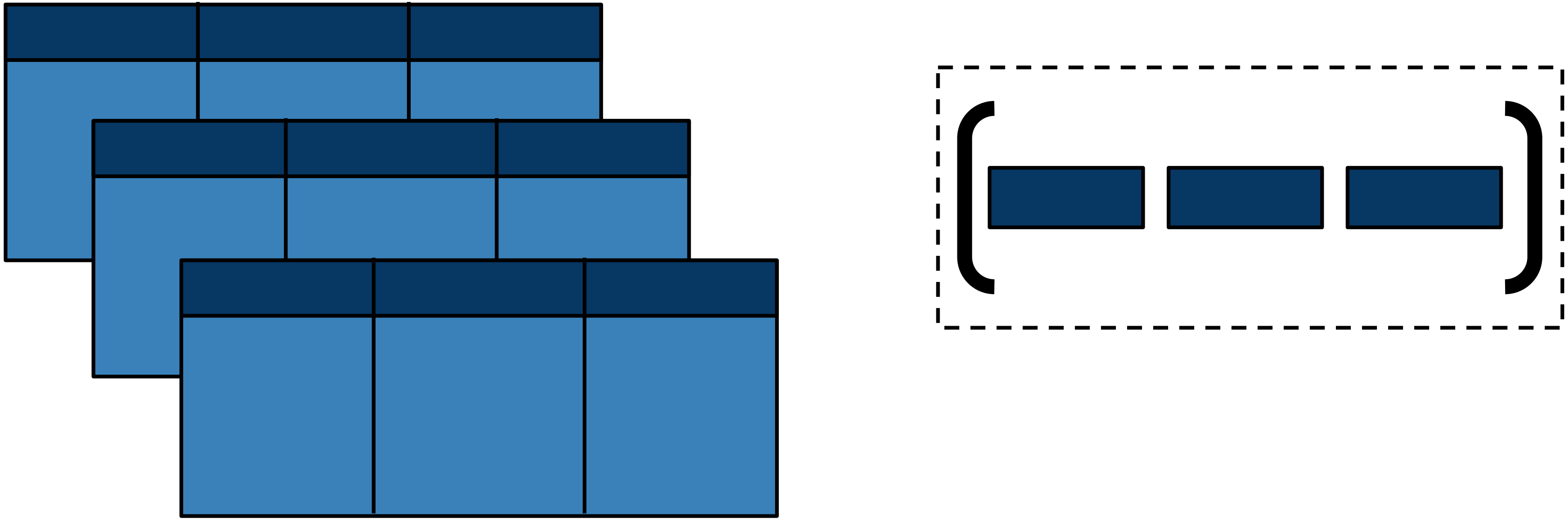
numPartitions = 1



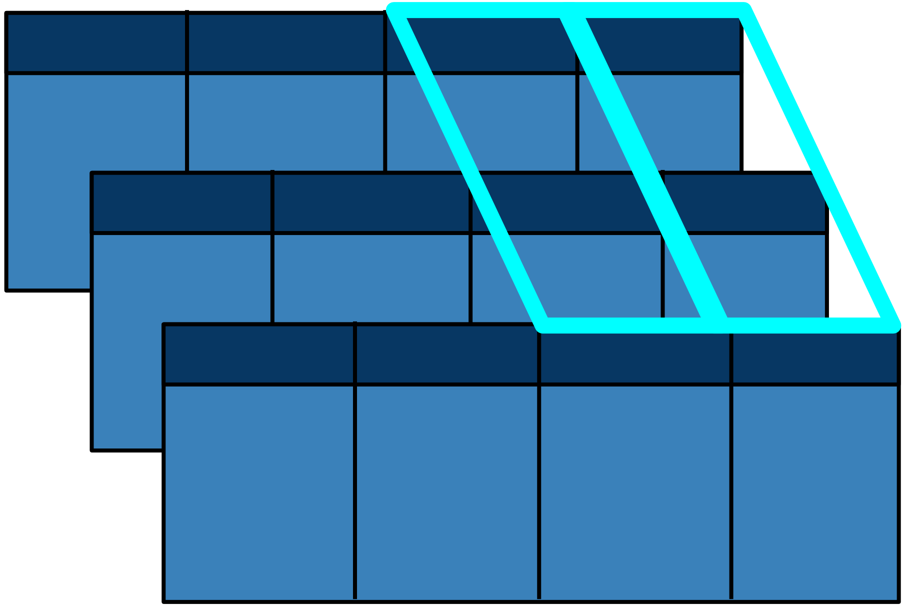
# collect



# columns



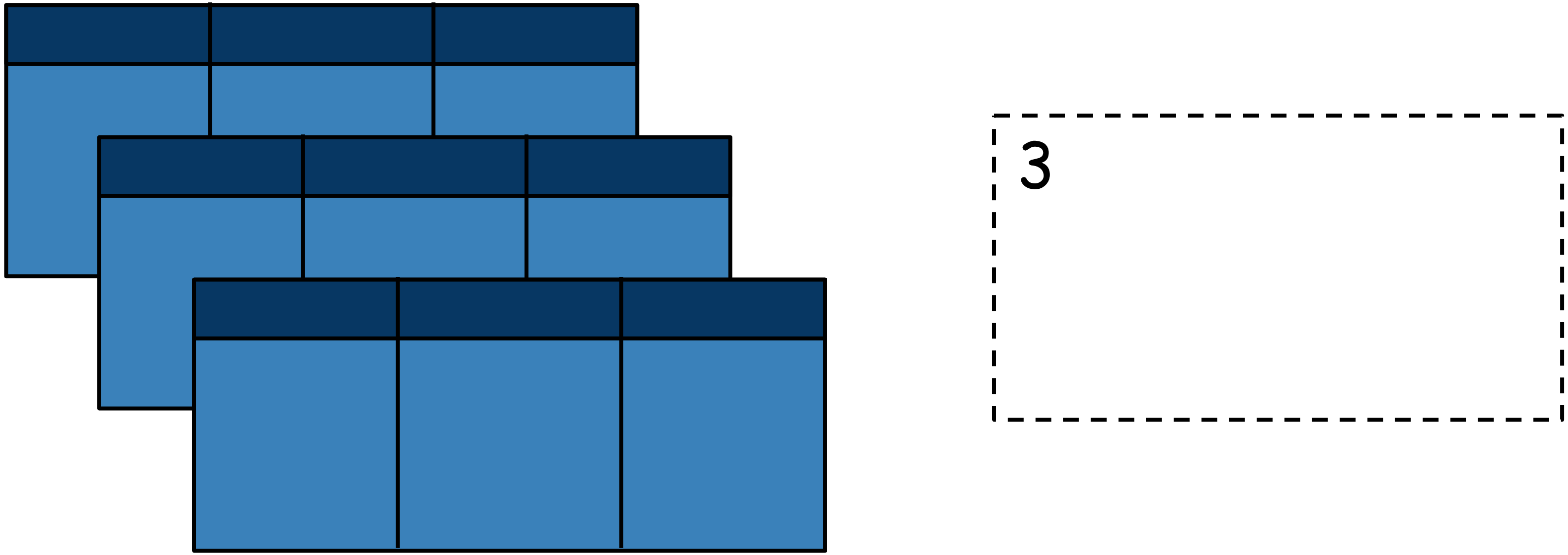
# corr



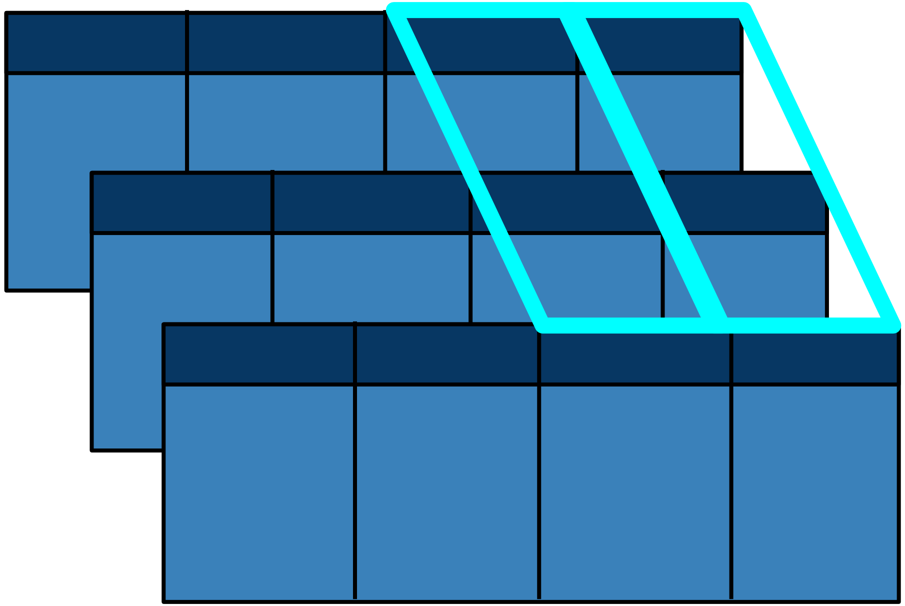
Pearson's r

$$r = \frac{\sum_i (A_i - \bar{A})(C_i - \bar{C})}{\sqrt{\sum_i (A_i - \bar{A})^2}\sqrt{\sum_i (C_i - \bar{C})^2}}$$

# count



# cov

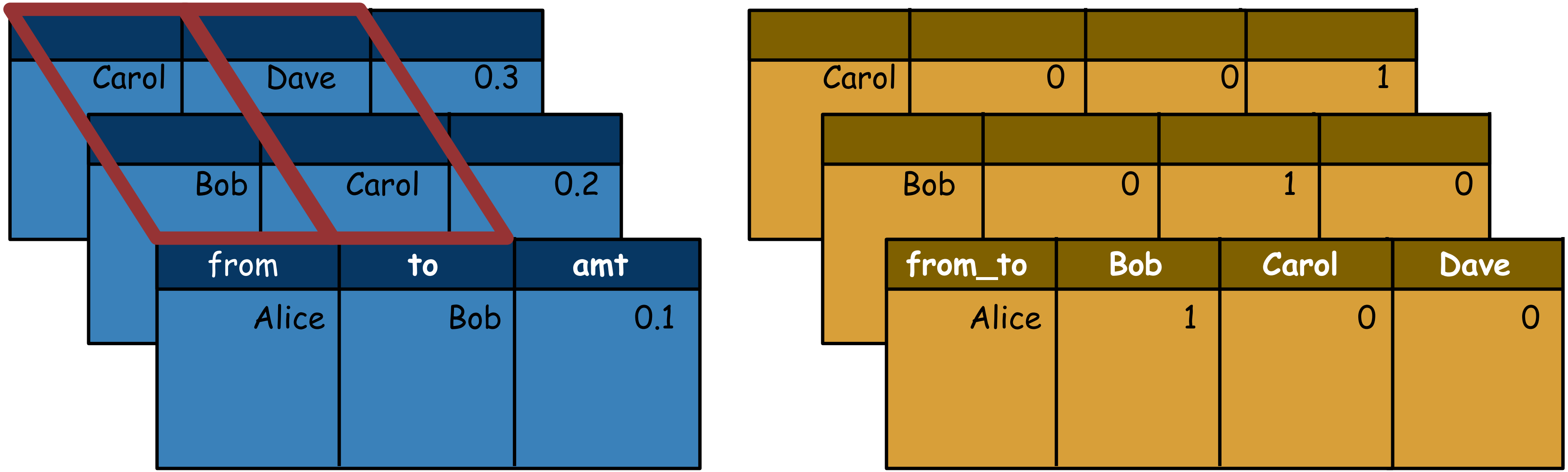


Sample Covariance

$$\frac{1}{N-1}\sum_{i}(A_i - \bar{A})(C_i - \bar{C})$$

# crosstab

col1 = 'from'   col2 = 'to'

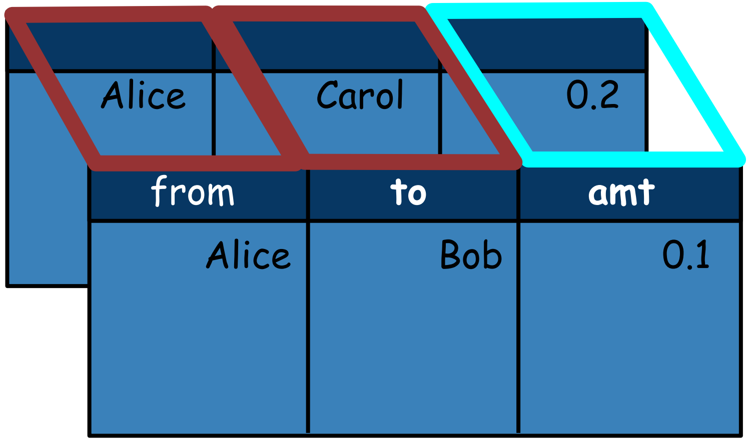


| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |
| Bob | Carol | 0.2 |
| Carol | Dave | 0.3 |

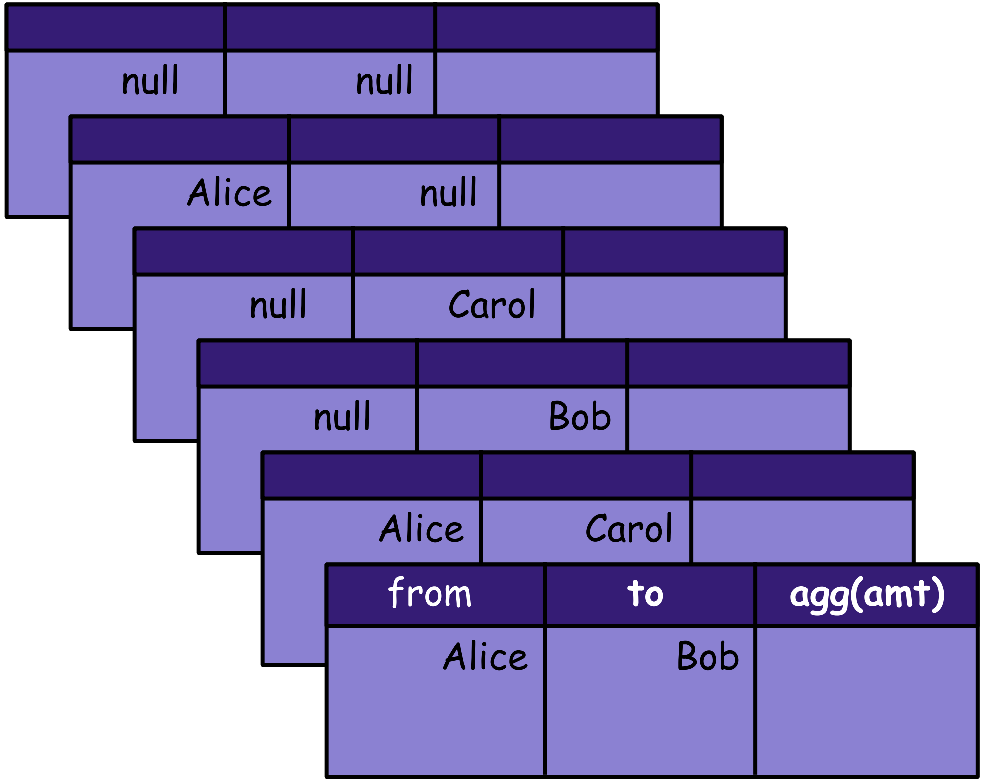
| from_to | Bob | Carol | Dave |
|---|---|---|---|
| Alice | 1 | 0 | 0 |
| Bob | 0 | 1 | 0 |
| Carol | 0 | 0 | 1 |

# cube

*cols = ‘from’, ‘to’

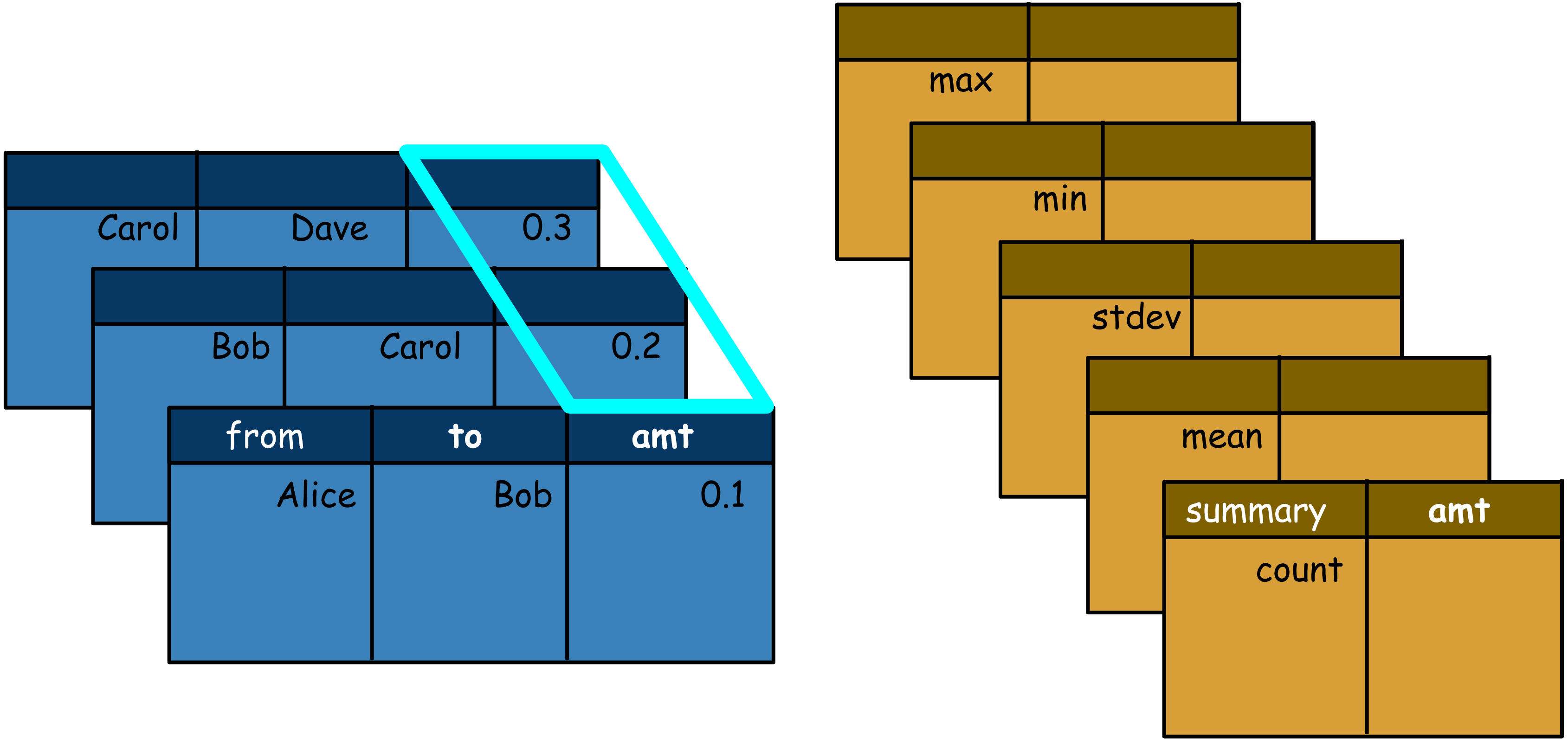


| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |
| Alice | Carol | 0.2 |

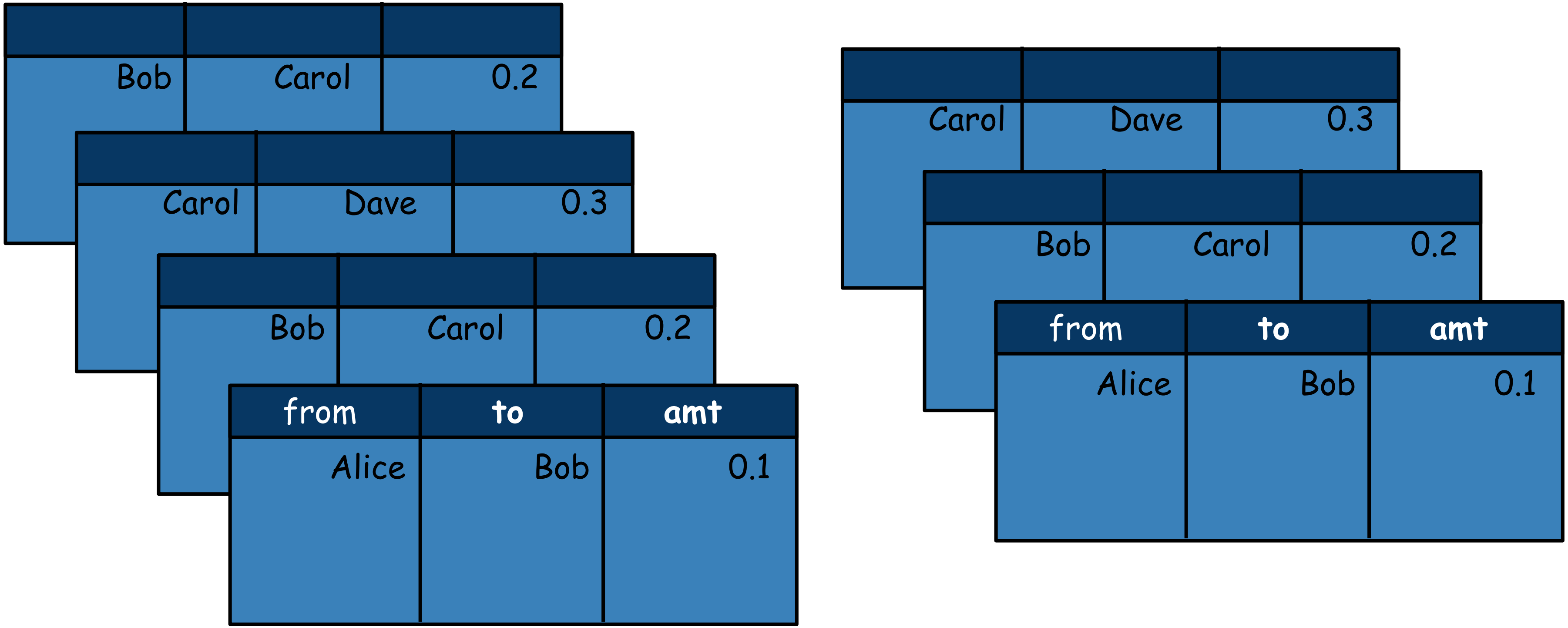


| from | to | agg(amt) |
|---|---|---|
| Alice | Bob | |
| Alice | Carol | |
| null | Bob | |
| null | Carol | |
| Alice | null | |
| null | null | |

# describe


Carol
Dave
0.3
Bob
Carol
0.2
from
to
amt
Alice
Bob
0.1
max
min
stdev
mean
summary
amt
count

# distinct

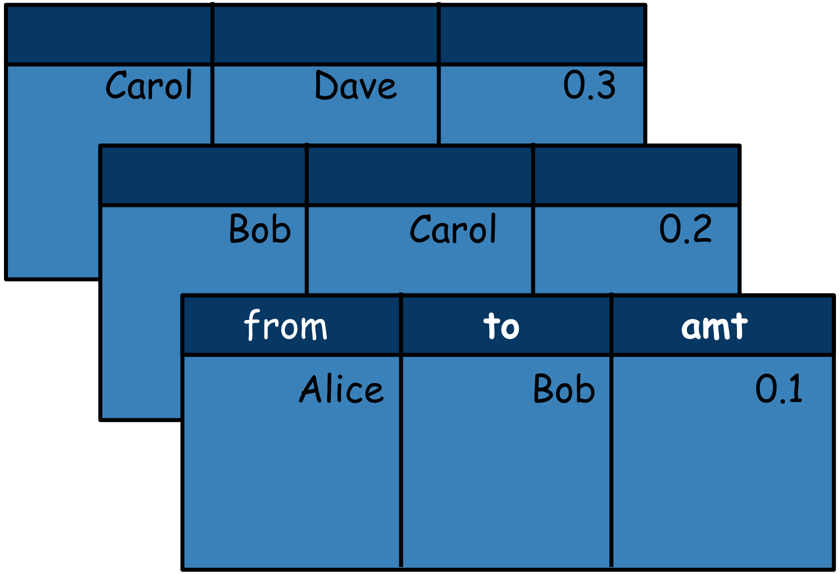


| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |
| Bob | Carol | 0.2 |
| Carol | Dave | 0.3 |
| Bob | Carol | 0.2 |

| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |
| Bob | Carol | 0.2 |
| Carol | Dave | 0.3 |

# drop

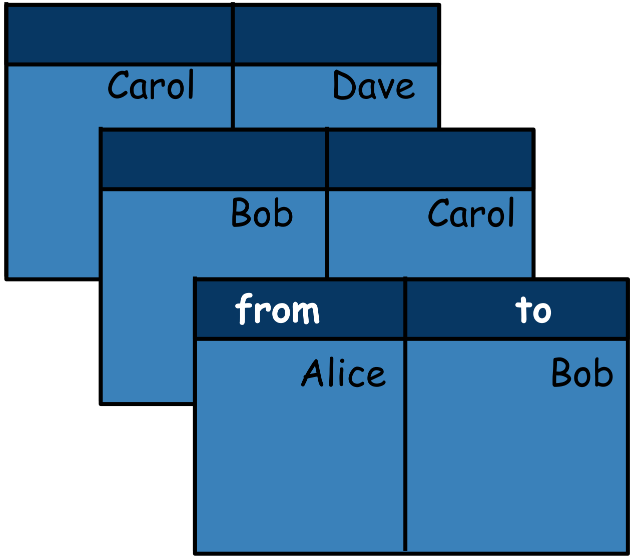
col = ‘amt’



| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |

| | | |
|---|---|---|
| Bob | Carol | 0.2 |

| | | |
|---|---|---|
| Carol | Dave | 0.3 |



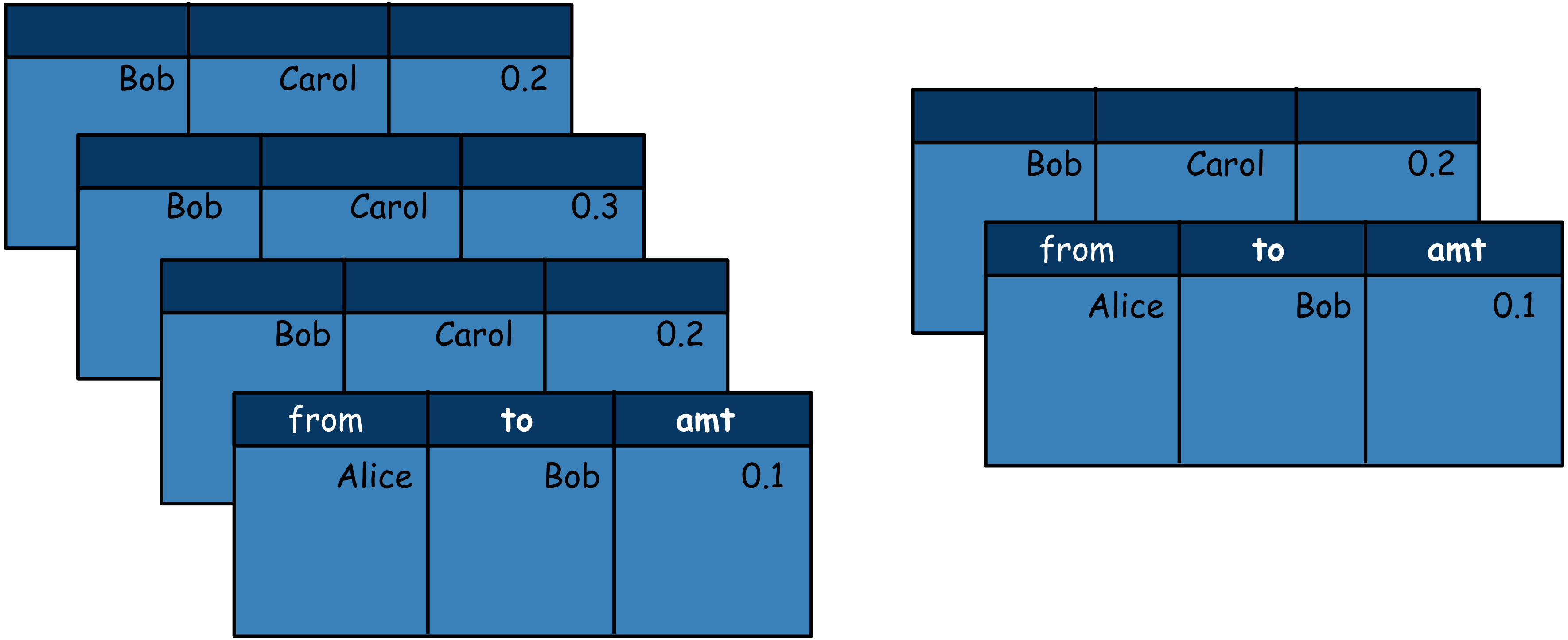
| from | to |
|---|---|
| Alice | Bob |

| | |
|---|---|
| Bob | Carol |

| | |
|---|---|
| Carol | Dave |

# dropDuplicates

subset = ['from','to']

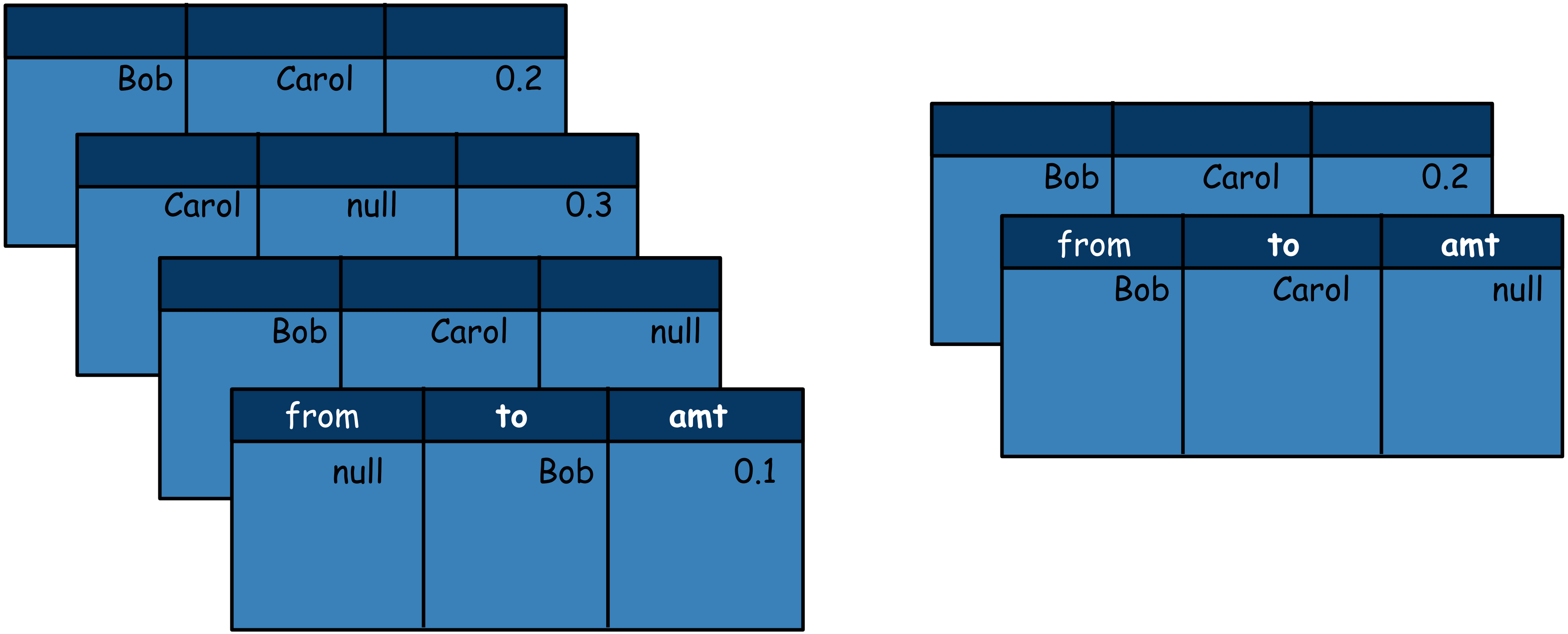


| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |
| Bob | Carol | 0.2 |
| Bob | Carol | 0.3 |
| Bob | Carol | 0.2 |

| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |
| Bob | Carol | 0.2 |

# dropna

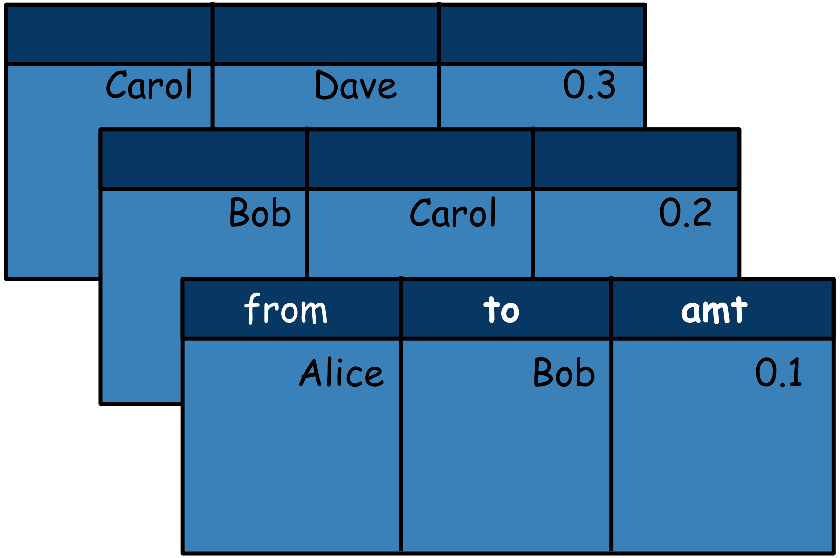
how = 'any'  subset = ['from', 'to']



| from | to | amt |
|---|---|---|
| Bob | Carol | 0.2 |
| Carol | null | 0.3 |
| Bob | Carol | null |
| null | Bob | 0.1 |

| from | to | amt |
|---|---|---|
| Bob | Carol | 0.2 |
| Bob | Carol | null |

# dtypes



| | | |
|---|---|---|
| Carol | Dave | 0.3 |

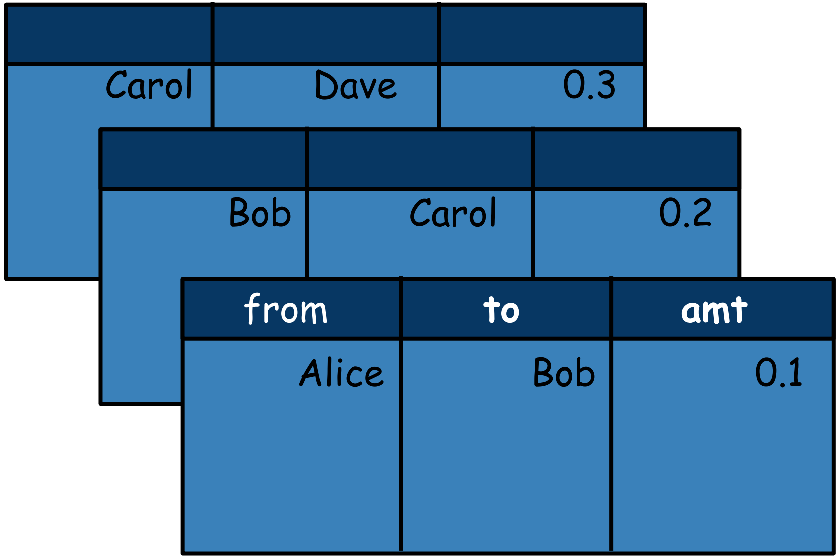
| | | |
|---|---|---|
| Bob | Carol | 0.2 |

| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |

[(‘from’,‘string’), (‘to’, ‘string’), (‘amt’, ‘double’)]

# explain

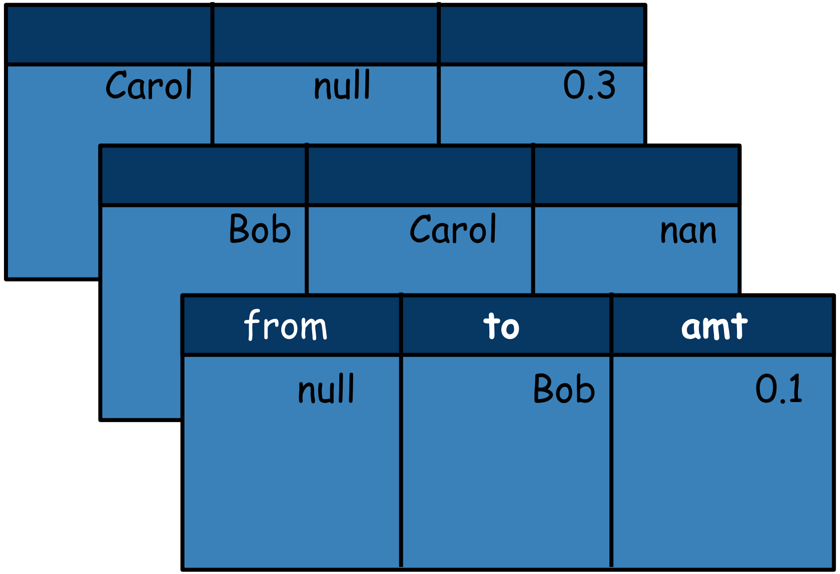
extended = True



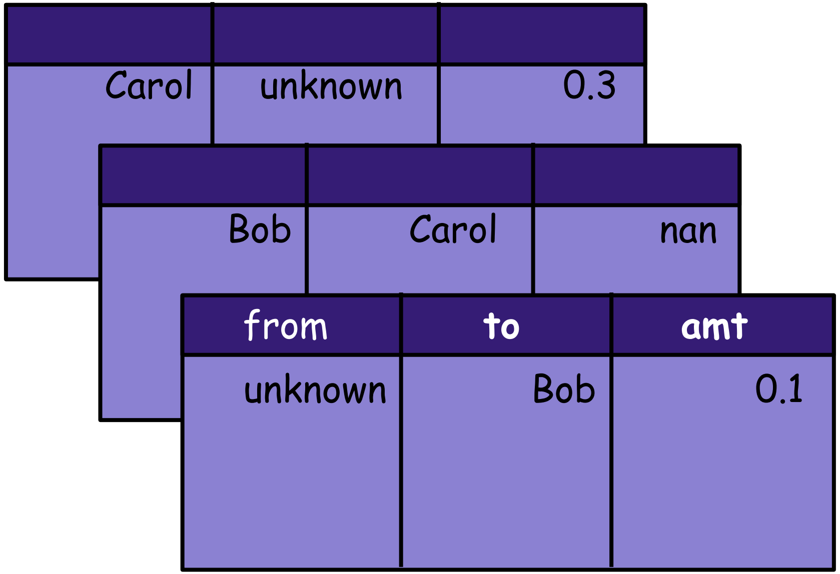
```
== Parsed Logical Plan ==
...
== Analyzed Logical Plan ==
...
== Optimized Logical Plan ==
...
== Physical Plan ==
...
== RDD ==
```

# fillna

value = ‘unknown”  subset = [‘from’, ‘to’]



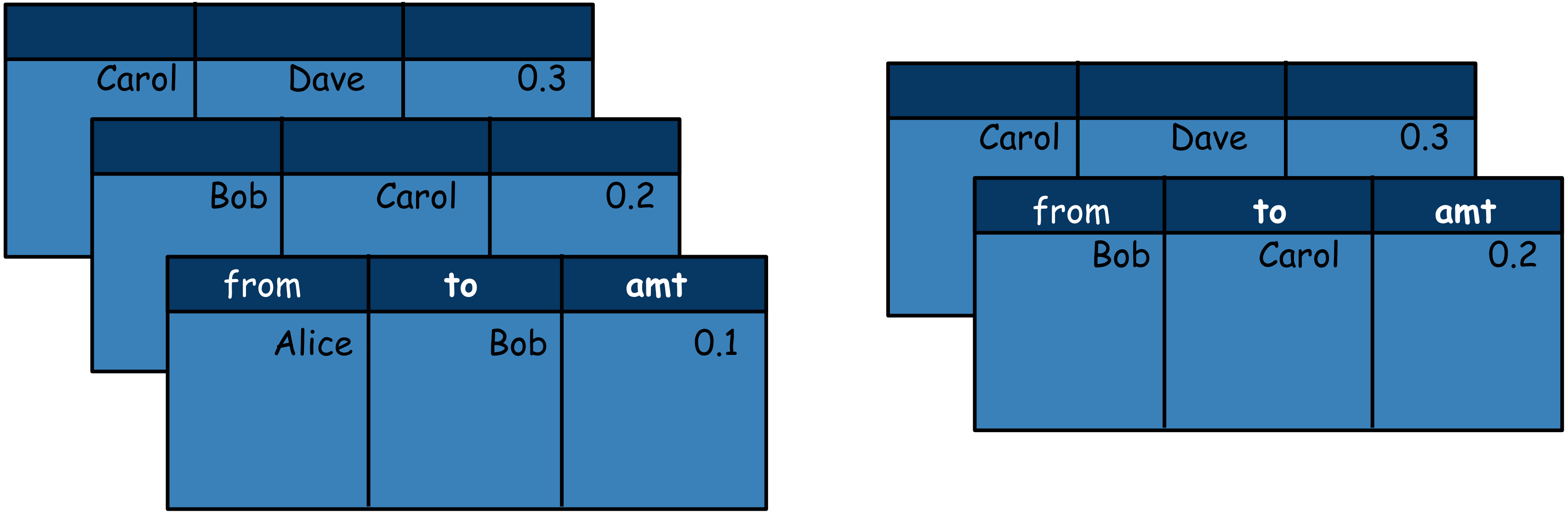
| from | to | amt |
|---|---|---|
| null | Bob | 0.1 |
| Bob | Carol | nan |
| Carol | null | 0.3 |



| from | to | amt |
|---|---|---|
| unknown | Bob | 0.1 |
| Bob | Carol | nan |
| Carol | unknown | 0.3 |

# filter

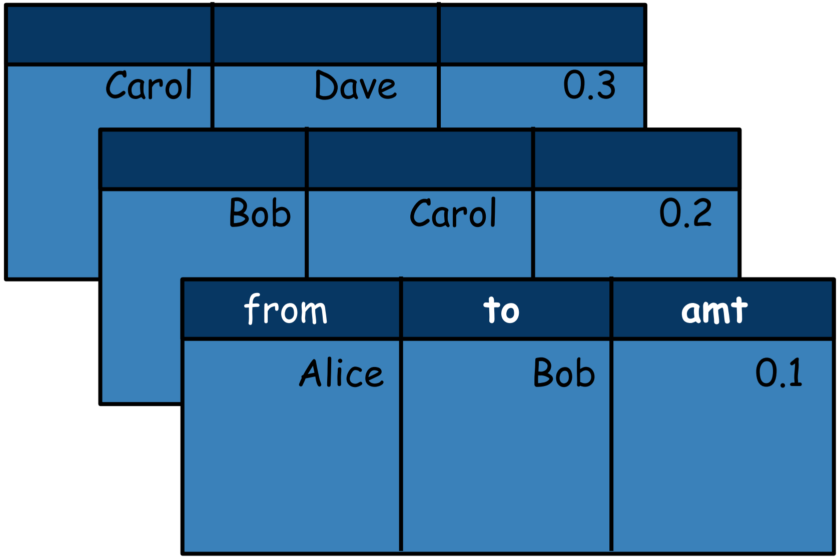
condition = “amt > 0.1”



| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |
| Bob | Carol | 0.2 |
| Carol | Dave | 0.3 |

| from | to | amt |
|---|---|---|
| Bob | Carol | 0.2 |
| Carol | Dave | 0.3 |

# first



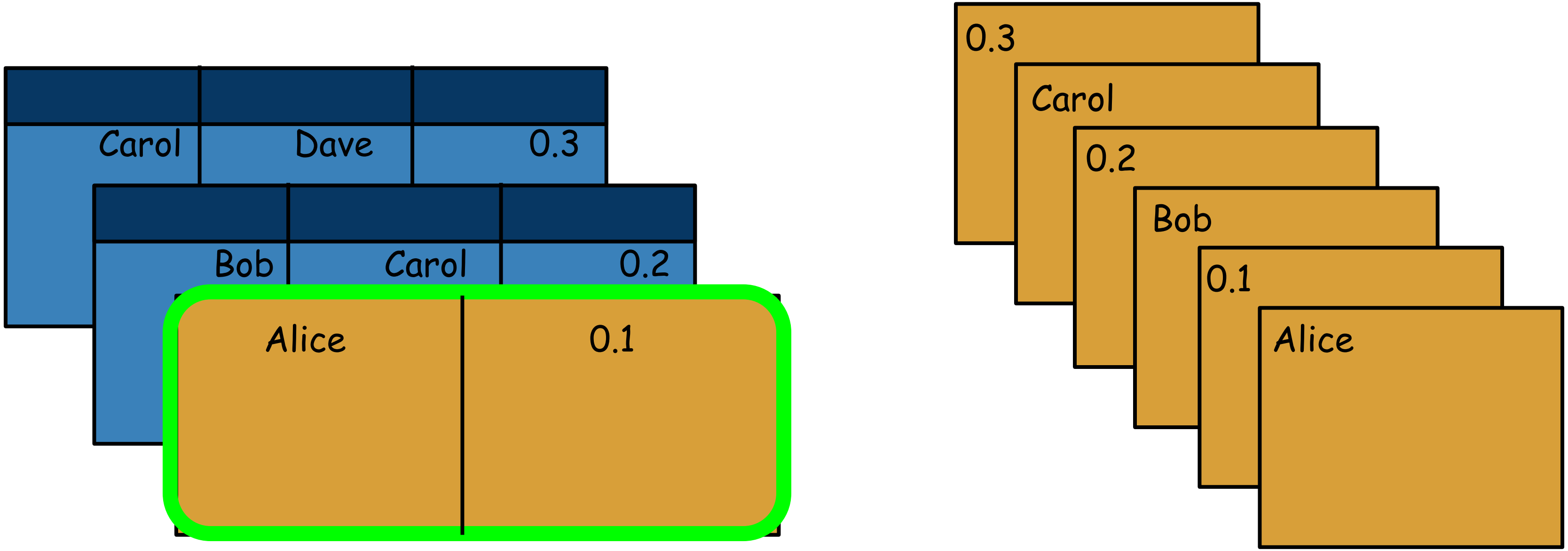
| | | |
|---|---|---|
| Carol | Dave | 0.3 |

| | | |
|---|---|---|
| Bob | Carol | 0.2 |

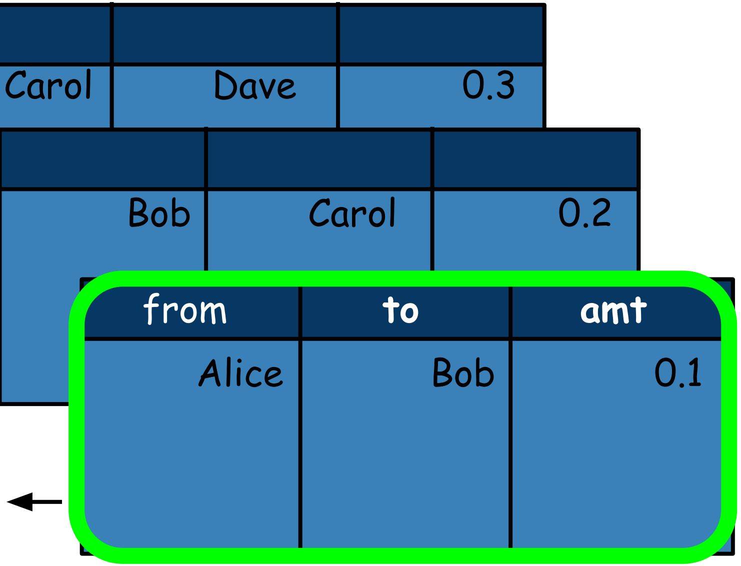
| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |

```
Row(from='Alice', to='Bob', amt=0.1)
```

# flatMap



# foreach

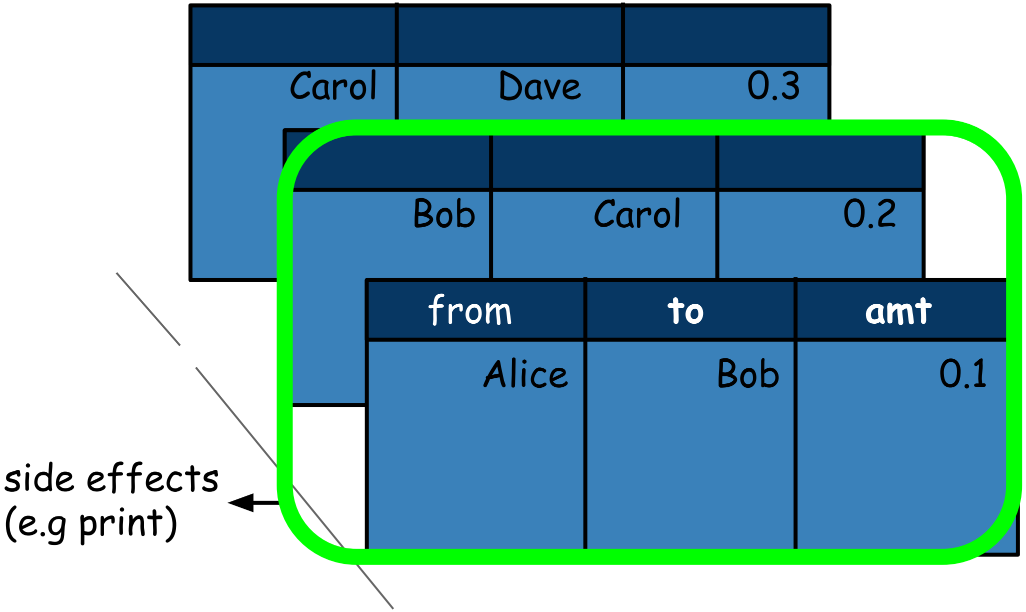


| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |
| Bob | Carol | 0.2 |
| Carol | Dave | 0.3 |

side effects
(e.g print)

*no return value, original DataFrame unchanged

# foreachPartition



| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |

|  |  |  |
|---|---|---|
| Bob | Carol | 0.2 |

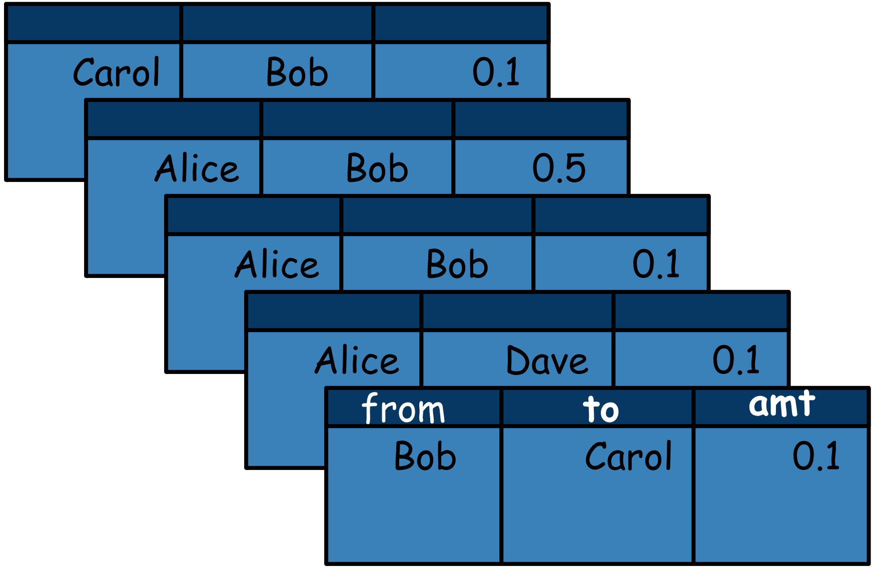
|  |  |  |
|---|---|---|
| Carol | Dave | 0.3 |

side effects
(e.g print)

*no return value, original DataFrame unchanged

# freqItems

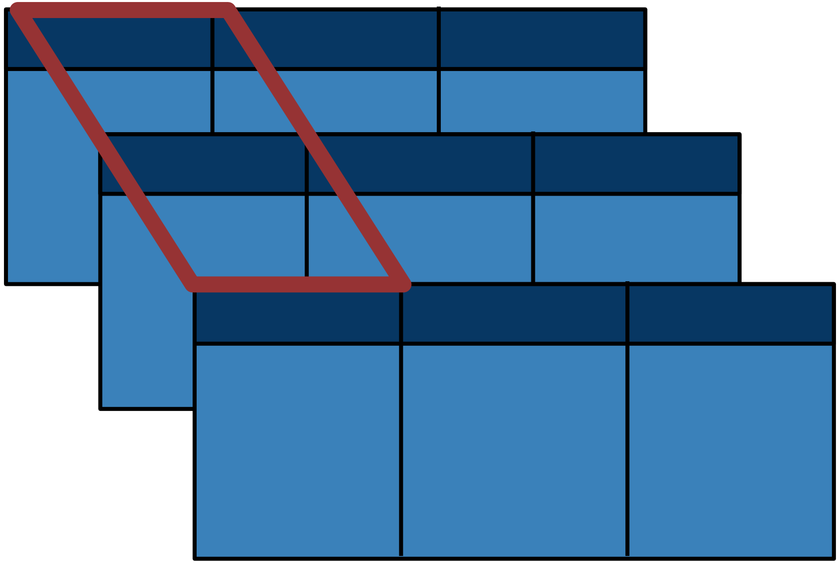
cols = ['from', 'amt']  support = 0.8



| from | to | amt |
|---|---|---|
| Carol | Bob | 0.1 |
| Alice | Bob | 0.5 |
| Alice | Bob | 0.1 |
| Alice | Dave | 0.1 |
| Bob | Carol | 0.1 |

| from_freqItems | amt_freqItems |
|---|---|
| [Alice] | [0.1] |

# groupBy (groupby)

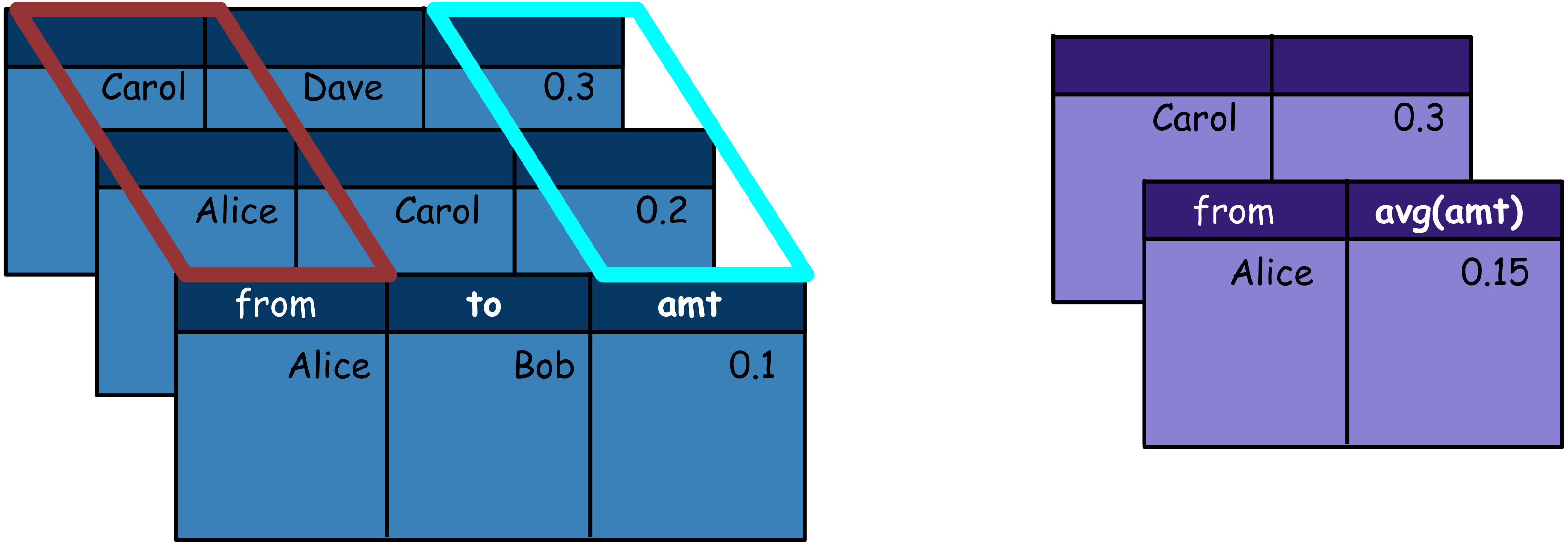


GroupedData Object

with methods: agg, avg, count, max, mean, min, pivot, sum

# groupBy(col1).avg(col2)

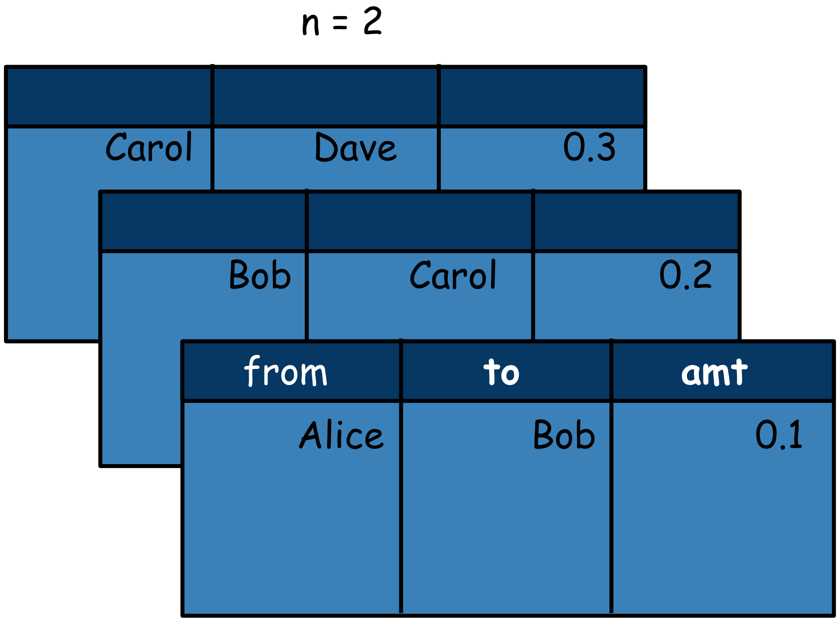
col1 = ‘from’  col2 = ‘amt’



| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |
| Alice | Carol | 0.2 |
| Carol | Dave | 0.3 |

| from | avg(amt) |
|---|---|
| Alice | 0.15 |
| Carol | 0.3 |

# head

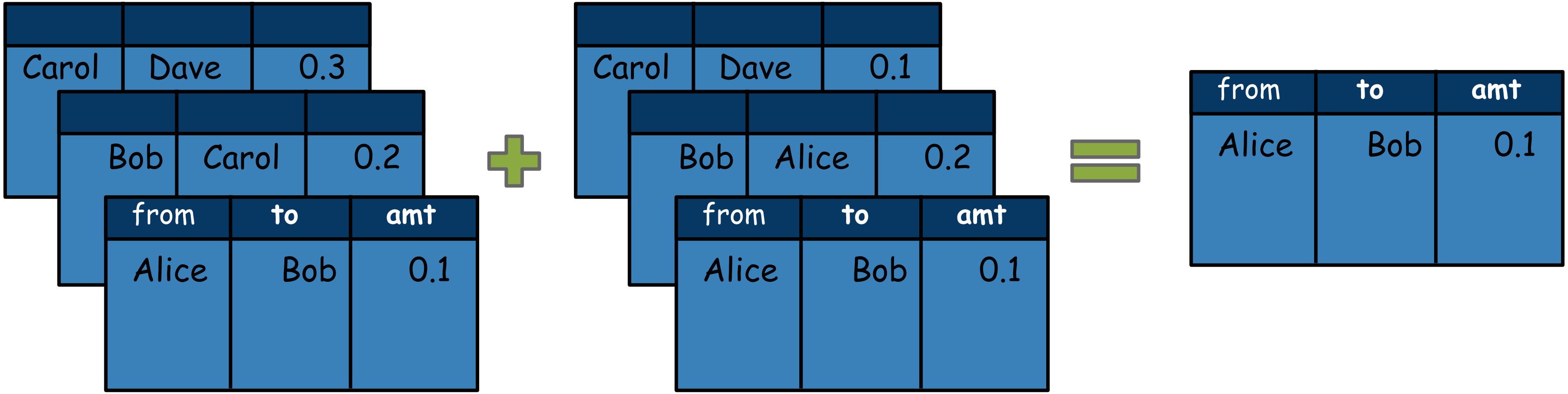


n = 2

| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |
| Bob | Carol | 0.2 |
| Carol | Dave | 0.3 |

```
[Row(from=u'Alice', to=u'Bob', amt=0.1),
Row(from=u'Bob', to=u'Carol', amt=0.2)]
```

# intersect



| from | to | amt |
|---|---|---|
| Carol | Dave | 0.3 |
| Bob | Carol | 0.2 |
| Alice | Bob | 0.1 |

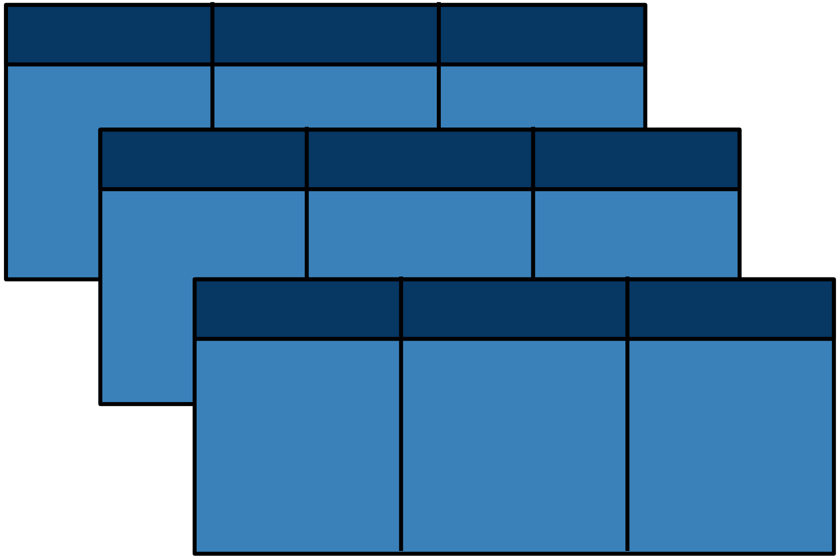
+

| from | to | amt |
|---|---|---|
| Carol | Dave | 0.1 |
| Bob | Alice | 0.2 |
| Alice | Bob | 0.1 |

=

| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |

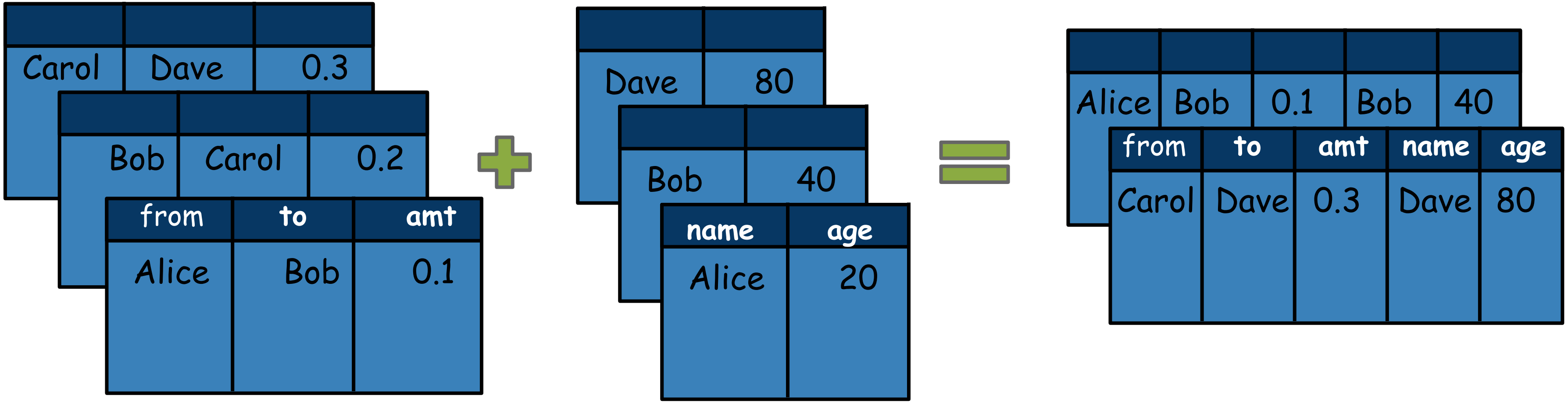
# isLocal



False

# join

joinExprs = x.to==y.name  joinType = 'inner'



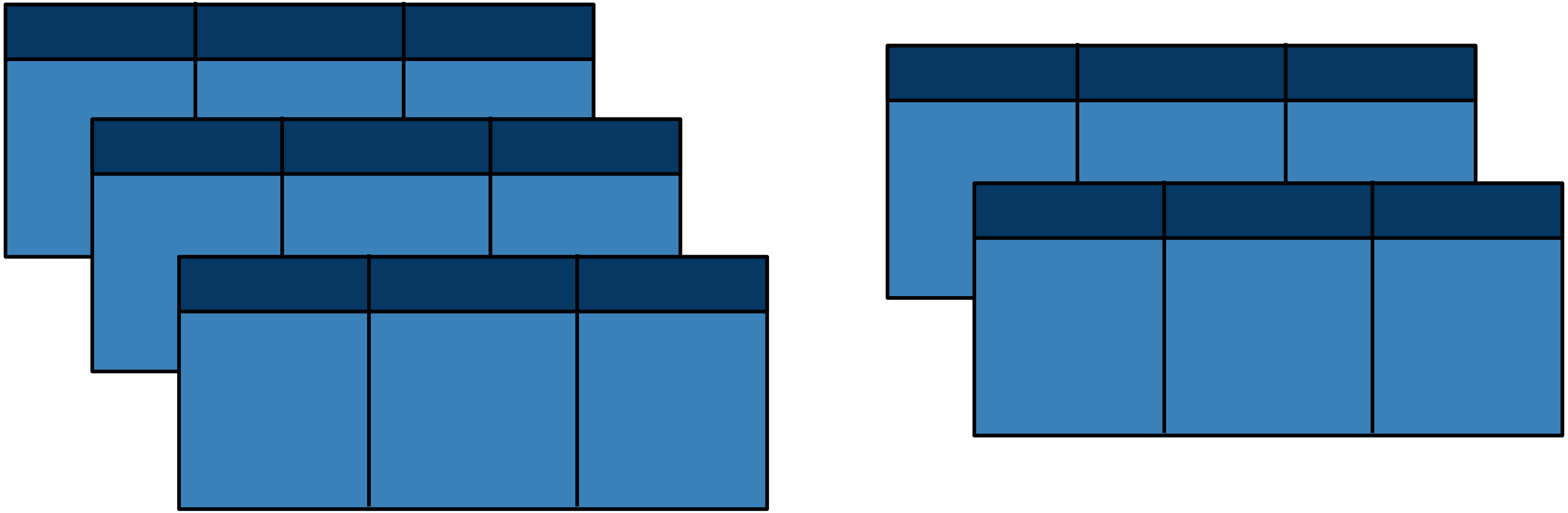
| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |
| Bob | Carol | 0.2 |
| Carol | Dave | 0.3 |

| name | age |
|---|---|
| Alice | 20 |
| Bob | 40 |
| Dave | 80 |

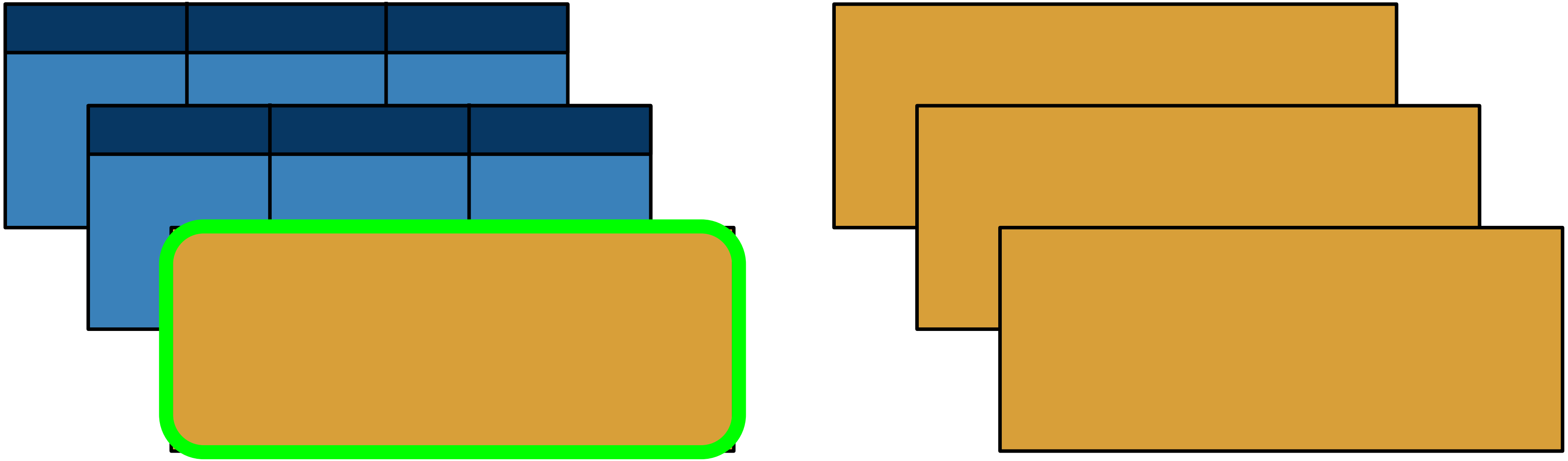
| from | to | amt | name | age |
|---|---|---|---|---|
| Carol | Dave | 0.3 | Dave | 80 |
| Alice | Bob | 0.1 | Bob | 40 |

# limit

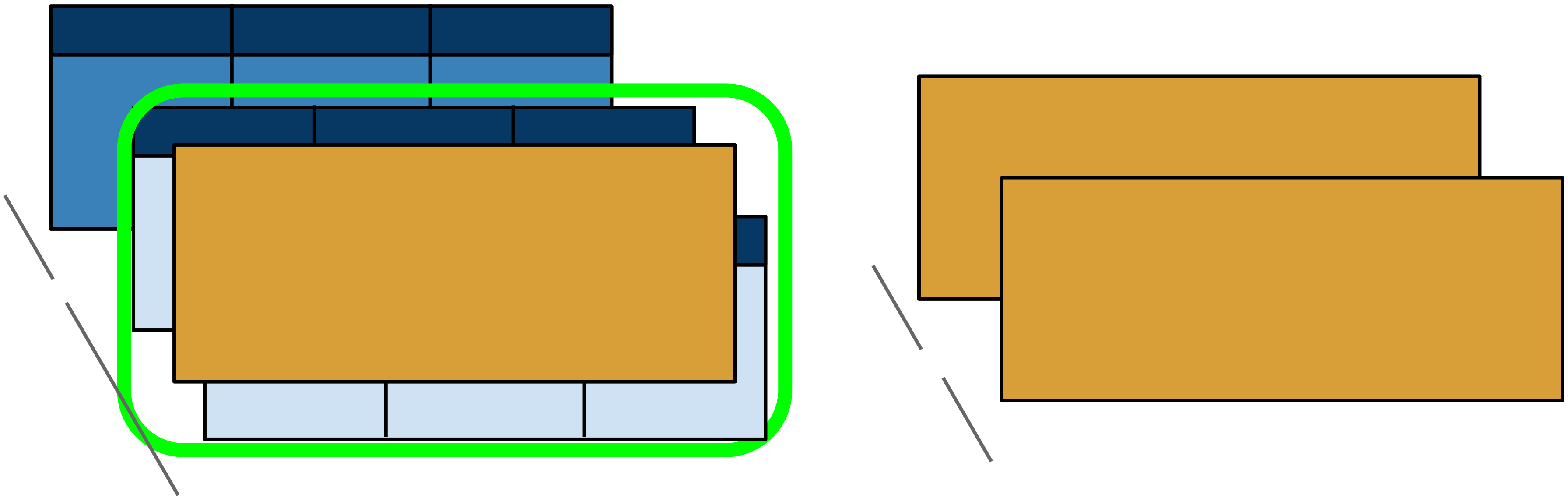
num = 2



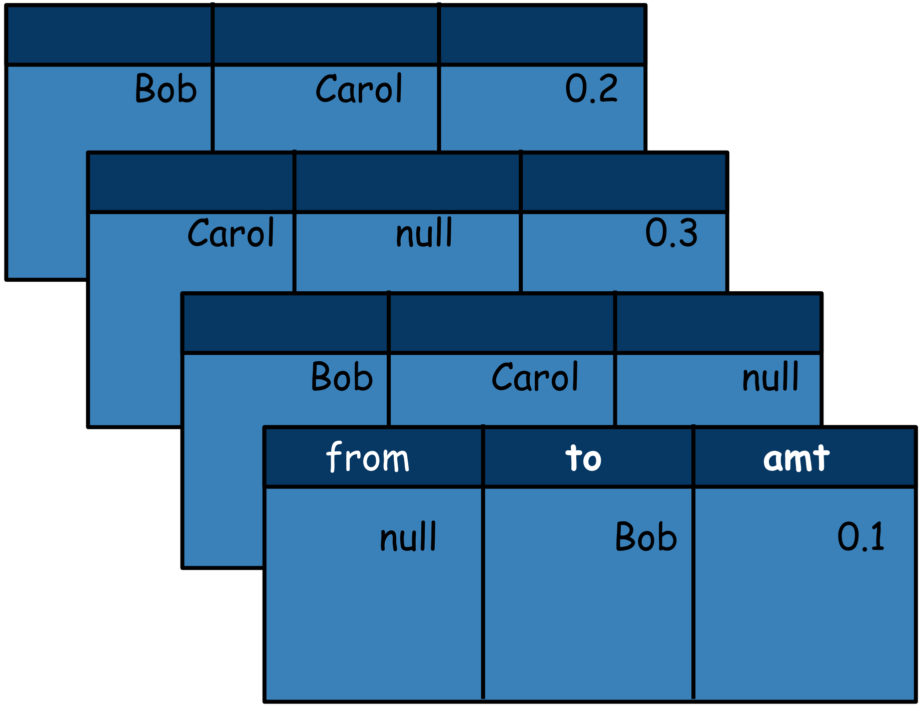
# map



# mapPartitions



# na



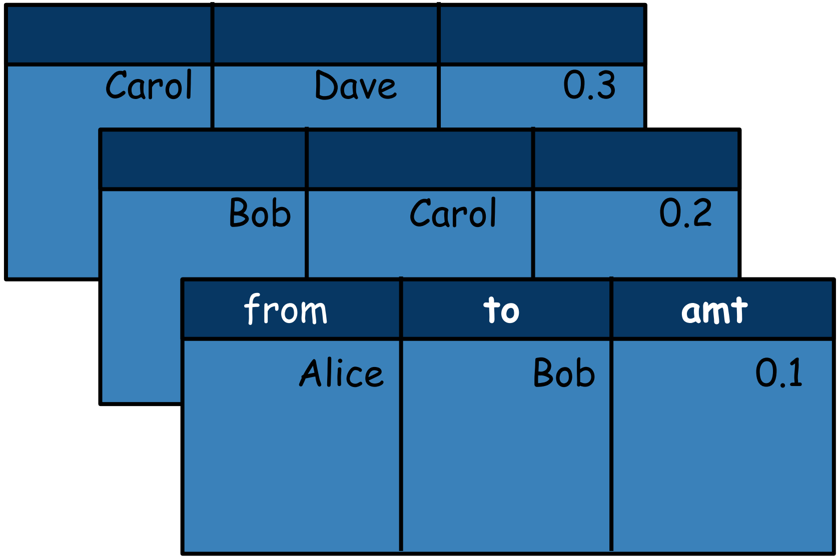
| from | to | amt |
|---|---|---|
| null | Bob | 0.1 |
| Bob | Carol | null |
| Carol | null | 0.3 |
| Bob | Carol | 0.2 |

DataFrameNaFunctions Object

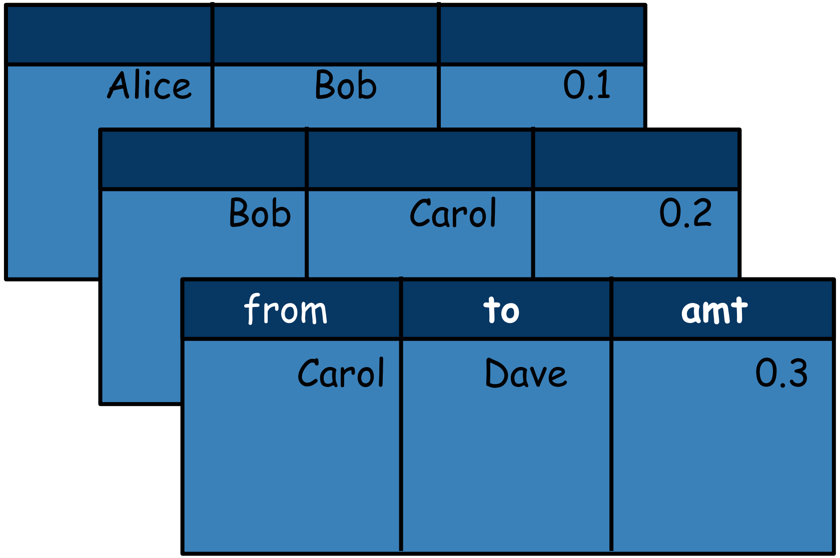
with methods: drop, fill, replace

# orderBy

cols = ['from'], ascending = [False]



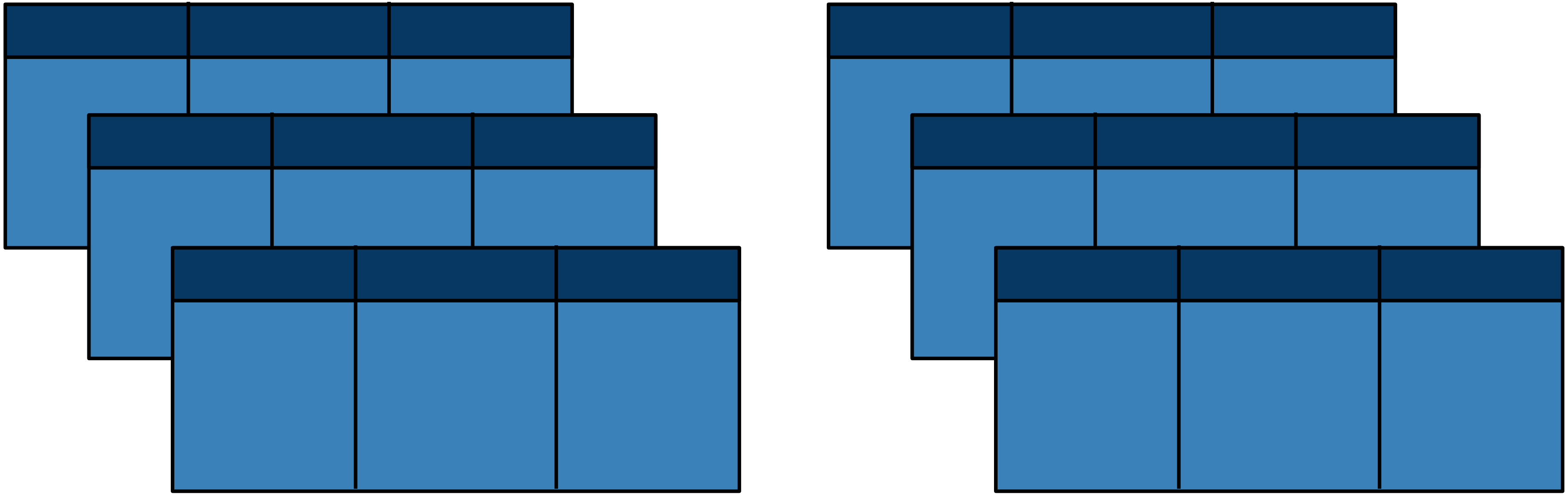
| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |
| Bob | Carol | 0.2 |
| Carol | Dave | 0.3 |



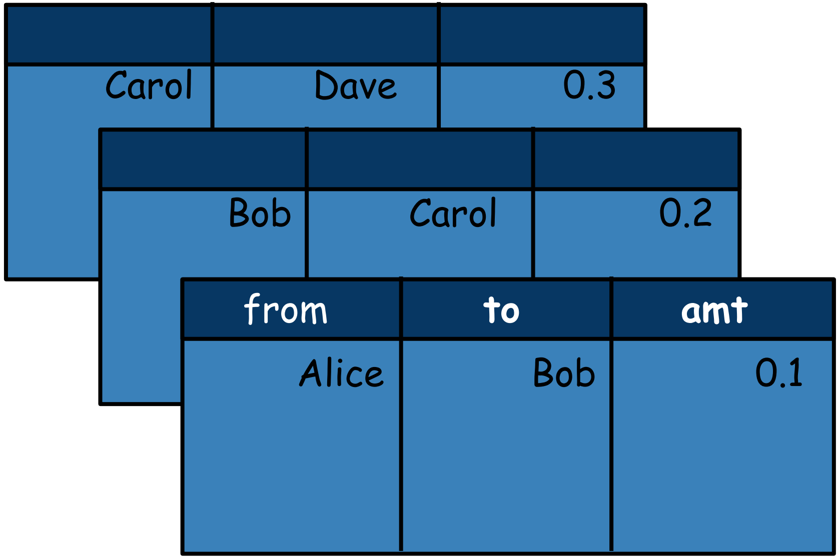
| from | to | amt |
|---|---|---|
| Carol | Dave | 0.3 |
| Bob | Carol | 0.2 |
| Alice | Bob | 0.1 |

# persist

strorageLevel = StorageLevel(MEMORY_ONLY_SER)



# printSchema



| | | |
|---|---|---|
| Carol | Dave | 0.3 |

| | | |
|---|---|---|
| Bob | Carol | 0.2 |

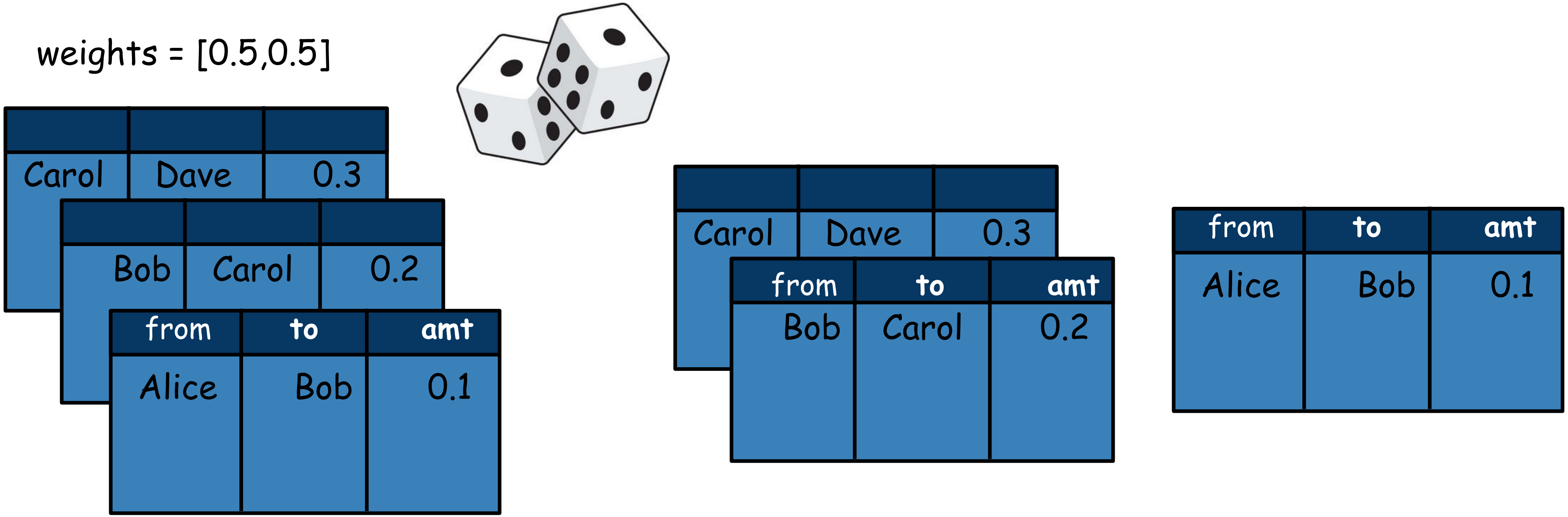
| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |

stdout

```
root
 |-- from: string (nullable = true)
 |-- to: string (nullable = true)
 |-- amt: double (nullable = true)
```

# randomSplit

weights = [0.5,0.5]



| | | |
|---|---|---|
| Carol | Dave | 0.3 |

| | | |
|---|---|---|
| Bob | Carol | 0.2 |

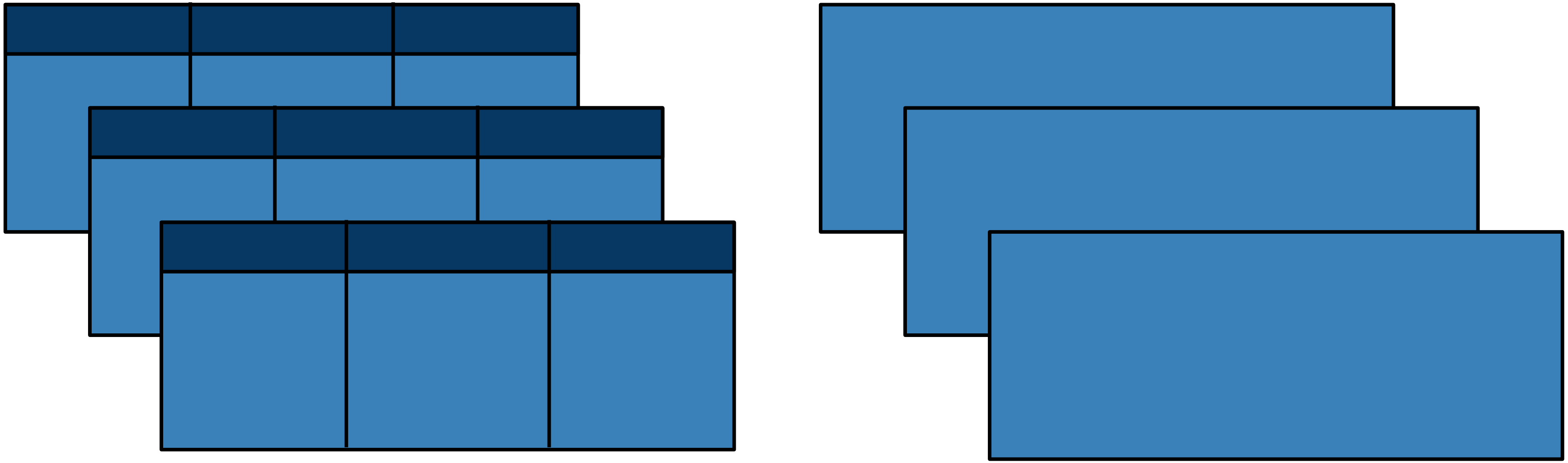
| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |

| | | |
|---|---|---|
| Carol | Dave | 0.3 |

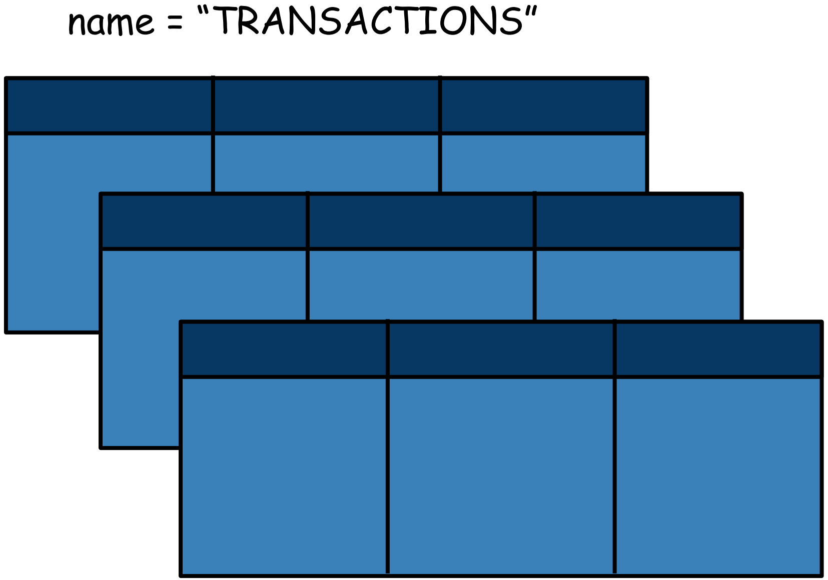
| from | to | amt |
|---|---|---|
| Bob | Carol | 0.2 |

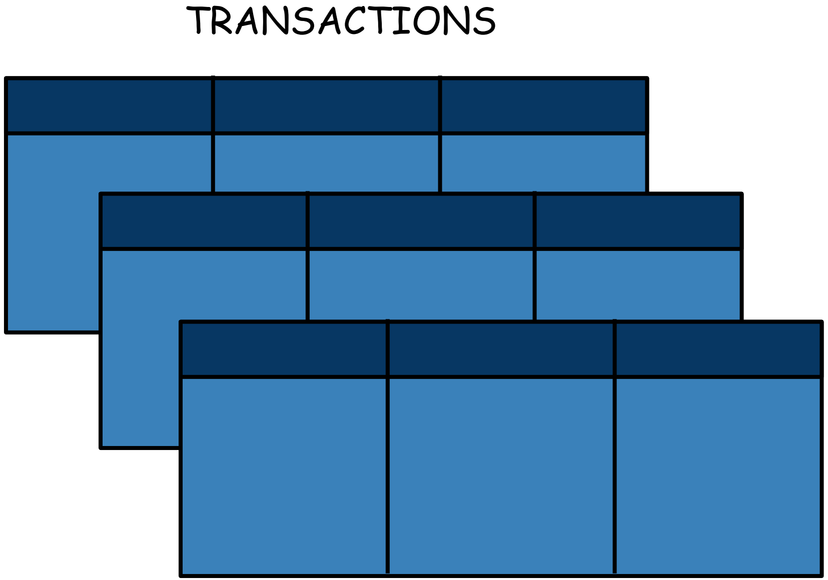
| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |

# rdd

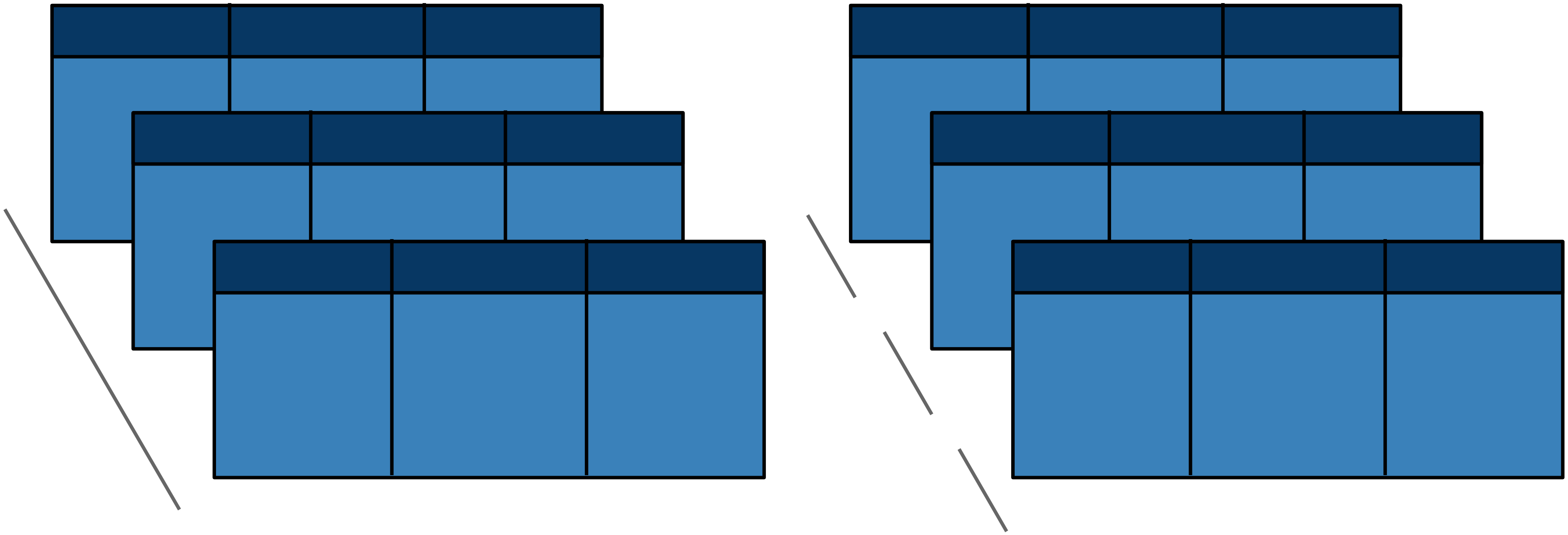


# registerTempTable



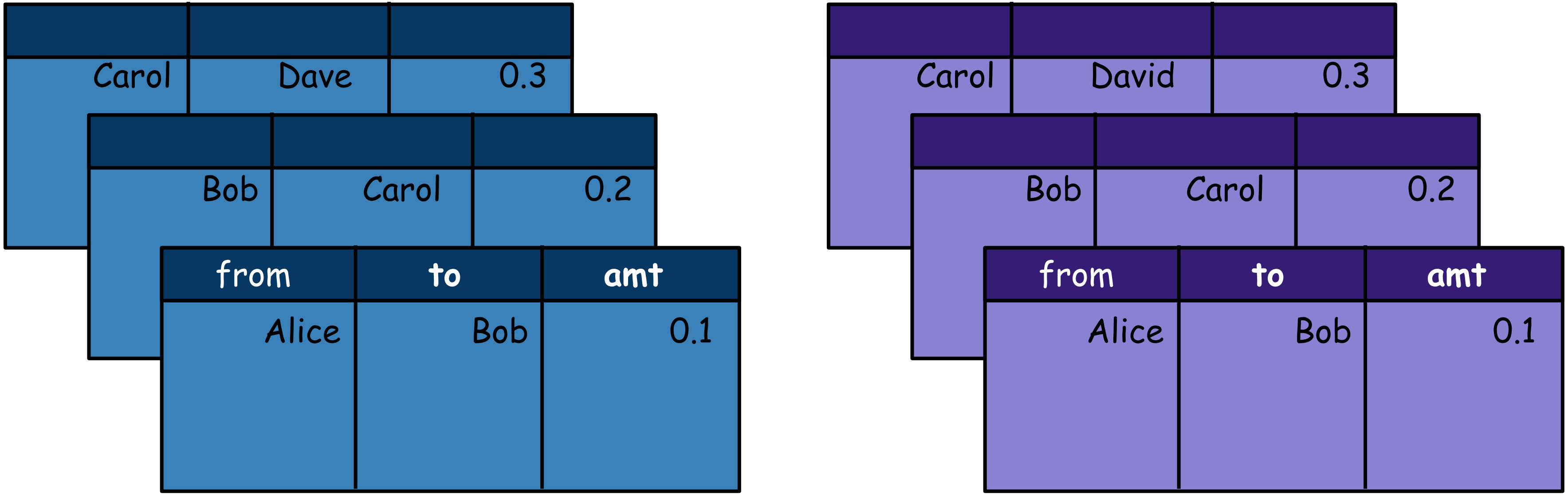


# repartition



# replace

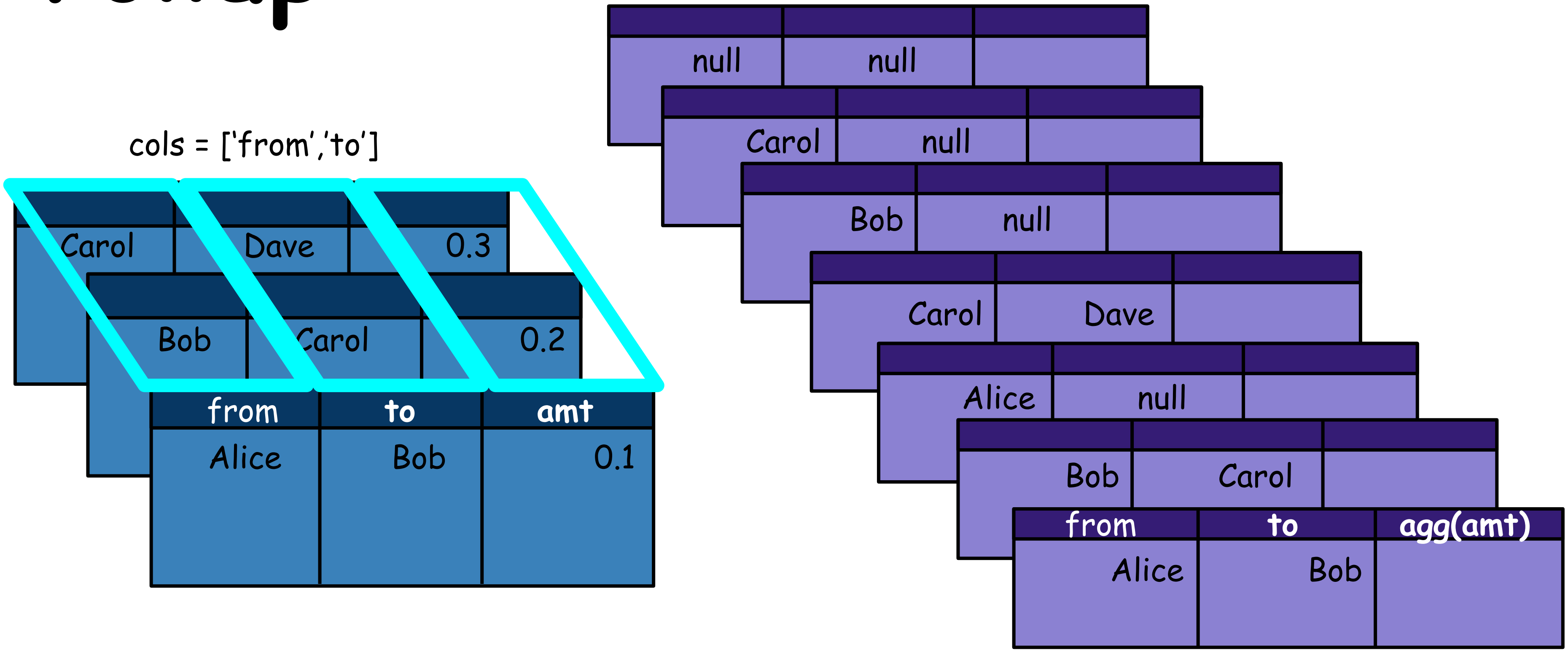
to_replace = 'Dave'  value = 'David'



| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |
| Bob | Carol | 0.2 |
| Carol | Dave | 0.3 |

| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |
| Bob | Carol | 0.2 |
| Carol | David | 0.3 |

# rollup

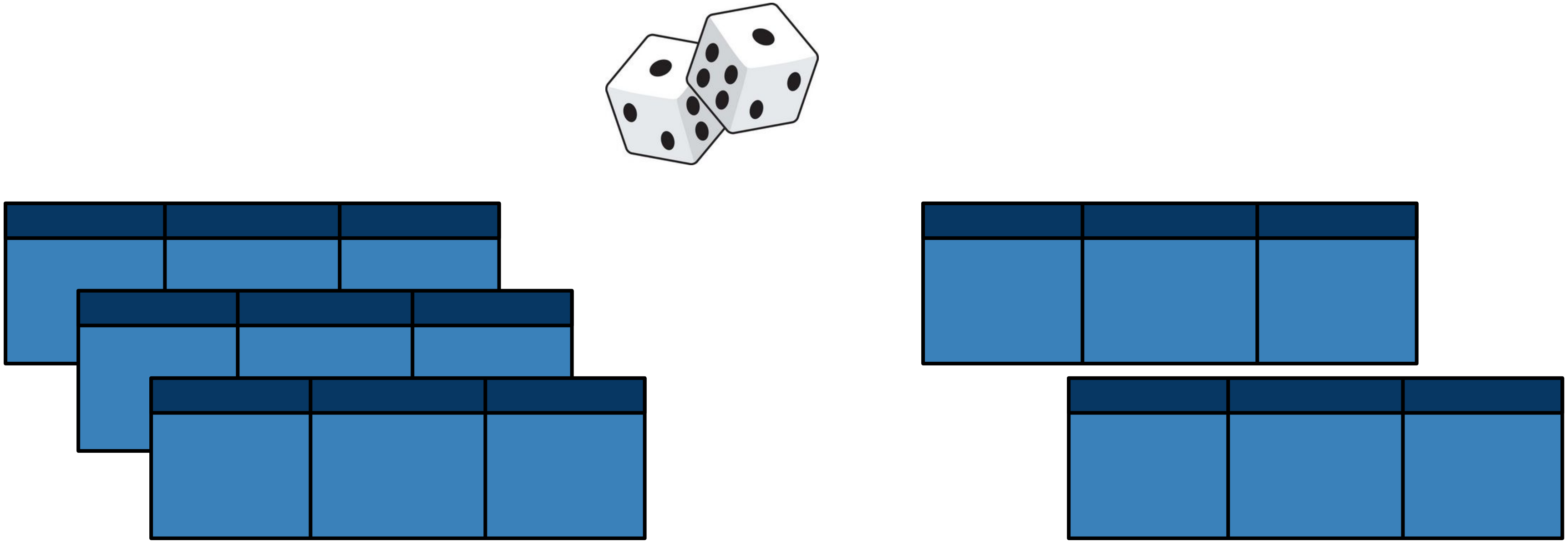


cols = [‘from’,‘to’]

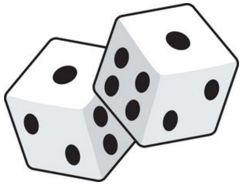
| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |
| Bob | Carol | 0.2 |
| Carol | Dave | 0.3 |

| from | to | agg(amt) |
|---|---|---|
| Alice | Bob | |
| Bob | Carol | |
| Alice | null | |
| Carol | Dave | |
| Bob | null | |
| Carol | null | |
| null | null | |

# sample



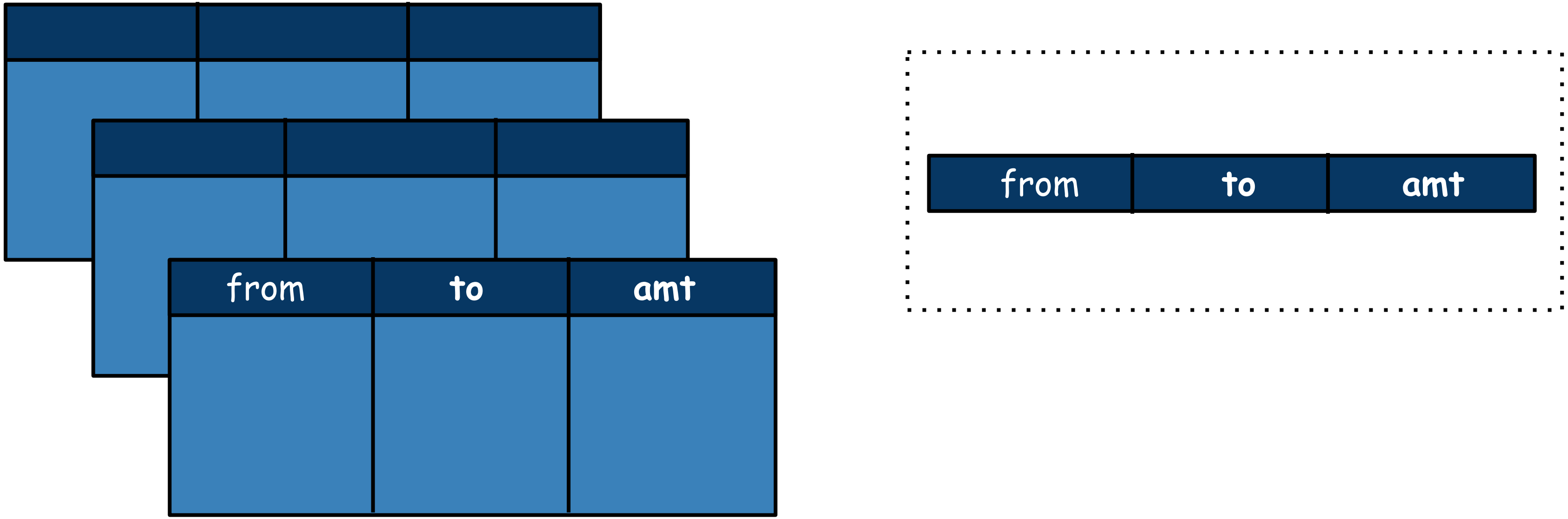
# sampleBy



| from | to | amt |
|---|---|---|
| Bob | Carol | 0.6 |
| Bob | Bob | 0.5 |
| Alice | Dave | 0.4 |
| Alice | Alice | 0.3 |
| Alice | Carol | 0.2 |
| Alice | Bob | 0.1 |

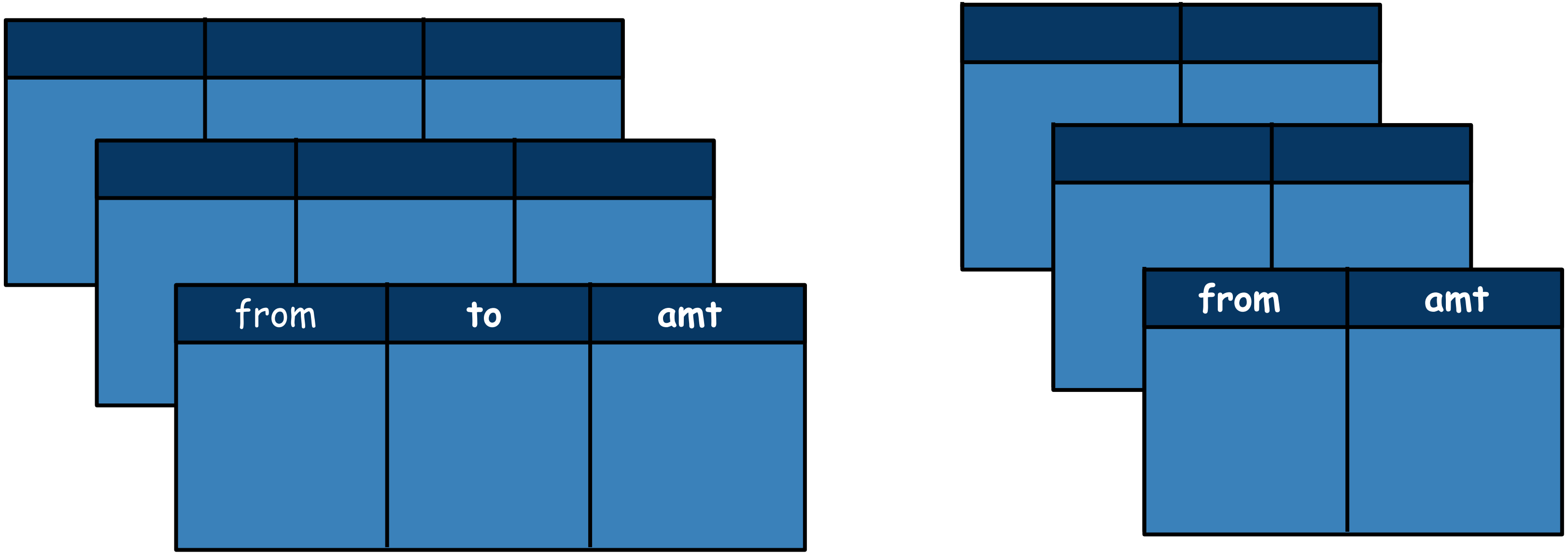
| from | to | amt |
|---|---|---|
| Bob | Carol | 0.6 |
| Bob | Bob | 0.5 |
| Alice | Bob | 0.3 |

# schema



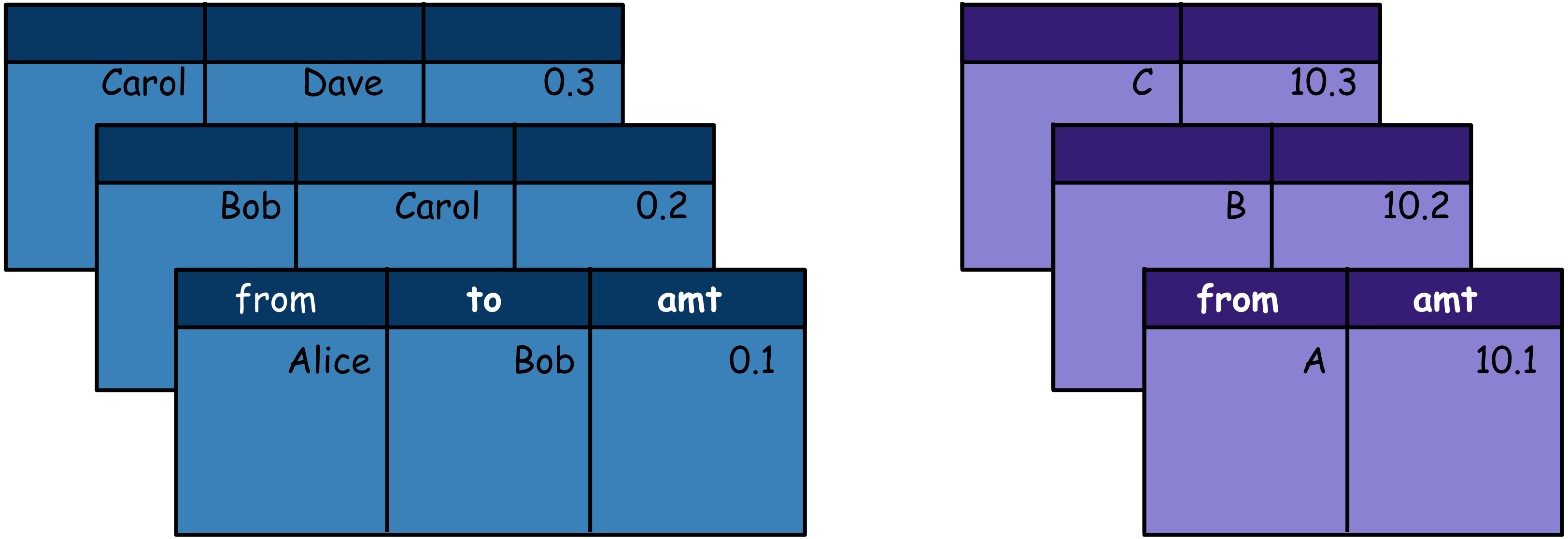
# select

cols = [‘from’, ‘amt’]



# selectExpr

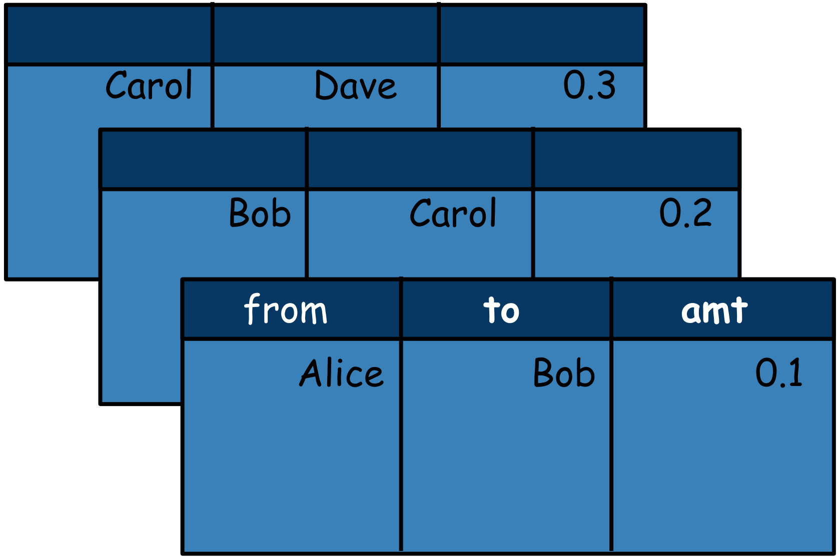
expr = [“substr(from,1,1)”, “amt + 10”]



| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |
| Bob | Carol | 0.2 |
| Carol | Dave | 0.3 |

| from | amt |
|---|---|
| A | 10.1 |
| B | 10.2 |
| C | 10.3 |

# show

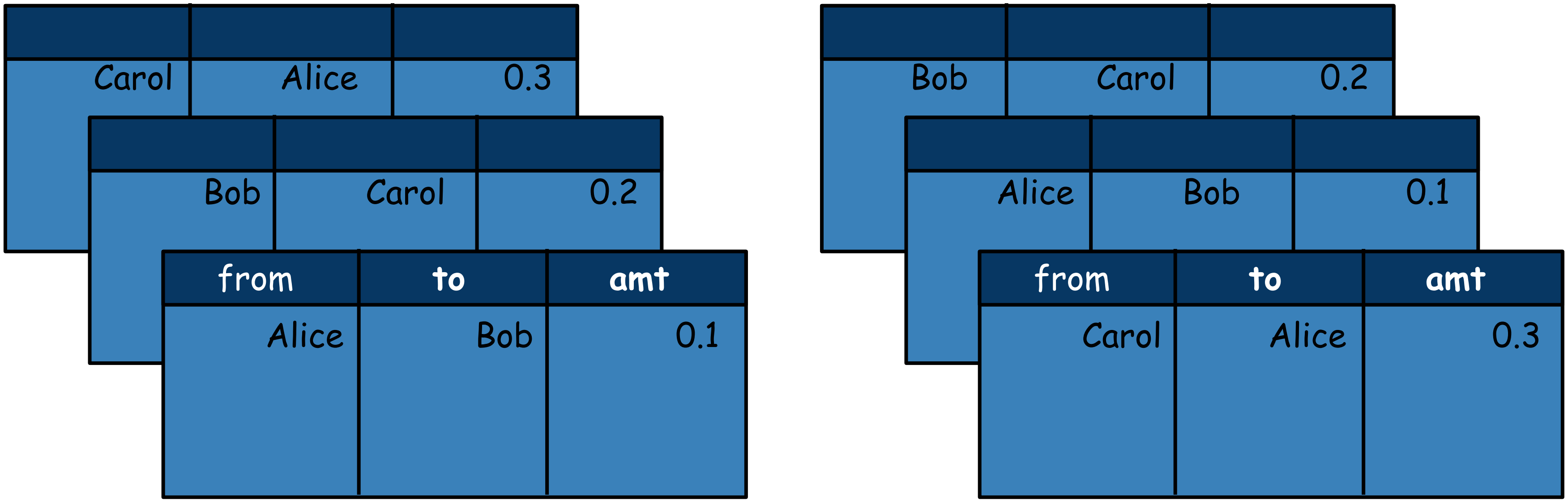


stdout

```
+-----+-----+---+
| from|   to|amt|
+-----+-----+---+
|Alice|  Bob|0.1|
|  Bob|Carol|0.2|
|Carol| Dave|0.3|
+-----+-----+---+
```

# sort

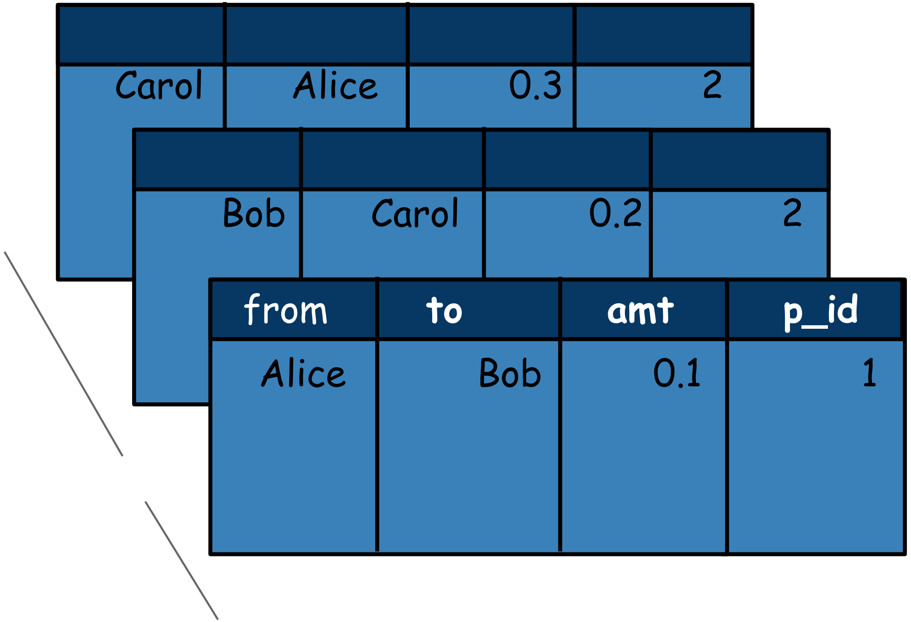
cols = ['to']



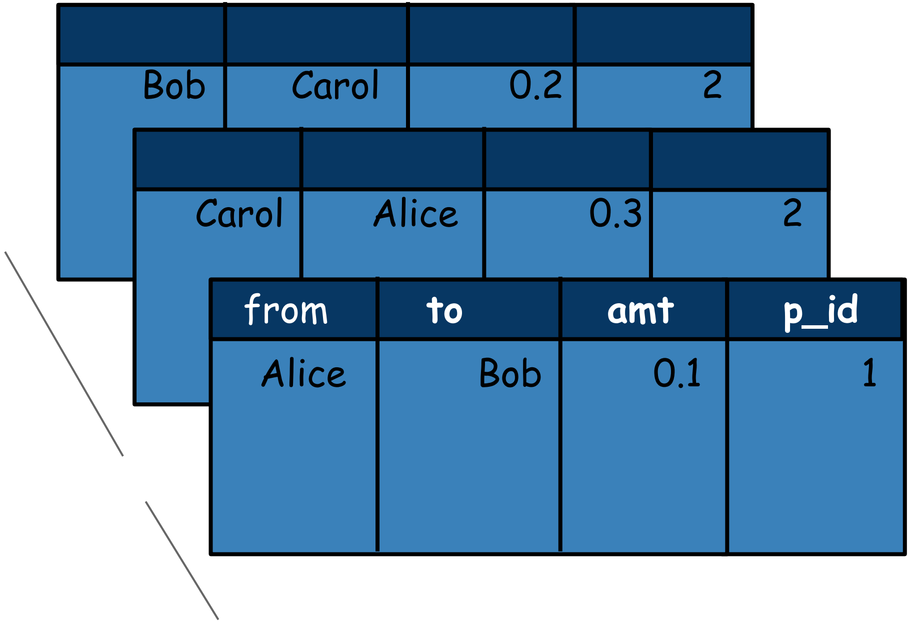
| from | to | amt |
|---|---|---|
| Carol | Alice | 0.3 |
| Bob | Carol | 0.2 |
| Alice | Bob | 0.1 |

| from | to | amt |
|---|---|---|
| Bob | Carol | 0.2 |
| Alice | Bob | 0.1 |
| Carol | Alice | 0.3 |

# sortWithinPartitions

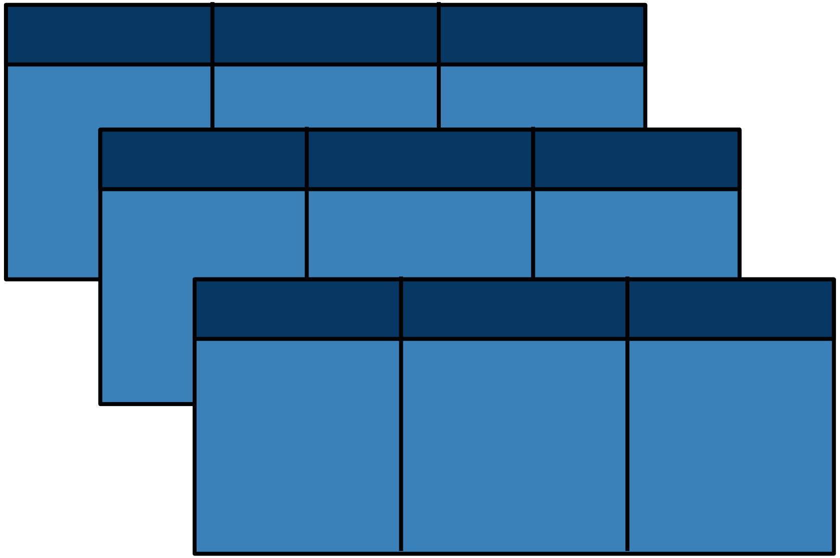


| from | to | amt | p_id |
|---|---|---|---|
| Carol | Alice | 0.3 | 2 |
| Bob | Carol | 0.2 | 2 |
| Alice | Bob | 0.1 | 1 |



| from | to | amt | p_id |
|---|---|---|---|
| Bob | Carol | 0.2 | 2 |
| Carol | Alice | 0.3 | 2 |
| Alice | Bob | 0.1 | 1 |

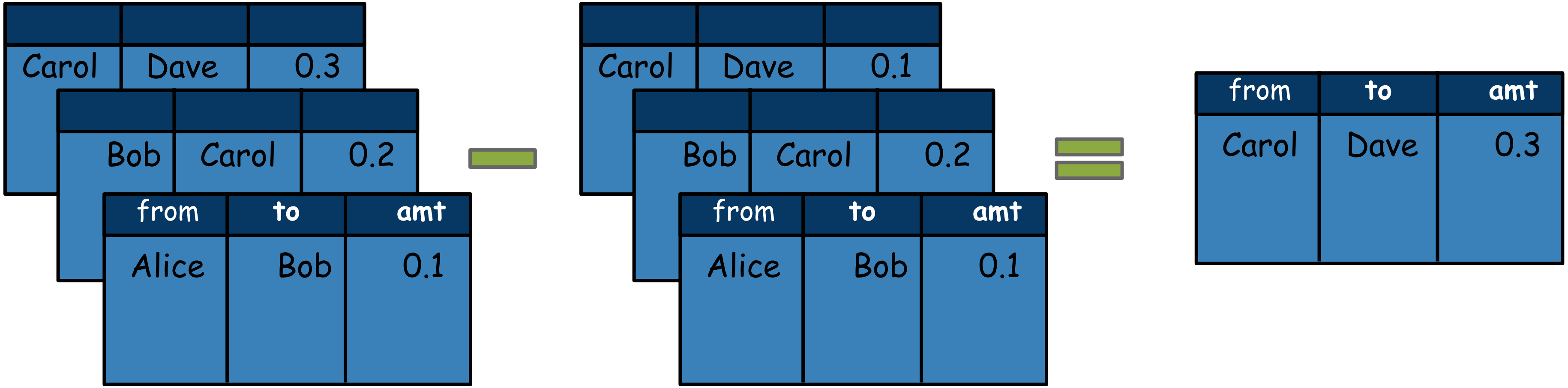
# stat



DataFrameStatFunctions Object

with methods: corr, cov, corsstab, freqItems, sampleBy

# subtract



|  |  |  |
|---|---|---|
| Carol | Dave | 0.3 |

|  |  |  |
|---|---|---|
| Bob | Carol | 0.2 |

| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |

−

|  |  |  |
|---|---|---|
| Carol | Dave | 0.1 |

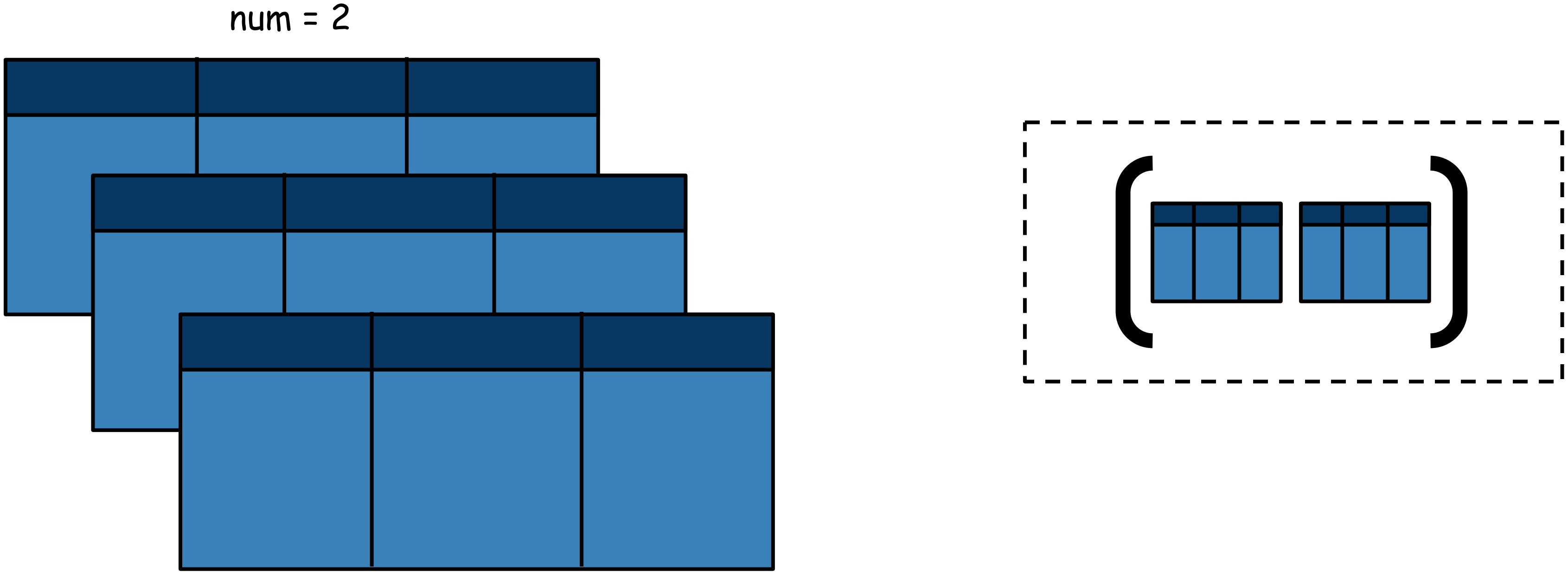
|  |  |  |
|---|---|---|
| Bob | Carol | 0.2 |

| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |

=

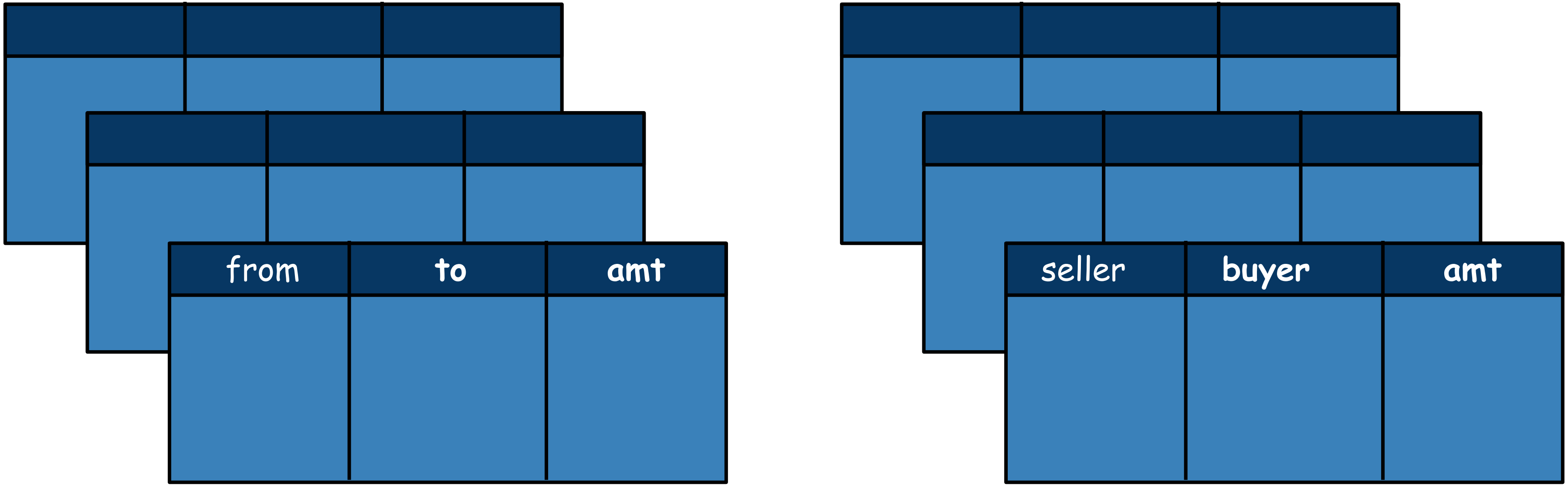
| from | to | amt |
|---|---|---|
| Carol | Dave | 0.3 |

# take

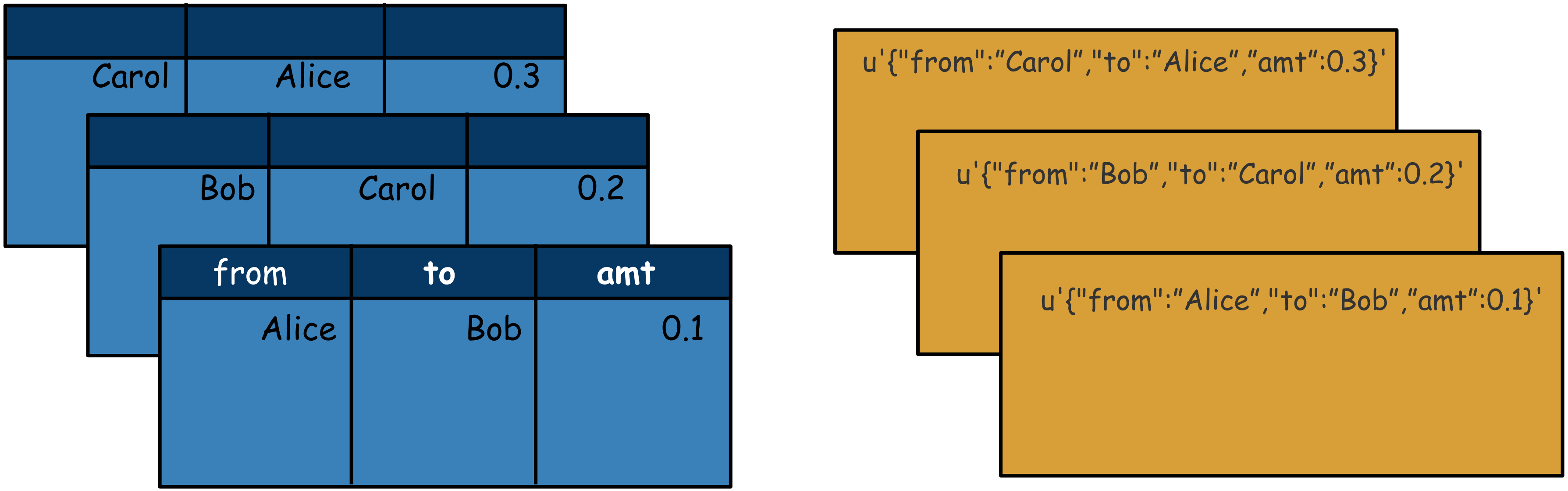


# toDF

```
cols = [“seller”, “buyer”]
```



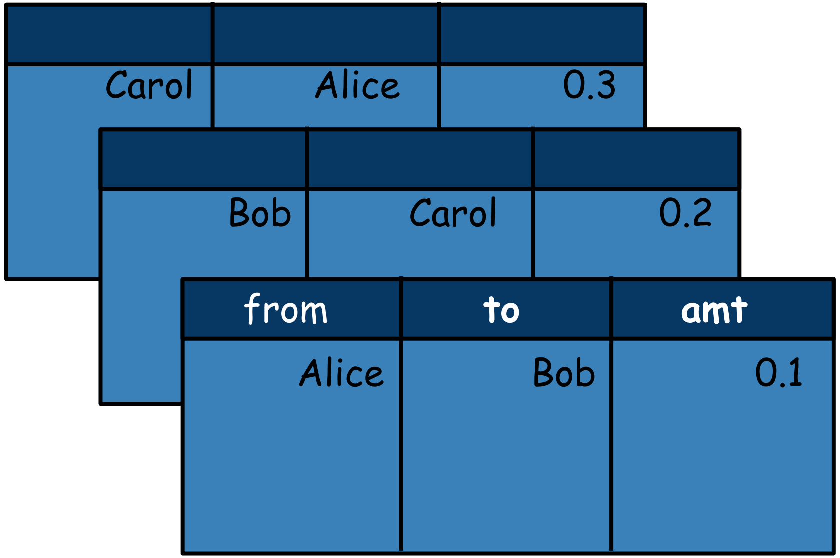
# toJSON



| from | to | amt |
|---|---|---|
| Carol | Alice | 0.3 |
| Bob | Carol | 0.2 |
| Alice | Bob | 0.1 |

```
u'{"from":"Carol","to":"Alice","amt":0.3}'
u'{"from":"Bob","to":"Carol","amt":0.2}'
u'{"from":"Alice","to":"Bob","amt":0.1}'
```

# toPandas



Carol Alice 0.3

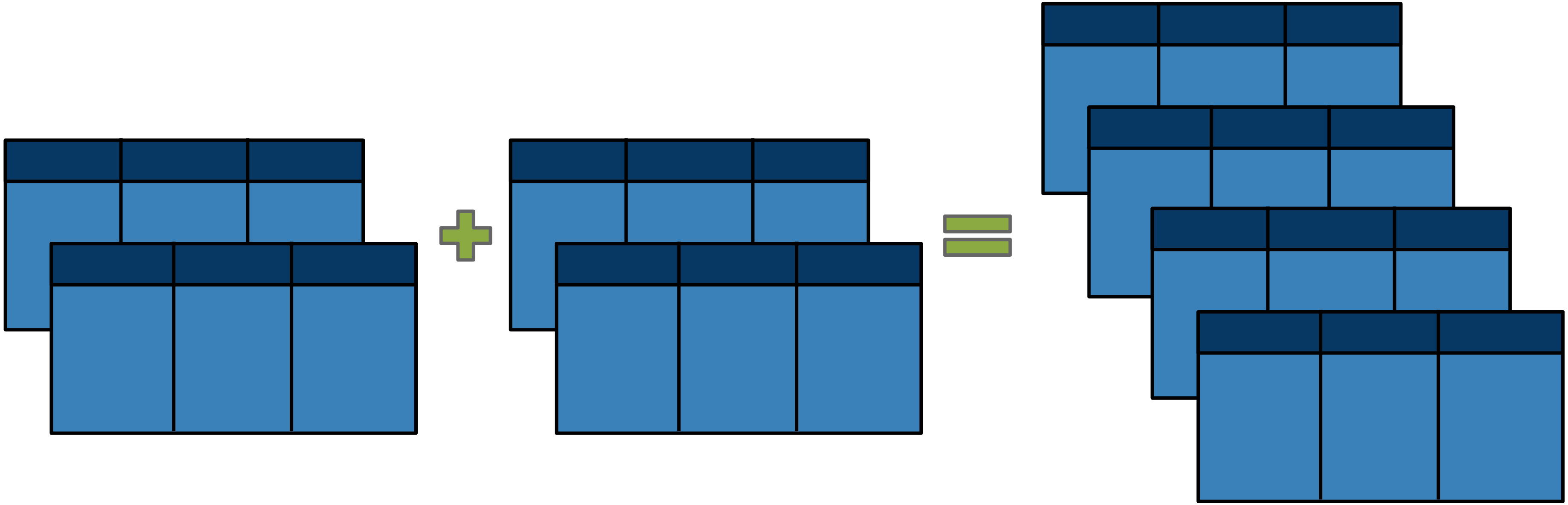
Bob Carol 0.2

from to amt

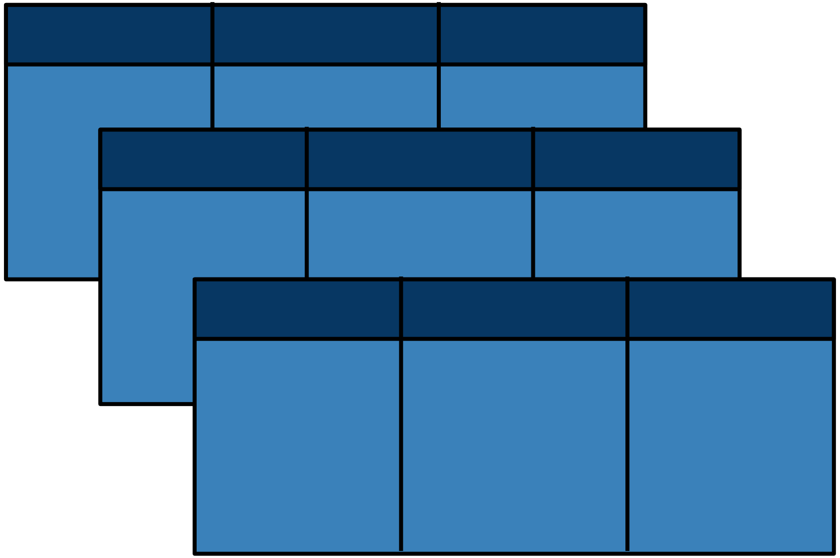
Alice Bob 0.1

```
   from  to   amt
0  Alice  Bob  0.1
1  Bob  Carol  0.2
2  Carol  Alice  0.3
```

# unionAll

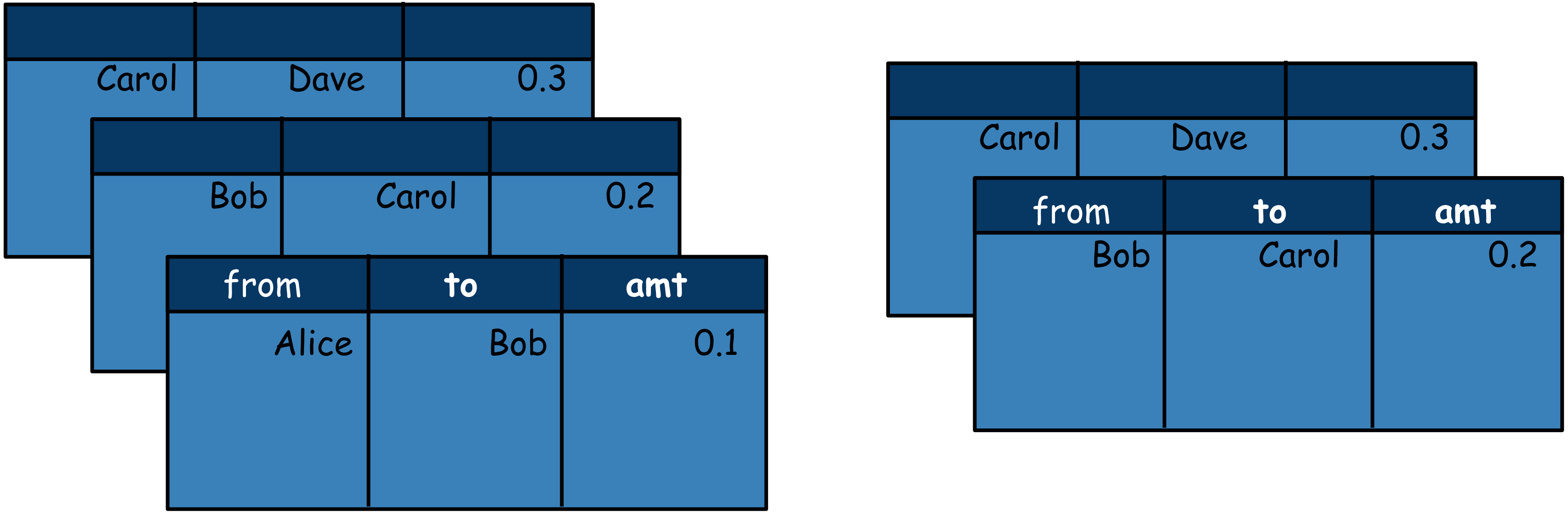


# unpersist



# where (filter)

condition = “amt > 0.1”

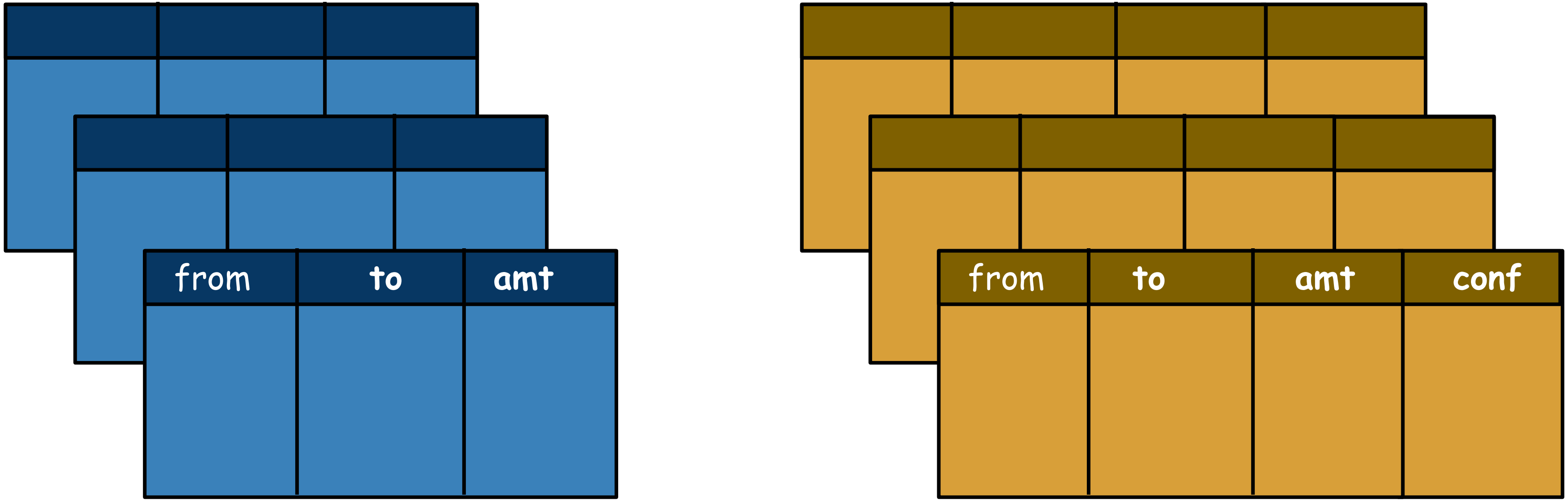


| from | to | amt |
|---|---|---|
| Alice | Bob | 0.1 |
| Bob | Carol | 0.2 |
| Carol | Dave | 0.3 |

| from | to | amt |
|---|---|---|
| Bob | Carol | 0.2 |
| Carol | Dave | 0.3 |

# withColumn

colName = ‘conf’

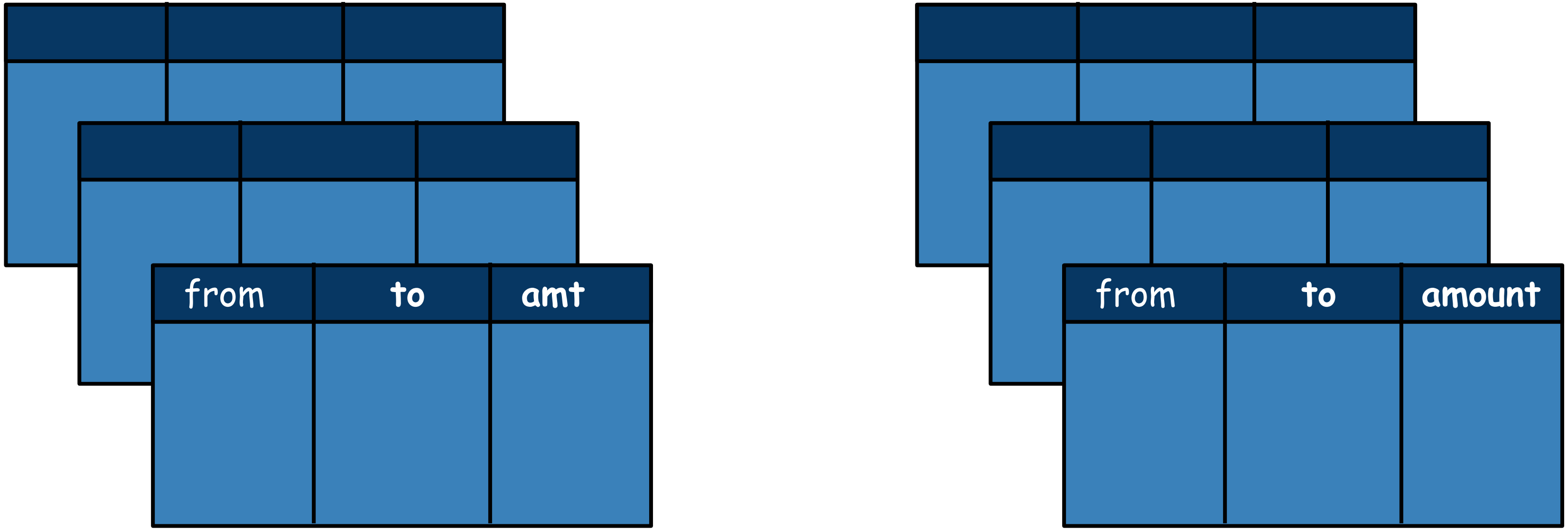


| from | to | amt |
|---|---|---|

| from | to | amt | conf |
|---|---|---|---|

# withColumnRenamed

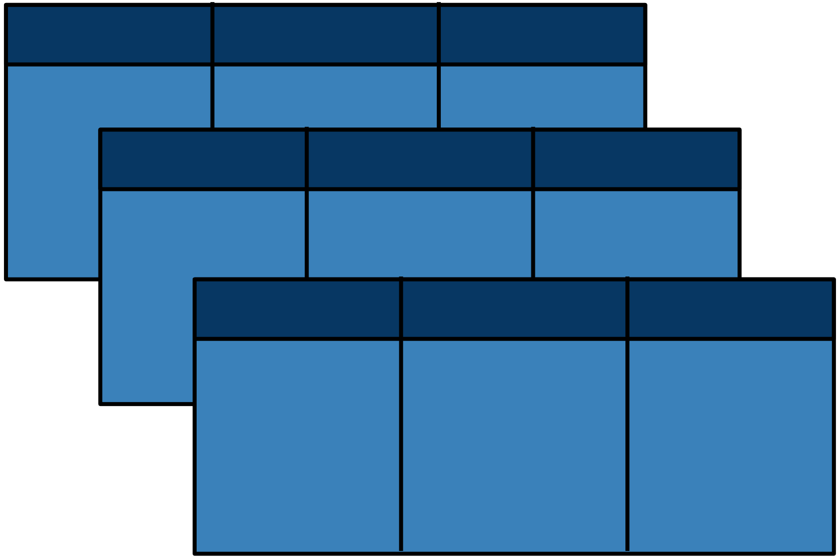
existing = 'amt'  col = 'amount'



from to amt

from to amount

# write



DataFrameWriter Object

with methods: format, insertInto, jdbc, json, mode, option, options, orc, parquet, partitionBy, save, saveAsTable, text