Package 'Capr'

May 16, 2024

Title Cohort Definition Application Programming

Version 2.0.7

Description Provides a programming language for defining cohort definitions in R to use in studies for Observational
Health Data Sciences and Informatics (OHDSI). The functions in 'Capr' allow for the programmatic creation of
OHDSI concept sets and cohorts that can be serialized to 'OHDSI' compatible 'json' files or to 'OHDSI-SQL'.
'Capr' functions can be used to create, save, and load component parts to a cohort definition allowing
R programmers to easily reuse cohort logic. 'Capr' provides tools to create a large number of OHDSI cohorts
while also helping bridge the gap between human readable descriptions of clinical phenotypes
and their computational implementation.

License Apache License (>= 2)

URL <https://ohdsi.github.io/Capr/>, <https://github.com/OHDSI/Capr/>

BugReports <https://github.com/OHDSI/Capr/issues/>

Encoding UTF-8

RoxygenNote 7.3.1

Depends R (>= 3.5.0),
CirceR (>= 1.3.1)

Imports magrittr (>= 1.5.0),
jsonlite,
methods,
purrr (>= 1.0.1),
rlang,
dplyr,
tidyr,
checkmate,
tibble,
readr,
stringr,
glue,
cli,
digest,
fs,
lubridate,

1

> DBI,
> DatabaseConnector,
> SqlRender,
> generics

Suggests testthat (>= 3.0.0),
> knitr,
> rmarkdown

Remotes ohdsi/CirceR

VignetteBuilder knitr

Config/testthat/edition 3

Additional_repositories https://OHDSI.github.io/drat

Collate 'Capr.R'
> 'conceptSet.R'
> 'attributes-concept.R'
> 'attributes-dateAdjustment.R'
> 'attributes-logic.R'
> 'query.R'
> 'window.R'
> 'criteria.R'
> 'attributes-nested.R'
> 'attributes-op.R'
> 'exit.R'
> 'cohort.R'
> 'collectCodesetId.R'
> 'utils.R'

R **topics documented:**

==	*FUnction checks if two concept set class objects are equivalent*

Description

FUnction checks if two concept set class objects are equivalent

Usage

```
## S4 method for signature 'ConceptSet,ConceptSet'
e1 == e2
```

Arguments

e1, e2   a ConceptSet Class object

---

age | *Function to create age attribute*

Description

Function to create age attribute

Usage

```
age(op)
```

Arguments

op   an opAttribute object that is either numeric or integer that defines the logical operation used to determine eligible patient age

Value

An age attribute that can be used in a cohort definition

---

as.data.frame,ConceptSet-method
| *Coerce a concept set expression to a dataframe*

Description

Coerce a concept set expression to a dataframe

Usage

```
## S4 method for signature 'ConceptSet'
as.data.frame(x)
```

Arguments

x   A Caper Concept Set

Value

A tibble (dataframe) with columns: concept_id, includeDescendants, isExcluded, includeMapped.

---

as.json   *Coerce Capr object to json*

Description

Coerce Capr object to json

Usage

```
as.json(x, pretty = TRUE, ...)

## S4 method for signature 'ConceptSet'
as.json(x, pretty = TRUE, ...)
```

Arguments

x	the capr object
pretty	a toggle to make the json look nice, part of jsonlite
...	additional arguments passes to jsonlite::toJSON

---

atLeast   *Function to enumerate an minimal count of occurrences*

Description

Function to enumerate an minimal count of occurrences

Usage

```
atLeast(x, query, aperture = duringInterval(eventStarts(-Inf, Inf)))
```

Arguments

x	the integer counting the number of occurrences
query	a query object that provides context to the clinical event of interest
aperture	an eventAperture object that shows the temporal span where the event is to be observed relative to the index event

Value

A criteria that can be used in a cohort definition specifying satisfaction of at least x instances of a query

---

atMost   *Function to enumerate a maximum count of occurrences*

Description

Function to enumerate a maximum count of occurrences

Usage

```
atMost(x, query, aperture = duringInterval(eventStarts(-Inf, Inf)))
```

Arguments

x	the integer counting the number of occurrences
query	a query object that provides context to the clinical event of interest
aperture	an eventAperture object that shows the temporal span where the event is to be observed relative to the index event

Value

A criteria that can be used in a cohort definition specifying satisfaction of at most x instances of a query

---

attrition   *Create a cohort attrition object*

Description

Create a cohort attrition object

Usage

```
attrition(..., expressionLimit = c("First", "All", "Last"))
```

Arguments

...	Capr groups
expressionLimit	how to limit initial events per person either First, All, or Last

Value

A cohort attrition object that can be used in a cohort definition

bt	*Between operator*

Description

function that builds an opAttribute based on between logic

Usage

```
bt(x, y)

## S4 method for signature 'integer'
bt(x, y)

## S4 method for signature 'numeric'
bt(x, y)

## S4 method for signature 'Date'
bt(x, y)
```

Arguments

x	the left side bound of the between logic This can either be an integer, numeric, or Date data type. Different data types will return the appropriate opAttribute type
y	the right side bound of the between logic. This can either be an integer, numeric, or Date data type. Different data types will return the appropriate opAttribute type

CensoringCriteria-class	
	An S4 class identifying a censoring criteria for the cohort

Description

The censoring criteria specifies events where the person exits the cohort. These events are based on a query class object and users can specify multiple queries in the censoring criteria.

Slots

criteria a list of Capr query class objects that specify the events that would lead a person to exit the cohort.

censoringEvents *Constructor for a set of censoring events*

Description

Constructor for a set of censoring events

Usage

```
censoringEvents(...)
```

Arguments

... a list of Capr query objects that are used as censoring events

Value

a censoring criteria S4 object used to define the censoring events of the cohort definition

cohort *Function that creates a cohort object*

Description

Function that creates a cohort object

Usage

```
cohort(entry, attrition = NULL, exit = NULL, era = NULL)
```

Arguments

entry	the index event of the cohort
attrition	rules that restrict the cohort further, developing attrition
exit	the event where the person exits the cohort
era	Cohort era (collapse) logic created with the 'cohortEra' function

Value

an S4 Cohort class object describing the cohort definiton

---

compile   *Compile a Capr object to json*

Description

Compile a Capr object to json

Usage

```
compile(object, ...)
```

Arguments

object	A Capr object such as a cohort, list of cohorts, or concept set.
...	Arguments passed on to jsonlite::toJSON. e.g. 'pretty = TRUE' for nicely formatted json.

Value

The json representation of the Capr object

---

compile,Cohort-method   *Compile a Capr cohort to json*

Description

Compile a Capr cohort to json

Compile a Capr Concept Set to json

Usage

```
## S4 method for signature 'Cohort'
compile(object, ...)

## S4 method for signature 'ConceptSet'
compile(object, ...)
```

Arguments

object	A Capr Concept Set created with 'cs'
...	Arguments passed on to jsonlite::toJSON. e.g. 'pretty = TRUE' for nicely formatted json.

Value

The json representation of Capr cohorts

The json representation of Capr cohorts

Examples

```
ch <- cohort(conditionOccurrence(cs(1,2, name = "concepts")))
compile(ch)
```

Concept-class   *An S4 class for a single OMOP Concept*

Description

A concept class contains all the information about the concept from the OMOP voabulary.

Slots

concept_id the OMOP/OHDSI concept ID

concept_name the name of the concept

standard_concept whether the concept is standard 'S', classification 'C', or non-standard NA

standard_concept_caption Whether the concept is standard full phrase

invalid_reason Whether the concept is invalid single letter

invalid_reason_caption whether the concept is invalid standard phrase

concept_code The original code of the concept from its vocabulary

domain_id The domain of the concept (e.g. Drug, Condition, Procedure, etc)

vocabulary_id the name of the vocabulary

concept_class_id type of concept class

---

conceptAttribute-class
                        An S4 class for a concept attribute

Description

An S4 class for a concept attribute

Slots

name the name of the attribute

conceptSet a list representing the concepts for the attribute

---

ConceptSet-class   *An S4 class for ConceptSetExpresion*

Description

A class for the concept set expressions bundles multiple concepts with mapping

Slots

id an id for the concept set expression to identify within a component

Name the name of the concept set expression

Expression a list containing expressions. expressions include multiple conceptSetItem objects

---

ConceptSetItem-class   *An S4 class for ConceptSetItem*

Description

A class that provides information on the mapping of the concept

Slots

Concept a concept class object

isExcluded toggle if want to exclude the concept

includeDescendants toggle if want to include descendants

includeMapped toggle if want to include map

---

conditionEra   *Query the condition era domain*

Description

Query the condition era domain

Usage

```
conditionEra(conceptSet, ...)
```

Arguments

conceptSet   A condition concept set

...   optional attributes

Value

A Capr Query

conditionOccurrence *Query the condition domain*

Description

Query the condition domain

Usage

```
conditionOccurrence(conceptSet, ...)
```

Arguments

conceptSet A condition concept set

...   optional attributes

Value

A Capr Query

conditionType *Add a condition type attribute to determine the provenance of the record*

Description

Add a condition type attribute to determine the provenance of the record

Usage

```
conditionType(ids, connection, vocabularyDatabaseSchema)
```

Arguments

ids   the concept ids for the attribute

connection a connection to an OMOP dbms to get vocab info about the concept

vocabularyDatabaseSchema

    the database schema for the vocabularies

Value

An attribute that can be used in a query function

---

continuousObservation *A function to construct the observationWindow*

Description

A function to construct the observationWindow

Usage

```
continuousObservation(priorDays = 0L, postDays = 0L)
```

Arguments

priorDays minimum number of observation days prior to the cohort index. Default 0 days

postDays minimum number of observation days post cohort index. Default 0 days

Value

An observation window that can be used in a Capr cohort definition

---

Criteria-class   *An S4 for a criteria*

Description

a criteria is a temporal observation of a clinical event relative to the index event

Slots

occurrence an occurrence object specifying how many events must occur to consider the event as part of the cohort definition

query a query object that provides context to the clinical event of interest

aperture an eventAperture object that shows the temporal span where the event is to be observed relative to the index event

---

cs   *Create a concept set*

Description

cs is used to create concept set expressions.

'exclude' is meant to be used inside 'cs' when creating a new concept set.

'mapped' is meant to be used inside 'cs' when creating a new concept set.

'descendants' is meant to be used inside 'cs' when creating a new concept set.

Usage

```
cs(..., name, id = NULL)

exclude(...)

mapped(...)

descendants(...)
```

Arguments

...	One or more numeric vectors that can be coerced to integers, or Calls to helper functions "exclude", "descendants", or "mapped".
name	A name for the concept set
id	An id for the concept set

Value

A Capr Concept Set Object

A list of Capr concepts

A list of Capr concepts

A list of Capr concepts

Functions

- `exclude()`: exclude concepts
- `mapped()`: Include mapped concepts
- `descendants()`: Include descendants

Examples

```
cs(1, 2, name = "concepts")
cs(1, c(10, 11, 2), name = "concepts")
cs(1, seq(2, 10, 2), name = "concepts")
cs(1, 2, 3, exclude(4, 5), name = "concepts")
cs(1, 2, 3, exclude(4, 5), mapped(6, 7), name = "concepts")
cs(1, 2, 3, exclude(4, 5), mapped(6, 7), descendants(8, 9), name = "concepts")
cs(descendants(1, 2, 3),  exclude(descendants(8, 9)), name = "concepts")
```

dateAdjustment   *Function to create age attribute*

Description

Function to create age attribute

Usage

```
dateAdjustment(
  startWith = "START_DATE",
  startOffset = 0L,
  endWith = "END_DATE",
  endOffset = 0L
)
```

Arguments

startWith	character string either START_DATE or END_DATE
startOffset	an integer value, default 0
endWith	character string either START_DATE or END_DATE
endOffset	an integer value, default 0

Value

A dateAdjustment attribute class that can be used with a query

dateAdjustmentAttribute-class
                    An S4 class for a date adjustment attribute

Description

An S4 class for a date adjustment attribute

Slots

name the name of the attribute

startWith character string either START_DATE or END_DATE

startOffset an integer value, default 0

endWith character string either START_DATE or END_DATE

endOffset an integer value, default 0

---

daysOfSupply *Function to create days supply attribute*

Description

This function is used only for a drug query. days supply is a column in the drug exposure table of the cdm. This attribute allows a subquery to find drugs that satisfy certain values determined by the op logic.

Usage

```
daysOfSupply(op)
```

Arguments

op   an opAttribute object that is either numeric or integer that defines the logical
               operation used to determine eligible number of days of supply

Value

An attribute that can be used in a cohort definition

---

death *Query the condition era domain*

Description

Query the condition era domain

Usage

```
death(conceptSet = NULL, ...)
```

Arguments

conceptSet   A condition concept set
...   optional attributes

Value

A Capr Query

---

drugEra   *Query the drug era domain*

Description

Query the drug era domain

Usage

```
drugEra(conceptSet, ...)
```

Arguments

conceptSet   A drug ingredient concept set

...   optional attributes

Value

A Capr Query

---

drugExit   *Function to create an exit based on exit based on the end of a continuous drug exposure*

Description

Function to create an exit based on exit based on the end of a continuous drug exposure

Usage

```
drugExit(
  conceptSet,
  persistenceWindow = 0L,
  surveillanceWindow = 0L,
  daysSupplyOverride = NULL
)
```

Arguments

conceptSet   the concept set of the drug exposure used to identify the exit

persistenceWindow

        allow for a maximum of days between exposure records when inferring the era of persistence exposure

surveillanceWindow

        add days to the end of the era of persistence exposure as an additional period of surveillance prior to cohort exit

daysSupplyOverride

        force drug exposure days supply to a set number of days

Value

an S4 DrugExposueExit class which defines the cohort exit by end of drug exposure

---

drugExposure   *Query the drug domain*

Description

Query the drug domain

Usage

```
drugExposure(conceptSet, ...)
```

Arguments

conceptSet   A drug concept set

...   optional attributes

Value

A Capr Query

DrugExposureExit-class
                    An S4 class for a cohort exit based on continuous exposure persistence.

Description

Specify a concept set that contains one or more drugs. A drug era will be derived from all drug exposure events for any of the drugs within the specified concept set, using the specified persistence window as a maximum allowable gap in days between successive exposure events and adding a specified surveillance window to the final exposure event. If no exposure event end date is provided, then an exposure event end date is inferred to be event start date + days supply in cases when days supply is available or event start date + 1 day otherwise. This event persistence assures that the cohort end date will be no greater than the drug era end date.

Slots

conceptSet the concept set of the drug exposure used to identify the exit

persistenceWindow allow for a maximum of days between exposure records when inferring the era of persistence exposure

surveillanceWindow add days to the end of the era of persistence exposure as an additional period of surveillance prior to cohort exit

daysSupplyOverride force drug exposure days supply to a set number of days

count an integer specifying the number of occurrences for a criteria

---

drugQuantity   *Function to create quantity attribute*

Description

This function is used only for a drug query. quantity is a column in the drug exposure table of the cdm. This attribute allows a subquery to find drugs that satisfy certain values determined by the op logic.

Usage

```
drugQuantity(op)
```

Arguments

op   an opAttribute object that is either numeric or integer that defines the logical
                  operation used to determine eligible quantity

Value

An attribute that can be used in a cohort definition

---

drugRefills   *Function to create refills attribute*

Description

This function is used only for a drug query. refills is a column in the drug exposure table of the cdm. This attribute allows a subquery to find drugs that satisfy certain values determined by the op logic.

Usage

```
drugRefills(op)
```

Arguments

op   an opAttribute object that is either numeric or integer that defines the logical
                  operation used to determine eligible number of refills

Value

An attribute that can be used in a cohort definition

---

drugType *Add a drug type attribute to determine the provenance of the record*

Description

Add a drug type attribute to determine the provenance of the record

Usage

```
drugType(ids, connection, vocabularyDatabaseSchema)
```

Arguments

`ids`	the concept ids for the attribute
`connection`	a connection to an OMOP dbms to get vocab info about the concept
`vocabularyDatabaseSchema`	
	the database schema for the vocabularies

Value

An attribute that can be used in a query function

---

duringInterval *Function that creates an eventAperture an opening where an event can occur relative to the index event*

Description

Function that creates an eventAperture an opening where an event can occur relative to the index event

Usage

```
duringInterval(
  startWindow,
  endWindow = NULL,
  restrictVisit = FALSE,
  ignoreObservationPeriod = FALSE
)
```

Arguments

`startWindow`	the starting window where an event can occur
`endWindow`	the end window of where an event can occur. This parameter is optional
`restrictVisit`	a logical toggle specifying whether the event should occur on the same visit
`ignoreObservationPeriod`	
	a logical toggle specifying whether we can consider events outside the observation period

Value

An event aperture that can be used in a Capr cohort definition

---

endDate   *Function that creates a end date attribute*

Description

Function that creates a end date attribute

Usage

```
endDate(op)
```

Arguments

op   an opAttribute object must be a date that defines the logical operation used to
                  determine eligible end dates

Value

An attribute that can be used in a cohort definition

Endpoint-class   *An S4 class for an Endpoint*

Description

this determines the time in days relative to an index either before or after

Slots

days either a character string all or an integer for the number of days

coeff a character string either before or after

---

entry   *Create a cohort entry criteria*

Description

Create a cohort entry criteria

Usage

```
entry(
  ...,
  observationWindow = continuousObservation(0L, 0L),
  primaryCriteriaLimit = c("First", "All", "Last"),
  additionalCriteria = NULL,
  qualifiedLimit = c("First", "All", "Last")
)
```

Arguments

`...`	Capr Queries
`observationWindow`	a time specifying the minimal time a person is observed
`primaryCriteriaLimit`	Which primary criteria matches should be considered for inclusion? "First", "Last" or "All"
`additionalCriteria`	a Capr group that adds restriction to the entry event
`qualifiedLimit`	Which criteria matches should be considered for inclusion? "First", "Last" or "All"

Value

A cohort entry Capr object

---

eq   *Equal to operator*

Description

function that builds an opAttribute based on equal to logic

Usage

```
eq(x)

## S4 method for signature 'integer'
eq(x)

## S4 method for signature 'numeric'
eq(x)

## S4 method for signature 'Date'
eq(x)
```

Arguments

x   the value to used as a bound in the op logic. This can either be an integer, numeric, or Date data type. Different data types will return the appropriate opAttribute type

---

era   *Create a Cohort Era class object*

Description

The Cohort Era depicts the time span of the cohort. The Censor Window includes the date window for which we register events. The Collapse Settings identify the era padding between events before exiting a cohort.

Usage

```
era(eraDays = 0L, studyStartDate = NULL, studyEndDate = NULL)
```

Arguments

eraDays   a numeric that specifies the number of days for the era padding

studyStartDate   a date string that specifies the starting date of registration

studyEndDate   a date string that specifies the end date of registration

Value

a S4 CohortEra class object defining the eras of the cohort definition

---

`EventAperture-class`   *An S4 class for Aperture*

Description

The aperture class provides context to when the criteria must be observed in a person timeline to pretain to the expression

Slots

`startWindow` a EventWindow class object identifying the start window

`endWindow` a EventWindow class object ifentifying the end window (optional)

`restrictVisit` a logic toggle where TRUE restricts to the same visit

`ignoreObservationPeriod` a logic toggle where TRUE allows events outside the observation period

---

`eventEnds`   *Function creates an event window where the event ends*

Description

Function creates an event window where the event ends

Usage

```
eventEnds(a, b, index = c("startDate", "endDate"))
```

Arguments

`a`	the left side of the event window
`b`	the right side of the event window
`index`	specifying what part of the index we start looking for events either at the index start date or index enddate

Value

An event window that can be used in a Capr cohort definition

---

eventStarts   *Function creates an event window where the event starts*

Description

Function creates an event window where the event starts

Usage

```
eventStarts(a, b, index = c("startDate", "endDate"))
```

Arguments

a	the left side of the event window
b	the right side of the event window
index	specifying what part of the index we start looking for events either at the index start date or index enddate

Value

An event window that can be used in a Capr cohort definition

EventWindow-class   *An S4 class for a Window*

Description

A window class provides details on the end points of the timeline

Slots

event a character string either start or end. Identifies the point of reference for the window

start an endpoint object containing the days and coefficient for the start of the window

end an endpoint object containing the days and coefficient for the end of the window

index A character string either start or end. Identifies where the index is relative to the window

---

exactly *Function to enumerate an exact count of occurrences*

Description

Function to enumerate an exact count of occurrences

Usage

```
exactly(x, query, aperture = duringInterval(eventStarts(-Inf, Inf)))
```

Arguments

x	the integer counting the number of occurrences
query	a query object that provides context to the clinical event of interest
aperture	an eventAperture object that shows the temporal span where the event is to be observed relative to the index event

Value

A criteria that can be used in a cohort definition specifying satisfaction of exactly x instances of a query

---

exit *Function that creates a cohort exit object*

Description

Function that creates a cohort exit object

Usage

```
exit(endStrategy, censor = NULL)
```

Arguments

endStrategy	the endStrategy object to specify for the exit
censor	the censoring criteria to specify for the exit

Value

A cohort exit object that can be used in a cohort definition

firstOccurrence   *Add first occurrence attribute*

Description

Add first occurrence attribute

Usage

```
firstOccurrence()
```

Value

An attribute that can be used in a query function

FixedDurationExit-class

An S4 class for a cohort exit based on fixed duration persistence.

Description

The event end date is derived from adding a number of days to the event's start or end date. If an offset is added to the event's start date, all cohort episodes will have the same fixed duration (subject to further censoring). If an offset is added to the event's end date, persons in the cohort may have varying cohort duration times due to the varying event durations (such as eras of persistent drug exposure or visit length of stay). This event persistence assures that the cohort end date will be no greater than the selected index event date, plus the days offset.

Slots

index specification of event date to offset

offsetDays an integer specifying the number of days to offset from the event date

fixedExit   *Function to create an exit based on exit based on the end of a continuous drug exposure*

Description

Function to create an exit based on exit based on the end of a continuous drug exposure

Usage

```
fixedExit(index = c("startDate", "endDate"), offsetDays)
```

Arguments

`index`	specification of event date to offset. Can be either startDate or endDate
`offsetDays`	an number specifying the days to offset from the event date. Will coerce to an integer

Value

a fixed Duration exit S4 object used to define the cohort exit as the end of a specified time

---

getConceptSetCall	*Create the Capr code to build a concept set*

Description

Create the Capr code to build a concept set

Usage

```
getConceptSetCall(x, name = x@Name)
```

Arguments

`x`	A concept set
`name`	the name of the concept set

Value

The Capr code required to build the concept set

---

getConceptSetDetails	*Fill in Concept Set details using a vocab*

Description

Concept sets created in R using the 'cs' function do not contain details like "CONCEPT_NAME", "DOMAIN_ID", etc. If an OMOP CDM vocabulary is available then these details can be filled in by the the 'getConceptSetDetails' function.

Usage

```
getConceptSetDetails(x, con, vocabularyDatabaseSchema = NULL)
```

Arguments

`x`	A concept set created by 'cs'
`con`	A connection to an OMOP CDM database
`vocabularyDatabaseSchema`	
	Schema name where your OMOP vocabulary format resides. Note that for SQL Server, this should include both the database and schema name, for example 'vocabulary.dbo'.

Value

A modified version of the input concept set with concept details filled in.

Examples

```
## Not run:
# create a concept set
vocabularyDatabaseSchema = "cdm5"
anemia <- cs(descendants(439777,4013073,4013074), name = "anemia")

# fill in the details from an OMOP CDM
library(DatabaseConnector)
con <- connect(dbms = "postgresql", user = "postgres", password = "", server = "localhost/cdm")
anemia <- getConceptSetDetails(condition_anemia, con, vocabularyDatabaseSchema = "cdm5")

## End(Not run)
```

Group-class *An S4 class for a group*

Description

a group is the combination of multiple criteria or sub groups

Slots

occurrence an occurrence object specifying how many events must occur to consider the event as part of the cohort definition

critera a list of criteria that are grouped together

group a list of sub-groups to consider

---

gt *Greater than operator*

Description

function that builds an opAttribute based on greater than logic

Usage

```
gt(x)

## S4 method for signature 'integer'
gt(x)

## S4 method for signature 'numeric'
gt(x)

## S4 method for signature 'Date'
gt(x)
```

Arguments

x   the value to used as a bound in the op logic. This can either be an integer, numeric, or Date data type. Different data types will return the appropriate opAttribute type

---

gte   *Greater than or equal to operator*

Description

function that builds an opAttribute based on greater than or equal to logic

Usage

```
gte(x)

## S4 method for signature 'integer'
gte(x)

## S4 method for signature 'numeric'
gte(x)

## S4 method for signature 'Date'
gte(x)
```

Arguments

x   the value to used as a bound in the op logic. This can either be an integer, numeric, or Date data type. Different data types will return the appropriate opAttribute type

---

logicAttribute-class   *An S4 class for a logical attribute*

Description

with a logic attribute if it is specified than we assume it is true

Slots

name the name of the attribute

---

lt *Less than operator*

Description

function that builds an opAttribute based on less than logic

Usage

```
lt(x)

## S4 method for signature 'integer'
lt(x)

## S4 method for signature 'numeric'
lt(x)

## S4 method for signature 'Date'
lt(x)
```

Arguments

x   the value to used as a bound in the op logic. This can either be an integer, numeric, or Date data type. Different data types will return the appropriate opAttribute type

---

lte *Less than or equal to operator*

Description

function that builds an opAttribute based on less than or equal to than logic

Usage

```
lte(x)

## S4 method for signature 'integer'
lte(x)

## S4 method for signature 'numeric'
lte(x)

## S4 method for signature 'Date'
lte(x)
```

Arguments

x   the value to used as a bound in the op logic. This can either be an integer, numeric, or Date data type. Different data types will return the appropriate opAttribute type

---

makeCohortSet *Make a cohort dataframe for cohort generator*

Description

Make a cohort dataframe for cohort generator

Usage

```
makeCohortSet(...)
```

Arguments

... multiple capr cohorts to bind into a dataframe

Value

a tibble containing cohortId, name, sql and json to pipe into CohortGenerator.

---

male *Add male attribute to a query*

Description

Add male attribute to a query

Add female attribute to a query

Usage

```
male()

female()
```

Value

An attribute that can be used in a query function

An attribute that can be used in a query function

Functions

- `male()`: male demographic attribute
- `female()`: female demographic attribute

Examples

```
# Create a cohort of males with Type 1 diabetes
t1dm <- cs(descendants(201254, 435216, 40484648), name = "type 1 diabetes")
t1dm_males <- cohort(conditionOccurrence(t1dm, male()))
# Create a cohort of males with Type 1 diabetes
t1dm <- cs(descendants(201254, 435216, 40484648), name = "type 1 diabetes")
t1dm_females <- cohort(conditionOccurrence(t1dm, female()))
```

measurement	*Query the measurement domain*

Description

Query the measurement domain

Usage

```
measurement(conceptSet, ...)
```

Arguments

conceptSet	A measurement concept set
...	optional attributes

Value

A Capr Query

measurementType	*Add a measurement type attribute to determine the provenance of the record*

Description

Add a measurement type attribute to determine the provenance of the record

Usage

```
measurementType(ids, connection, vocabularyDatabaseSchema)
```

Arguments

ids	the concept ids for the attribute
connection	a connection to an OMOP dbms to get vocab info about the concept
vocabularyDatabaseSchema	
	the database schema for the vocabularies

Value

An attribute that can be used in a query function

---

nbt *Not between operator*

Description

function that builds an opAttribute based on not between logic

Usage

```
nbt(x, y)

## S4 method for signature 'integer'
nbt(x, y)

## S4 method for signature 'numeric'
nbt(x, y)

## S4 method for signature 'Date'
nbt(x, y)
```

Arguments

x   the left side bound of the between logic This can either be an integer, numeric, or Date data type. Different data types will return the appropriate opAttribute type

y   the right side bound of the between logic. This can either be an integer, numeric, or Date data type. Different data types will return the appropriate opAttribute type

---

nestedAttribute-class *An S4 class for a nested attribute*

Description

An S4 class for a nested attribute

Slots

name the name of the attribute

conceptSet a list representing the concepts for the attribute

nestedWithAll	*Construct a nested group where all criteria and groups must be satisfied*

Description

Construct a nested group where all criteria and groups must be satisfied

Usage

```
nestedWithAll(...)
```

Arguments

...	a set of criteria or groups

nestedWithAny	*Function to construct a nested group where any criteria and groups may be satisfied*

Description

Function to construct a nested group where any criteria and groups may be satisfied

Usage

```
nestedWithAny(...)
```

Arguments

...	a set of criteria or groups

nestedWithAtLeast	*Function to construct a nested group where at least some of the criteria or groups must be satisfied*

Description

Function to construct a nested group where at least some of the criteria or groups must be satisfied

Usage

```
nestedWithAtLeast(x, ...)
```

Arguments

x	an integer specifying the number of criteria or groups that must be satisfied
...	a set of criteria or groups

nestedWithAtMost	*Function to construct a nested group where at most some of the criteria or groups must be satisfied*

Description

Function to construct a nested group where at most some of the criteria or groups must be satisfied

Usage

```
nestedWithAtMost(x, ...)
```

Arguments

x	an integer specifying the number of criteria or groups that must be satisfied
...	a set of criteria or groups

observation	*Query the observation domain*

Description

Query the observation domain

Usage

```
observation(conceptSet, ...)
```

Arguments

conceptSet	A condition concept set
...	optional attributes

Value

A Capr Query

observationExit	*Function to create an exit based on continuous observation*

Description

Function to create an exit based on continuous observation

Usage

```
observationExit()
```

Value

an S4 ObservationExit class which defines the cohort exit as the end of continuous observation

ObservationExit-class   *An S4 class for a cohort exit based on end of continuous observation.*

Description

The event persists until the end of continuous observation of the persons

Slots

index specification of event date to offset

offsetDays an integer specifying the number of days to offset from the event date

observationType   *Add a observation type attribute to determine the provenance of the*
                           record

Description

Add a observation type attribute to determine the provenance of the record

Usage

observationType(ids, connection, vocabularyDatabaseSchema)

Arguments

ids   the concept ids for the attribute

connection   a connection to an OMOP dbms to get vocab info about the concept

vocabularyDatabaseSchema

                   the database schema for the vocabularies

Value

An attribute that can be used in a query function

ObservationWindow-class

                          An S4 class for an ObservationWindow

Description

this determines the minimal observation time before and after index for all persons in the cohort

Slots

priorDays minimum number of days prior to the cohort index

postDays minimum number of days post cohort index

`Occurrence-class` *An S4 class for an occurrence.*

Description

This determines how many events need to occur to count the criteria in the cohort definition (relative to the index event)

Slots

`type` a character string determine the logic for counting occurrences. Can be all, any, exactly, atLeast, or atMost

`count` an integer specifying the number of occurrences for a criteria

---

`opAttributeDate-class` *An S4 class for a op attribute that is a date*

Description

An S4 class for a op attribute that is a date

Slots

`name` the name of the attribute

`op` the operator one of: gt,lt,gte,lte,eq,bt,!bt

`value` a value serving as the single limit or lower limit in a bt.

`extent` a value serving as the upper limit in a bt, otherwise this is empty

---

`opAttributeInteger-class`

An S4 class for a op attribute that is an integer

Description

An S4 class for a op attribute that is an integer

Slots

`name` the name of the attribute

`op` the operator one of: gt,lt,gte,lte,eq,bt,!bt

`value` a value serving as the single limit or lower limit in a bt.

`extent` a value serving as the upper limit in a bt, otherwise this is empty

---

```
opAttributeNumeric-class
```
An S4 class for a op attribute that is a numeric

Description

An S4 class for a op attribute that is a numeric

Slots

name the name of the attribute

op the operator one of: gt,lt,gte,lte,eq,bt,!bt

value a value serving as the single limit or lower limit in a bt

extent a value serving as the upper limit in a bt, otherwise this is empty

---

```
opAttributeSuper-class
```
An S4 super class for other opAttribute objects to inherit.

Description

An S4 super class for other opAttribute objects to inherit.

```
procedure
```
Query the procedure domain

Description

Query the procedure domain

Usage

```
procedure(conceptSet, ...)
```

Arguments

conceptSet   A procedure concept set

...   optional attributes

Value

A Capr Query

procedureType	*Add a procedure type attribute to determine the provenance of the record*

Description

Add a procedure type attribute to determine the provenance of the record

Usage

```
procedureType(ids, connection, vocabularyDatabaseSchema)
```

Arguments

`ids`	the concept ids for the attribute
`connection`	a connection to an OMOP dbms to get vocab info about the concept
`vocabularyDatabaseSchema`	
	the database schema for the vocabularies

Value

An attribute that can be used in a query function

Query-class	*An S4 class for a Circe Query*

Description

A query is a medical concept that can be extracted from a database through a 'where' clause in a 'SQL' statement. This includes concepts.

Slots

`domain` The domain to search (e.g. "Condition", "Drug", "Measurement", etc)

`conceptSet` The Concept set describing the observation to serach for

`attributes` a list of attributes that modify the query (e.g. 'male()', 'female()', 'age(gte(65))')

---

rangeHigh   *Function to create rangeHigh attribute*

Description

This function is used only for measurement query. range_high is a column in the measurement table of the cdm. This attribute allows a subquery to find measurements that satisfy certain values determined by the op logic.

Usage

```
rangeHigh(op)
```

Arguments

op   an opAttribute object that is either numeric or integer that defines the logical
                       operation used to determine eligible range high

Value

An attribute that can be used in a cohort definition

---

rangeLow   *Function to create rangeLow attribute*

Description

This function is used only for measurement query. range_low is a column in the measurement table of the cdm. This attribute allows a subquery to find measurements that satisfy certain values determined by the op logic.

Usage

```
rangeLow(op)
```

Arguments

op   an opAttribute object that is either numeric or integer that defines the logical
                       operation used to determine eligible range low

Value

An attribute that can be used in a cohort definition

---

readConceptSet   *Read a concept set json or csv into R*

Description

Concept sets can be serialized to json or csv file formats. 'readConceptSet' reads the files into R as Capr concepts sets.

Usage

```
readConceptSet(path, name, id = NULL)
```

Arguments

path   Name of concept set file to read in csv or json format. (e.g. "concepts.json")

name   the name of the concept set

id   the id for the concept set (keep?)

Examples

```
library(Capr)
path <- tempfile("concepts", fileext = ".json")
concepts <- cs(1, 2, descendants(4, 5), exclude(descendants(6, 7)), name = "test")
writeConceptSet(concepts, path = path)

concepts <- readConceptSet(path)
```

---

startDate   *Function that creates a start date attribute*

Description

Function that creates a start date attribute

Usage

```
startDate(op)
```

Arguments

op   an opAttribute object must be a date that defines the logical operation used to determine eligible start dates

Value

An attribute that can be used in a cohort definition

---

toCirce   *Function to coerce cohort to circe*

Description

Function to coerce cohort to circe

Usage

```
toCirce(cd)
```

Arguments

cd   the Capr cohort class

Value

an s3 list representing the circe object to coerce to json

---

unit   *Add unit attribute to a query*

Description

Add unit attribute to a query

Usage

```
unit(x)
```

Arguments

x   A single character idetifier for a unit or a concept set that identifies units

Value

An attribute that can be used in a query function

Examples

```
# create a unit attribute
unit(8713L)
unit("%")
```

---

valueAsNumber   *Function to create valueAsNumber attribute*

Description

This function is used only for measurement query. valueAsNumber is a column in the measurement table of the cdm. This attribute allows a subquery to find measurements that satisfy certain values determined by the op logic.

Usage

```
valueAsNumber(op)
```

Arguments

op   an opAttribute object that is either numeric or integer that defines the logical
                operation used to determine eligible patient age

Value

An attribute that can be used in a cohort definition

---

visit   *Query the visit occurrence domain*

Description

Query the visit occurrence domain

Usage

```
visit(conceptSet, ...)
```

Arguments

conceptSet   A condition concept set
...   optional attributes

Value

A Capr Query

---

visitType   *Add a visit type attribute to determine the provenance of the record*

Description

Add a visit type attribute to determine the provenance of the record

Usage

```
visitType(ids, connection, vocabularyDatabaseSchema)
```

Arguments

ids   the concept ids for the attribute

connection   a connection to an OMOP dbms to get vocab info about the concept

vocabularyDatabaseSchema
                        the database schema for the vocabularies

Value

An attribute that can be used in a query function

---

withAll   *Function to construct a group where all criteria and groups must be satisfied*

Description

Function to construct a group where all criteria and groups must be satisfied

Usage

```
withAll(...)
```

Arguments

...   a set of criteria or groups

Value

an S4 group class specifying a bundle of criteria that all must be satisfied in context of the cohort definition

withAny	*Function to construct a group where any criteria and groups may be satisfied*

Description

Function to construct a group where any criteria and groups may be satisfied

Usage

```
withAny(...)
```

Arguments

...	a set of criteria or groups

Value

an S4 group class specifying a bundle of criteria that any may be satisfied in context of the cohort definition

withAtLeast	*Function to construct a group where at least some of the criteria or groups must be satisfied*

Description

Function to construct a group where at least some of the criteria or groups must be satisfied

Usage

```
withAtLeast(x, ...)
```

Arguments

x	an integer specifying the number of criteria or groups that must be satisfied
...	a set of criteria or groups

Value

an S4 group class specifying a bundle of criteria that at least x be satisfied in context of the cohort definition

withAtMost	*Function to construct a group where at most some of the criteria or groups must be satisfied*

Description

Function to construct a group where at most some of the criteria or groups must be satisfied

Usage

```
withAtMost(x, ...)
```

Arguments

x	an integer specifying the number of criteria or groups that must be satisfied
...	a set of criteria or groups

Value

an S4 group class specifying a bundle of criteria that at most x be satisfied in context of the cohort definition

writeCohort	*Write Cohort json file*

Description

Write Cohort json file

Usage

```
writeCohort(x, path)
```

Arguments

x	A Capr cohort
path	The name of the file to create

Value

Invisibly returns the path to the json file that was written

Examples

```
## Not run:
cs1 <- cs(descendants(exclude(436665),440383,442306,4175329), name = "concepts")
# optional step to fill in concept set details. Requires database connection.
con <- {A CDM datbase connection}
cs1 <- getConceptSetDetails(cs1, con)

x <- cohort(conditionOccurrence(cs1))
writeCohort(x, "cohortDefinition.json")

## End(Not run)
```

---

writeConceptSet   *Save a concept set as a json file*

Description

The resulting concept Set JSON file can be imported into Atlas.

Usage

```
writeConceptSet(x, path, format = "auto", ...)
```

Arguments

x	A Capr concept set created by 'cs()'
path	Name of file to write to. (e.g. "concepts.json")
format	the file extension to write
...	additional arguments

Examples

```
anemia <- cs(descendants(439777,4013073,4013074), name = "anemia")
writeConceptSet(anemia, file.path(tempdir(), 'anemia.json'))
writeConceptSet(anemia, file.path(tempdir(), 'anemia.csv'))
```

Index