MA(q)

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The function `make_MA` generates synthetic time series based on MA(q) (MeanAverage of order q) model. By Providing the MA coefficients and white noise variance to the `make_MA` function, data for a time series can be created.

Example 1: First example

First, specify the length of the time series `t`. Next, specify `theta`, which contains the MA coefficients, where `t` must be bigger than sum of all $theta_i$ in `theta`. At last, specify white noise variance as `sigma`, where `sigma` must be bigger than 0.

```
t <- 10
theta <- 1
sigma <- 1

zeitreihen::make_MA(t,theta,sigma)
```

```
##  [1] -2.33227233  0.33700462 -0.99372266 -1.84074062  0.84562950  1.34497631
##  [7]  0.24763582 -0.02442122  0.53756186 -0.07305038
```

The output is a numeric/complex vector of length `t`, which contains data generated by MA model with hand over parameter. The output values corresponds to the sequential observations from 1 to `t`.

What happens:

- Within the function, It is checked if `t`, `theta` and `sigma` have the required format.
- `q` is derived by the length of `theta`.
- Allocation of a numeric vector of length `t`to store the time series data
- By providing `sigma`, we allocate t+q instances of White noise in `Z`.
- Computation of X_i iterativly by using the definition of $X_i = Z_t + Z_{t-1}\theta_1 + \ldots + Z_{t-q}\theta_q$.
- At last, The values are returned.

Required Format:

- `t` must be an positive integer of length equal to 1, where NA, Inf or NaN aren't allowed.
- `theta` must be non-empty numeric/complex vector, where `t` has to be bigger than the length of `theta` and `theta` is not allowed to contain NA, INF or NaN values.
- `sigma` must be is a non-zero and positive numeric vector of length equal to 1, where NA, Inf or NaN are not allowed.

Example 2: medium example

```
t <- 10
theta <- complex(real=1,imaginary=2)
sigma <- 1

zeitreihen::make_MA(t,theta,sigma)
```

```
##  [1]  0.8421306+1.4820662i -1.3556208+0.2021950i -2.1297151-2.9134367i
##  [4] -1.0574663-1.3459935i -0.6192258-0.7689392i -1.0184137-0.4695125i
##  [7] -0.8383147-1.5673150i  0.4998820-0.1093144i  1.5348260+1.1090783i
## [10] -0.2530566+1.9605738i
```

Hint: `make_MA` supports numeric/complex vector for `theta`.

Example 3: big example

```
t <- 40
theta <- 3
sigma <- 1

zeitreihen::make_MA(t,theta,sigma)
```

```
##  [1]  2.83974780  2.51445083  6.14353752  4.29317761  1.78783011 -1.44760042
##  [7] -1.37339872  1.96417196 -0.47447295 -2.44447487  3.17533788 -1.59247497
## [13] -7.68098319 -7.05739864 -2.49148656  2.21164406 -0.88754304  3.77084375
## [19]  0.20012407  5.38861943  7.71108536  8.18507893 -6.57477989 -6.83695988
## [25] -5.03460365 -3.64467524 -2.09712415 -1.72892787 -6.57413661 -1.25910728
## [31]  3.56242899  2.69440383  0.05434398 -3.58551369  0.57381157 -4.00072395
## [37] -3.52629500  1.61091412 -1.43755212  0.89358397
```

Calling the `make_MA`, where `sigma` is omitted is allowed. Within `make_MA` we use the `1` as a value for `sigma`.
Hint: The Output will get big so mind to generate only the number of observation that are needed.

Example 4: Incorrect Inputs

```
t <- 10
theta <- 1
sigma <- 0

zeitreihen::make_MA(t,theta,sigma)
```

```
## Error in zeitreihen::make_MA(t, theta, sigma): sigma must be positive
```

```
t <- 10
theta <- "L"
sigma <- 1

zeitreihen::make_MA(t,theta,sigma)
```

```
## Error in zeitreihen::make_MA(t, theta, sigma): The values of theta must be numeric or complex
```

```
t <- 2
theta <- c(1,2)
sigma <- 1

zeitreihen::make_MA(t,theta,sigma)
```

```
## Error in zeitreihen::make_MA(t, theta, sigma): t must be greater than the length of theta
```

```
t <- 2
theta <- NULL
sigma <- 1
```

```
zeitreihen::make_MA(t,theta,sigma)
```

```
## Error in zeitreihen::make_MA(t, theta, sigma): theta must be an atomic vector
```