Package ‘sautilities’

June 12, 2023

Title Seasonal Adjustment Utilities For Use With the Seasonal Package

Version 4.2

Description Several utilities to provide support for the seasonal package. This includees routines that select the X-11 seasonal filter based on the magnitude of the estimate of the seasonal moving average coefficient from the airline model, duplicates the functionality of the TERROR software that performs quality control on time series based on one step ahead forecasts, generate model summaries from seas objects, generate names and abbreviations for X-13ARIMA-SEATS tables, save spec files, seasonal objects, and metafiles into external files, process list objects of numbers, indicate which elements of a list have try-errors, replace NA with a string, set outlier critical values, add an outlier spec to a static seas element, get indexes and entries from UDG output generated from seasonal, save seasonal objects into R scripts and X-13ARIMA-SEATS spec files, and functions to collect diagnostics summaries for various X-13ARIMA-SEATS diagnostics.

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Depends R (>= 2.10)

Imports plotrix,
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R topics documented:

`absmax` *Maximum absolute value of a vector*

Description

Generates the maximum of the absolute value of a numeric vector

Usage

```
absmax(x)
```

Arguments

x	vector of numbers

Value

Maximum of the absolute value of a vector

Examples

```
r50 <- rnorm(50)
r50.absmax <- absmax(r50)
```

---

acf_fail — *ACF Test failure message*

Description

Tests whether the sample autocorrelation of the residuals from a time series model fails the Ljung-Box or Box-Pierce Q test.

Usage

```
acf_fail(udg_list = NULL, acf_lags_fail = c(1, 2, 3, 4, 12, 24), num_sig = 8)
```

Arguments

udg_list	List object generated by `udg()` function of the `seasonal` package. This is a required entry.
acf_lags_fail	Lags of the ACF to test Default is `c(1, 2, 3, 4, 8)`.
num_sig	Limit for number of lags with significant ACF values Default is `4`.

Value

Logical object which is `TRUE` if series fails the ACF test, `FALSE` otherwise

Examples

```
ukgas_seas <- seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                             x11='', transform.function = 'log', forecast.maxlead=20,
                             check.print = c( 'pacf', 'pacfplot' ))
ukgas_udg <- seasonal::udg(ukgas_seas)
ukgas_acf_fail <- acf_fail(ukgas_udg, acf_lags_fail = c(1, 2, 3, 4, 8), num_sig = 4)
```

acf_fail_why   *ACF Test Explanation*

Description

ACF Test Failure Message

Usage

```
acf_fail_why(
  udg_list = NULL,
  acf_lags_fail = c(1, 2, 3, 4, 12, 24),
  num_sig = 8,
  return_both = FALSE
)
```

Arguments

udg_list	List object generated by udg() function of the seasonal package. This is a required entry.
acf_lags_fail	• lags of the ACF to test Default is c(1, 2, 3, 4, 8).
num_sig	• limit for number of lags with significant ACF values Default is 4.
return_both	Logical scalar indicating whether the calling function will return both the test results and why the test failed or just produce a warning. Default is FALSE.

Details

Generates text on why the sample autocorrelation of the residuals from a time series model fails the Ljung-Box or Box-Pierce Q test

Value

character object tells why series fails the ACF test, 'pass' otherwise.

Examples

```
ukgas_seas <- seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                             x11='', transform.function = 'log', forecast.maxlead=20,
                             check.print = c( 'pacf', 'pacfplot' ))
ukgas_udg <- seasonal::udg(ukgas_seas)
ukgas_acf_fail_why <- acf_fail_why(ukgas_udg, acf_lags_fail = c(1, 2, 3, 4, 8),
                                   num_sig = 4, return_both = TRUE)
```

acf_test *Global ACF test*

Description

Tests whether the residuals from a time series model has acceptable autocorrelation in the residuals.

Usage

```
acf_test(
  seas_obj = NULL,
  num_sig = 8,
  acf_lags_fail = c(1, 2, 3, 4, 12, 24),
  acf_lags_warn = c(12, 24),
  return_this = "test"
)
```

Arguments

seas_obj	Object generated by seas() of the seasonal package. This is a required entry.
num_sig	Limit for number of lags with significant ACF values Default is 8.
acf_lags_fail	• lags of the ACF to test Default is c(1, 2, 3, 4, 12, 24).
acf_lags_warn	• lags of the ACF to test for warnings Default is c(12, 24).
return_this	character string; what the function returns - 'test' returns test results, 'why' returns why the test failed or received a warning, or 'both'. Default is 'test'.

Value

A text string denoting if series passes, fails, or has a warning for residual autocorrelation. If model diagnostics not found, return 'none'.

Examples

```
ukgas_seas <- seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                             x11='', transform.function = 'log', forecast.maxlead=20,
                             check.print = c( 'pacf', 'pacfplot' ))
ukgas_acf_test <- acf_test(ukgas_seas, num_sig = 4, acf_lags_fail = c(1, 2, 3, 4, 8),
                           acf_lags_warn = c(4, 8), return_this = 'both')
```

acf_warn *ACF test warning message*

Description

Tests whether the residuals from a time series model generates a warning for the AIC test

Usage

```
acf_warn(udg_list = NULL, acf_lags_warn = c(12, 24))
```

Arguments

udg_list	• list object generated by udg() function of the seasonal package.
acf_lags_warn	• lags of the ACF to test for warnings

Value

Logical object which is TRUE if series generates a warning for the ACF test, FALSE otherwise

Examples

```
ukgas_seas <- seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                             x11='', transform.function = 'log', forecast.maxlead=20,
                             check.print = c( 'pacf', 'pacfplot' ))
ukgas_udg <- seasonal::udg(ukgas_seas)
ukgas_acf_warn <- acf_warn(ukgas_udg, acf_lags_warn = c(4,8))
```

---

acf_warn_why   *ACF Test Warning Message*

Description

Generates text on why the sample autocorrelation of the residuals from a time series model fails the Ljung-Box or Box-Pierce Q test

Usage

```
acf_warn_why(udg_list = NULL, acf_lags_warn = c(12, 24), return_both = FALSE)
```

Arguments

udg_list	• list object generated by udg() function of the seasonal package. This is a required entry.
acf_lags_warn	• lags of the ACF to test for warnings Default is c(12, 24).
return_both	Logical scalar indicating whether the calling function will return both the test results and why the test failed or produced a warning. Default is FALSE.

Value

character string which tells why the series generates a warning for the ACF test, 'pass' otherwise.

Examples

```
ukgas_seas <- seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                             x11='', transform.function = 'log', forecast.maxlead = 20,
                             check.print = c( 'pacf', 'pacfplot' ))
ukgas_udg <- seasonal::udg(ukgas_seas)
ukgas_acf_warn_why <- acf_warn_why(ukgas_udg, acf_lags_warn = c(4, 8), return_both = TRUE)
```

all_model_diag *Model diagnostic summary*

Description

Generate a summary of model diagnostics for a single series

Usage

```
all_model_diag(
  seas_obj = NULL,
  add_aicc = FALSE,
  add_norm = FALSE,
  add_auto_out = FALSE,
  return_list = FALSE
)
```

Arguments

`seas_obj`	`seas` object generated from a call of `seas` on a single time series This is a required entry.
`add_aicc`	logical scalar; add AICC value to the summary. Default is `FALSE`
`add_norm`	logical scalar; add normality statistics to the summary. Default is `FALSE`
`add_auto_out`	logical scalar; add identified automatic outliers to the summary. Default is `FALSE`
`return_list`	logical scalar; return a list rather than a vector. Default is `FALSE`

Value

vector or list of model diagnostics for a given series

Examples

```
air_seas <-
   seasonal::seas(AirPassengers, x11='', slidingspans = '',
                  regression.aictest = 'td', forecast.maxlead=36,
                  check.print = c( 'pacf', 'pacfplot' ))
air_diag <- all_model_diag(air_seas, add_aicc = TRUE, add_norm = TRUE,
                           add_auto_out = TRUE, return_list = TRUE)
```

all_model_diag_list *Model diagnostic summary from a list*

Description

Generate a summary of model diagnostics from a list of `seas` objects series

Usage

```
all_model_diag_list(
  seas_obj_list,
  add_aicc = FALSE,
  add_norm = FALSE,
  add_auto_out = FALSE,
  add_spec = FALSE,
  save_summary = FALSE,
  save_file = "this_excel_file.xlsx",
  save_append = TRUE,
  save_sheetname = "diag"
)
```

Arguments

seas_obj_list	list of seas objects generated from a call of seas on a single time series
add_aicc	logical scalar; add AICC value to the summary
add_norm	logical scalar; add normality statistics to the summary
add_auto_out	logical scalar; add identified automatic outliers to the summary
add_spec	logical scalar; add test for spectral peaks to the summary
save_summary	logical scalar; save the summary matrix in a separate Excel file
save_file	character string; file name for saving summary matrix
save_append	logical scalar; if TRUE, append the sheet to the Excel file, otherwise overwrite the sheet. Default is TRUE.
save_sheetname	character string; sheet name used for the Excel file

Value

vector of model diagnostics for a given series

Examples

```
unemp_seas_list <-
   seasonal::seas(unemployment_list, slidingspans = "",
                  transform.function = "log",
                  outlier.types = "all",
                  arima.model = "(0 1 1)(0 1 1)",
                  forecast.maxlead=36, x11 = "",
                  check.print = c( "pacf", "pacfplot" ))
unemp_seas_update <-
     Filter(function(x) inherits(x, "seas"), unemp_seas_list)
unemp_diag <-
    all_model_diag_list(unemp_seas_update, add_aicc = TRUE,
                        add_norm = TRUE, add_auto_out = TRUE,
                        add_spec = TRUE)
```

check_stats *Displays various X-13 diagnostics*

Description

Displays various X-13 diagnostics for a single series.

Usage

```
check_stats(
  seas_obj = NULL,
  print_summary = TRUE,
  test_full = TRUE,
  test_span = TRUE,
  acf_num_sig = 8,
  acf_lags_fail = c(1, 2, 3, 4, 12, 24),
  acf_lags_warn = c(12, 24),
  model_t_value = 3,
  model_p_value = 0.05,
  otl_auto_limit = 5,
  otl_all_limit = 5,
  d11f_p_level = 0.01,
  qs_p_limit_pass = 0.01,
  qs_p_limit_warn = 0.05,
  qs_p_limit_fail = 0.01,
  qs_robust_sa = TRUE,
  sf_limit = 25,
  change_limit = 40,
  mq_fail_limit = 1.2,
  mq_warn_limit = 0.8,
  return_list = FALSE
)
```

Arguments

`seas_obj`	object generated by `seas()` of the seasonal package.
`print_summary`	Logical object; if `TRUE`, print the result of summary(`seas_obj`); if `FALSE`, a model summary will be printed out. Default is `TRUE`.
`test_full`	Logical scalar indicating whether to apply the QS test to the full series span. Default is `TRUE`.
`test_span`	Logical scalar indicating whether to test the QS test to the final 8-year span used by the spectrum diagnostic. Default is `TRUE`.
`acf_num_sig`	Numeric object; limit for number of lags with significant ACF values. Default is `8`.
`acf_lags_fail`	Numeric vector; lags of the ACF to test. Default is `c(1, 2, 3, 4, 12, 24)`.
`acf_lags_warn`	Numeric vector; lags of the ACF to test for warnings, Default is `c(12, 24)`.
`model_t_value`	t-statistic limit for regressors. Default is `3.0`.
`model_p_value`	p-value limit for regressors. Default is `0.05`.

`otl_auto_limit`	limit for number of automatically identified outliers. Default is `5`.
`otl_all_limit`	limit for number of outlier regressors. Default is `5`.
`d11f_p_level`	p-level used to test the d11 f-test for residual seasonality. Default is `0.01`.
`qs_p_limit_pass`	Numeric scalar; P-value limit for QS statistic for passing. Default is `0.01`.
`qs_p_limit_warn`	Numeric scalar; P-value limit for QS statistic for warning. Default is `0.05`.
`qs_p_limit_fail`	Numeric scalar; P-value limit for QS statistic for failing. Default is `0.01`.
`qs_robust_sa`	Logical scalar indicating if original series adjusted for extremes is included in testing. Default is `TRUE`.
`sf_limit`	Numeric object; limit for the percentage of seasonal spans flagged. Default is `25`.
`change_limit`	Numeric object; limit for the percentage of month-to-month changes flagged Default is `40`.
`mq_fail_limit`	Numeric scalar; value above which the M or Q statistic fails. Default is `1.2`.
`mq_warn_limit`	Numeric scalar; value above which the M or Q statistic gives a warning message if it is less than `this_fail_Limit`, Default is `0.8`.
`return_list`	Logical scalar; indicates if the function will return a summary of diagnostics. Default is `TRUE`.

Value

Displays assorted seasonal adjusmtent and modeling diagnostics.

Examples

```
ukgas_seas <-
   seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                  x11='', transform.function = 'log', forecast.maxlead=20,
                  check.print = c( 'pacf', 'pacfplot' ))
ukgas_check_stats <-
   check_stats(ukgas_seas, acf_num_sig = 5, acf_lags_fail = c(1, 2, 3, 4, 8),
               acf_lags_warn = c(4, 8), otl_auto_limit = 4, otl_all_limit = 6,
               return_list = TRUE)
```

`choose_optimal_seasonal_filter` *Choose Optimal X-11 seasonal moving average*

Description

Choose the optimal X-11 seasonal moving average based on the value of the seasonal moving average coefficient from an airline model.

Usage

```
choose_optimal_seasonal_filter(
  this_seasonal_theta = NULL,
  dp_limits = TRUE,
  use_3x15 = TRUE
)
```

Arguments

`this_seasonal_theta`
: numeric scalar; seasonal moving average coefficient from an airline model. This is a required entry.

`dp_limits`
: logical scalar, if `TRUE` limits from Deputot and Planas will be used to choose the moving average, else limits from Bell Chow and Chu will be used. Default is `TRUE`.

`use_3x15`
: logical scalar, if `TRUE` 3x15 seasonal filter will be returned if chosen, otherwise function will return a `3x9` value. Default is `FALSE`.

Value

The optimal X-11 seasonal filter, unless the airline model cannot be estimated.

Examples

```
shoes_seas <- seasonal::seas(shoes2008, x11='', slidingspans = '',
                        transform.function = 'log', x11 = "",
                        arima.model = '(0 1 1)(0 1 1)',
                        regression.aictest = c('td', 'easter'),
                        forecast.maxlead=36, check.print = c( 'pacf', 'pacfplot' ))
shoes_seasonal_MA <- shoes_seas$est$coefficients[["MA-Seasonal-12"]]
this_seasonal  <- choose_optimal_seasonal_filter(shoes_seasonal_MA)
this_seasonal2 <- choose_optimal_seasonal_filter(shoes_seasonal_MA, dp_limits = FALSE)
```

---

combined_spectrum_test *Combined spectrum test from Maravall (2012)*

Description

generate a test for seasonality by combining the results from the AR(30) and Tukey nonparametric spectrums as laid out in Maravall (2012)

Usage

```
combined_spectrum_test(
  this_seas = NULL,
  this_ar_spec_cv = NULL,
  this_series = "series.adjoriginal",
  take_log = TRUE,
  take_diff = TRUE
)
```

Arguments

- `this_seas` — `seas` object for a single series. This is a required entry.
- `this_ar_spec_cv` — List object with two elements - 99 and 95 percent critical values for the frequencies of the AR(30) spectrum as generated by the `gen_ar_spec_cv`
- `this_series` — character string; the table used to generate the AR(30) spectrum. Default is `"b1"`.
- `take_log` — logical scalar; indicates if the AR spectrum is generated from the log of the data. Default is `TRUE`.
- `take_diff` — logical scalar; indicates if the data is differenced before the AR spectrum is generated. Default is `TRUE`.

Value

`TRUE` if spectral evidence of seasonality is detected; `FALSE` if not.

Examples

```
air_seas <- seasonal::seas(AirPassengers, series.save = "b1",
                   arima.model='(0 1 1)(0 1 1)',
                   forecast.maxlead = 36, slidingspans = '',
                   transform.function = 'log')
this_ar30_spec_cv <- gen_ar_spec_cv(1000, 97, 12)
this_spectrum_test <- combined_spectrum_test(air_seas, this_ar30_spec_cv)
```

`compare_dates` *Date Match*

Description

Compare two dates to see if they match

Usage

```
compare_dates(this_date = NULL, comp_date = NULL)
```

Arguments

- `this_date` — Integer array of length 2, a date where the first element is the year and the second element is the month or quarter. This is a required entry.
- `comp_date` — Integer array of length 2, a date to comapare to `this_date`.

Value

a logical scalar; `TRUE` if the dates match, `FALSE` if they don't

Examples

```
match_start <- compare_dates(start(shoes2007), c(1990,1))
```

`convert_date_string_to_date` *Convert date string from UDG output*

Description

convert a date string from the X-13 UDG file to a `c(year, month)` date

Usage

```
convert_date_string_to_date(this_date_string)
```

Arguments

`this_date_string`
date string usually extracted from the X-13 UDG output

Value

integer array of length 2 with the year and month/quarter of from the date string

Examples

```
air_seas <- seasonal::seas(AirPassengers,
                    arima.model='(0 1 1)(0 1 1)',
                    forecast.maxlead = 36, slidingspans = '',
                    transform.function = 'log')
this_start_spec_string <- seasonal::udg(air_seas, "startspec")
this_start_spec        <- convert_date_string_to_date(this_start_spec_string)
```

`d11f_test` *D11 F-test for residual seasonality*

Description

Generates X-11's f-test for residual seasonality in the seasonally adjusted data

Usage

```
d11f_test(seas_obj = NULL, p_level = 0.01, return_this = "test")
```

Arguments

`seas_obj`	Object generated by `seas()` of the seasonal package. This is a required entry.
`p_level`	p-level used to test the d11 f-test for residual seasonality Default is `0.01`.
`return_this`	character string; what the function returns - `'test'` returns test results, `'why'` returns why the test failed or received a warning, or `'both'`. Default is `'test'`.

Value

A text string denoting if series passes or has a warning for residual seasonality. If d11f statistic not found, return 'none'.

Examples

```
ukgas_seas <- seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                             x11='', transform.function = 'log', forecast.maxlead=20,
                             check.print = c( 'pacf', 'pacfplot' ))
ukgas_d11f_test <- d11f_test(ukgas_seas, p_level = 0.05, return_this = 'both')
```

`d11f_test_why` *ACF Test Warning Message*

Description

Why D11 f-test for residual seasonality fails

Usage

```
d11f_test_why(udg_list = NULL, p_level = 0.01, return_both = FALSE)
```

Arguments

udg_list	List object generated by udg() function of the seasonal package. This is a required entry.
p_level	p-level used to test the d11 f-test for residual seasonality Default is 0.01.
return_both	Logical scalar indicating whether the calling function will return both the test results and why the test failed or produced a warning. Default is FALSE.

Value

A text string denoting why a series fails or has a warning for residual seasonality. If d11f statistic not found, return 'none'.

Examples

```
ukgas_seas <-
   seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                  x11='', transform.function = 'log', forecast.maxlead=20,
                  check.print = c( 'pacf', 'pacfplot' ))
ukgas_udg <- seasonal::udg(ukgas_seas)
ukgas_d11f_why <- d11f_test_why(ukgas_udg, p_level = 0.05, return_both = TRUE)
```

employment_data_mts *US Employment Series, four main components in an mts object*

Description

#' An mts object of the four main components of US Employment expressed as time series objects that end in December, 2022

Usage

```
employment_data_mts
```

Format

An mts object with 4 time series elements in four columns:

n2000013 Employed Males 16-19

n2000014 Employed Females 16-19

n2000025 Employed Males 20+

n2000026 Employed Females 20+

employment_list *US Employment Series, four main components in a list object*

Description

#' A list object of the four main components of US Employment expressed as time series objects that end in December, 2022

Usage

```
employment_list
```

Format

A list object with 4 time series elements:

n2000013 Employed Males 16-19

n2000014 Employed Females 16-19

n2000025 Employed Males 20+

n2000026 Employed Females 20+

fix_diag_list *Fix Diagnostic List*

Description

Fix an incomplete diagnostic list by filling in missing elements with NAs

Usage

```
fix_diag_list(this_test = NULL, this_names = NULL, return_this = "both")
```

Arguments

this_test	list object of a seasonal adjustment or modeling diagnostic This is a required entry.
this_names	character vector; complete set of names to check against This is a required entry.
return_this	character string; what the function returns - 'test' returns test results, 'why' returns why the test failed or received a warning, or 'both'. Default is 'both'.

Value

diagnostic list object with missing names filled in

Examples

```
xt_composite_seas <- seasonal::seas(xt_data_new,
     transform.function = "log",
     check.print = c("none", "+acf", "+acfplot", "+normalitytest"),
     regression.aictest = NULL,
     outlier.types = "all",
     arima.model = "(0 1 1)(0 1 1)",
     list = list(
         list(x11 = ""),
         list(x11 = ""),
         list(seats.save = c("s11", "s12", "s10")),
         list(x11 = "")
     ),
)
xt_comp_update <-
     Filter(function(x) inherits(x, "seas"), xt_composite_seas)
xt_test_m7 <- lapply(xt_comp_update, function(x)
     try(mq_test(x, return_this = 'both')))
test_names <- names(xt_data_new)
num_names <- length(test_names)
if (!is.null(xt_test_m7)) {
    if (length(xt_test_m7) < num_names) {
      xt_test_m7 <-
         fix_diag_list(xt_test_m7, test_names, return_this = 'both')
    }
}
```

`gen_ao_outlier_ts` *Generate level change regression variable as a ts object*

Description

Generates a ts object for a AO (point) outlier regressor

Usage

```
gen_ao_outlier_ts(
  ao_date,
  this_start,
  this_end,
  this_freq = 12,
  return_matrix = TRUE
)
```

Arguments

`ao_date`	Integer vector of length two - dates for AO outlier to be generated
`this_start`	Numeric vector; start date of AO outlier regressor generated.
`this_end`	Numeric vector; end date of AO outlier regressor generated.
`this_freq`	Numeric scalar; frequency of time series. Default: `12`, for a monthly series.
`return_matrix`	Logical scalar; If true, the object returned is a one column time series matrix object. Default: `TRUE`

Value

Generate ts object of a point outlier regressor

Examples

```
UKgas_ao_date <- c(1970, 2)
UKgas_ao_1970_2 <-
   gen_ao_outlier_ts(UKgas_ao_date, this_start = c(1960, 1), this_end = c(1990, 4),
                     this_freq = 4)
```

`gen_ar_spec_cv` *Generate critical values for AR(30) spectrum as in Maravall (2012)*

Description

Generate critical values for AR(30) spectrum as in Maravall (2012)

Usage

```
gen_ar_spec_cv(n_sim = 1e+05, series_length = 121, freq = 12)
```

Arguments

n_sim integer scalar; number of simulations; default is 100000

series_length integer scalar; length of each series simulated. Default is 121.

freq integer scalar; frequency of the time series; default is 12 (monthly).

Value

List of critical values for each seasonal frequency for the 95th and 99th percentile.

Examples

```
ar30_spec_cv <- gen_ar_spec_cv(1000, 97, 12)
```

---

gen_hybrid_sa *Generate a hybrid seasonal adjustment*

Description

Generates a "hybrid" seasonal adjustment by replacing a span of a multiplicative seasonal adjustment with an additive adjustment

Usage

```
gen_hybrid_sa(
  this_mult_sa = NULL,
  this_add_sa = NULL,
  this_start_hybrid = NULL,
  this_end_hybrid = NULL
)
```

Arguments

this_mult_sa time series object of a multiplicative seasonal adjustment This is a required entry.

this_add_sa time series object of an additive seasonal adjustment This is a required entry.

this_start_hybrid integer vector of length 2, start of the span where additive adjustments replace multiplicative adjustment. This is a required entry.

this_end_hybrid integer vector of length 2, end of the span where additive adjustments replace multiplicative adjustment. This is a required entry.

Value

time series object with hybrid seasonal adjustment

Examples

```
air_mult_seas <- seasonal::seas(AirPassengers, transform.function = "log")
air_mult_sa   <- seasonal::final(air_mult_seas)
air_add_seas  <- seasonal::seas(AirPassengers, transform.function = "none")
air_add_sa    <- seasonal::final(air_add_seas)
air_hybrid_sa <- gen_hybrid_sa(air_mult_sa, air_add_sa, c(1956,1), c(1956,12))
```

---

gen_ls_outlier_ts *Generate level change regression variable as a ts object*

Description

Generates a ts object for a LS (level shift) outlier regressor

Usage

```
gen_ls_outlier_ts(
  ls_date,
  this_start,
  this_end,
  this_freq = 12,
  x13type = TRUE,
  return_matrix = TRUE
)
```

Arguments

ls_date	Integer vector of length two - dates for LS outlier to be generated.
this_start	Numeric vector; start date of LS outlier regressor generated.
this_end	Numeric vector; end date of LS outlier regressor generated.
this_freq	Numeric scalar; frequency of time series. Default: 12, for a monthly series
x13type	Logical scalar; Indicates if level change outlier is defined as in X-13ARIMA-SEATS. Default: TRUE
return_matrix	Logical scalar; If true, the object returned is a one column time series matrix object. Default: TRUE

Value

Generate ts object of a level change outlier regressor

Examples

```
UKgas_ls_date <- c(1970, 2)
UKgas_ls_1970_2 <-
   gen_ls_outlier_ts(UKgas_ls_date, this_start = c(1960, 1), this_end = c(1990, 4),
                     this_freq = 4)
```

`gen_tc_outlier_ts` *Generate temporary change outlier regression as a ts object*

Description

Generates a ts object for a TC (temporary change) outlier regressor

Usage

```
gen_tc_outlier_ts(
  tc_date = NULL,
  this_start = NULL,
  this_end = NULL,
  this_freq = 12,
  tc_alpha = NULL,
  return_matrix = TRUE
)
```

Arguments

`tc_date`	Integer vector of length two - dates for TC outlier to be generated This is a required entry.
`this_start`	Numeric vector; start date of TC outlier regressor generated. This is a required entry.
`this_end`	Numeric vector; end date of TC outlier regressor generated. This is a required entry.
`this_freq`	Numeric scalar; frequency of time series. Default: `12`, for a monthly series
`tc_alpha`	Numeric scalar; Rate of decay for the TC outlier. Default: will be computed as in `X-13ARIMA-SEATS` for a weekly series
`return_matrix`	Logical scalar; If true, the object returned is a one column time series matrix object. Default: `TRUE`

Value

ts object for a temporary change outlier regressor

Examples

```
UKgas_tc_date <- c(1970, 2)
UKgas_tc_1970_2 <-
   gen_tc_outlier_ts(UKgas_tc_date, this_start = c(1960, 1), this_end = c(1990, 4),
                     this_freq = 4, tc_alpha = 0.9, return_matrix = TRUE)
```

gen_x13_table_list *X-13 Tables Available*

Description

generates a list of X-13 tables that can be extracted with the seasonal package

Usage

```
gen_x13_table_list(this_table_type = "all")
```

Arguments

this_table_type
: vector of character strings listing types of X-13 tables to output. Default is 'all', other choices are 'diagnostics', 'matrices', 'spectrum', 'timeseries'.

Value

A list of arrays with table names and abbreviations from X-13ARIMA-SEATS in several different elements specified by the user: diagnostics, matrices, spectrum, timeseries

Examples

```
x13_tables_all <- gen_x13_table_list()
```

get_arima_estimates_matrix *ARMA Coefficient Summary*

Description

Generate a summary of ARMA coefficients for a single series

Usage

```
get_arima_estimates_matrix(seas_obj = NULL, add_diff = FALSE)
```

Arguments

seas_obj	seas object generated from a call of seas on a single time series. This is a required entry.
add_diff	logical scalar; add differencing information, if included in model

Value

matrix of ARMA coefficients, standard errors, and t-statistics for a given series

Examples

```
air_seas <-
   seasonal::seas(AirPassengers, x11='', slidingspans = '', transform.function = 'log',
                        arima.model = '(0 1 1)(0 1 1)', regression.aictest = 'td',
                        forecast.maxlead=36, check.print = c( 'pacf', 'pacfplot' ))
air_arima_matrix <- get_arima_estimates_matrix(air_seas, add_diff = TRUE)
```

---

get_auto_outlier_string   *Get automatic outlier names*

Description

Get the names of outliers identified in the seas object for a single series.

Usage

```
get_auto_outlier_string(seas_obj = NULL)
```

Arguments

seas_obj	A seas object for a single series generated from the seasonal package. This is a required entry.

Value

Character string containing a summary of the outliers identified in the regARIMA model. If no regressors or automatic outliers in the model, the routine will return a blank character.

Examples

```
air_seas <- seasonal::seas(AirPassengers, arima.model = '(0 1 1)(0 1 1)', x11='')
this_auto_outlier <- get_auto_outlier_string(air_seas)
```

---

get_fcst_tval   *t-values of within sample forecasts*

Description

returns t-values of within sample forecasts, up to 3

Usage

```
get_fcst_tval(seas_obj = NULL, terror_lags = NULL)
```

Arguments

seas_obj	seas object for a single series This is a required entry.
terror_lags	Integer scalar for number of forecast lags from the end of series we'll collect t-statistics. Must be either 1, 2, or 3. This is a required entry.

Value

an array of t-values of within sample forecasts, up to length 3

Examples

```
air_seas_short <- seasonal::seas(AirPassengers, series.span = ',1960.9',
                    arima.model='(0 1 1)(0 1 1)', x11 = "",
                    forecast.maxlead = 36, slidingspans = '',
                    transform.function = 'log')
fcst_tstat <- get_fcst_tval(air_seas_short, 3)
```

`get_model_ftest` *Get model based F-test*

Description

Extract values associated with the model based F-test specified by the `this_ftest` argument

Usage

```
get_model_ftest(seas_obj = NULL, this_ftest = "seasonal", return_this = "all")
```

Arguments

`seas_obj`	A seas object for a single series generated from the `seasonal` package This is a required entry.
`this_ftest`	Character string; type of model based f-test to return. Default is `"seasonal"`; only other acceptable value is `"td"`.
`return_this`	Character string, Code that controls what values are returned. Acceptable values are `"all"`, `"dof"` (degrees of freedom), `"ftest"`, (F-test value), or `"pval"` (F-test p-value). Default is "all".

Value

Numeric vector with seasonal or trading day F-statistic, degrees of freedom, p-value. If not found, return `NULL`.

Examples

```
air_seas_td_seasonal <-
    seasonal::seas(AirPassengers, arima.model = '(0 1 1)',
                   regression.variables = c('seasonal', 'td'), x11='')
this_seas_ftest <- get_model_ftest(air_seas_td_seasonal, this_ftest = 'seasonal',
                                   return_this = 'ftest')
this_td_ftest   <- get_model_ftest(air_seas_td_seasonal, this_ftest = 'td',
                                   return_this = 'ftest')
```

get_month_index *Generate index of month abbreviation*

Description

Process string of month abbrev to return a numeric index

Usage

```
get_month_index(this_month_string)
```

Arguments

`this_month_string`
: Character string; 3 character abbreviation of month

Value

Index of month - 1 for 'Jan', 2 for 'Feb', etc.

Examples

```
thisOtl <- 'AO2015.Jan'
thisCode <- 'AO'
thisPerChar <- substr(thisOtl,nchar(thisCode)+6,nchar(thisOtl))
thisPerIndex <- get_month_index(thisPerChar)
```

get_mq_key *Make a UDG key for X-11-ARIMA M and Q statistics*

Description

Generates the UDG key for X-11-ARIMA M and Q statistics based on a label

Usage

```
get_mq_key(this_label = NULL)
```

Arguments

`this_label`
: character string; name of an X-11-ARIMA M and Q statistics This is a required entry.

Value

character string with the corresponding UDG label for `this_label`. If incorrect label is specified, returns `NULL`.

Examples

```
m7_key  <- get_mq_key('M7')
```

get_mq_label *Make a label for X-11-ARIMA M and Q statistics*

Description

Generates a label for X-11-ARIMA M and Q statistics

Usage

```
get_mq_label(this_key = "f3.q")
```

Arguments

`this_key`	character string; name of an X-11-ARIMA M and Q statistics used in the UDG X-13 output. Default is `"f3.q"`.

Value

character string with the corresponding label for `this_key`. If incorrect label is specified, returns `NULL`.

Examples

```
m7_label  <- get_mq_label('f3.m07')
```

get_nonseasonal_theta *Nonseasonal Moving Average from Airline Model*

Description

Get the value of a nonseasonal moving average coefficient estimated from an airline model.

Usage

```
get_nonseasonal_theta(
  seas_obj = NULL,
  this_index = 1,
  return_string = TRUE,
  significant_digits = 3
)
```

Arguments

`seas_obj`	A seas object for a single series generated from the `seasonal` package. This is a required entry.
`this_index`	An integer scalar, an index of the vector values to be passed. Acceptable values are `1` (nonseasonal MA coefficient value), `2` (nonseasonal MA coefficent standard error), or `3` (t-value of the nonseasonal MA coefficient). Default is `1`.
`return_string`	A Logical scalar; indicates whether value returned is a string or numeric. Default is `TRUE`.

significant_digits
: an integer scalar; significant digits to be saved when a string is returned. Default is 3.

Value

Character string containing a value related to the seasonal MA coefficient from the regARIMA model fit in the seas object seas_obj. If return_string is FALSE, this is a numeric. The standard error or t-value of the seasonal MA coefficient can be returned depending on the value of this_index.

Examples

```
air_seas <- seasonal::seas(AirPassengers, transform.function = 'log',
                          arima.model = '(0 1 1)(0 1 1)', x11='')
this_nonseasonal_theta <- get_nonseasonal_theta(air_seas, return_string = FALSE)
```

---

get_norm_stat *Extract normality statistics from X-13*

Description

Extract normality statistics from the seas object of a single series

Usage

```
get_norm_stat(seas_obj = NULL, this_norm = NULL)
```

Arguments

seas_obj	seas object generated by the seasonal package for a single series. This is a required entry.
this_norm	character string; type of normality statistic being extracted. Permissable values are 'a', 'kurtosis', 'skewness'. This is a required entry.

Value

Double precision number for normality statistic described in this_key. If incorrect this_key used, function returns a NULL value. If normality statistic not generated in this run, function returns a NULL value.

Examples

```
air_seas <- seasonal::seas(AirPassengers, slidingspans = '', transform.function = 'log',
                 x11 = '', forecast.maxlead=36, check.print = c( 'pacf', 'pacfplot' ))
air_norm_stat <- get_norm_stat(air_seas, this_norm = 'kurtosis')
```

get_regarima_estimates_matrix
Generate summary of regARIMA model coefficients

Description

Generate a summary of coefficients from a regARIMA model for a single series

Usage

```
get_regarima_estimates_matrix(
  seas_obj = NULL,
  add_diff = FALSE,
  this_xreg_names = NULL
)
```

Arguments

seas_obj	seas object generated from a call of seas on a single time series This is a required entry.
add_diff	logical scalar; add differencing information, if included in model
this_xreg_names	Character array; name of user defined regressors. Default is NULL, no user defined regressors. Number of names in this vector should match number of user-defined regressors; if not, a warning message will be produced.

Value

matrix of regARIMA model coefficients, standard errors, and t-statistics for a given series

Examples

```
air_seas <- seasonal::seas(AirPassengers, x11='', slidingspans = '',
                           transform.function = 'log', arima.model = '(0 1 1)(0 1 1)',
                           regression.aictest = 'td', forecast.maxlead=36,
                           check.print = c( 'pacf', 'pacfplot' ))
air_regarima_matrix <- get_regarima_estimates_matrix(air_seas)
```

get_regression_estimates_matrix
Generate regression coefficient summary

Description

Generate a summary of regression coefficients for a single series

Usage

```
get_regression_estimates_matrix(seas_obj = NULL, this_xreg_names = NULL)
```

Arguments

seas_obj	seas object generated from a call of seas on a single time series This is a required entry.

this_xreg_names	Character array; name of user defined regressors. Default is NULL, no user defined regressors.

Value

matrix of regression coefficients, standard errors, and t-statistics for a given series

Examples

```
air_seas <- seasonal::seas(AirPassengers, x11='', slidingspans = '',
                           transform.function = 'log', arima.model = '(0 1 1)(0 1 1)',
                           regression.aictest = 'td', forecast.maxlead=36,
                           check.print = c( 'pacf', 'pacfplot' ))
air_reg_matrix <- get_regression_estimates_matrix(air_seas)
```

## get_reg_string	*Get names of regressors*

Description

Generate string of names for the regressors used in the model fit for a given series

Usage

```
get_reg_string(seas_obj = NULL, xreg_names = NULL)
```

Arguments

seas_obj	seas object generated by the seasonal package for a single series. This is a required entry.

xreg_names	Character vector with names of user defined regressors used in model. Default is NULL, no user defined regressors. Number of names in this vector should match number of user-defined regressors; if not, a warning message will be produced.

Value

Character string containing a summary of the regressors in the regARIMA model. If no regressors in the model, the routine will return a blank character.

Examples

```
air_seas <- seasonal::seas(AirPassengers, slidingspans = '',
                  transform.function = 'log',
                  x11 = '', forecast.maxlead=36,
                  check.print = c( 'pacf', 'pacfplot' ))
air_reg <- get_reg_string(air_seas)
```

`get_seasonal_ftest_all` *Generate model based F-test*

Description

Generate model based F-test, changing the model to remove seasonal differences and adding seasonal regressors if necessary. This function is used in the overall seasonal test from Maravall (2012)

Usage

```
get_seasonal_ftest_all(seas_obj = NULL, this_series = "b1")
```

Arguments

`seas_obj`	seas object for a single series. This is a required entry.
`this_series`	character string; the table used to generate the model based F-test. Default is "b1".

Value

a numeric vector with the degrees of freedom, F statistic, and probability generated for the model based seasonal f-test used in the seasonal testing procedure in Maravall(2012)

Examples

```
air_seas <-
     seasonal::seas(AirPassengers, arima.model='(0 1 1)(0 1 1)',
                    forecast.maxlead = 36, slidingspans = '',
                    transform.function = 'log')
air_ftest_all <-
    get_seasonal_ftest_all(air_seas, this_series = "a1")
```

`get_seasonal_ftest_prob` *Probability of model based F-test*

Description

Get probability for model based F-test, changing the model to remove seasonal differences and adding seasonal regressors if necessary. This function is used in the overall seasonal test from Maravall (2012)

Usage

```
get_seasonal_ftest_prob(seas_obj = NULL, this_series = "b1")
```

Arguments

`seas_obj`	`seas` object for a single series. This is a required entry.
`this_series`	character string; the table used to generate the model based F-test. Default is `"b1"`.

Value

test probability generated for the model based seasonal F-test used in the seasonal testing procedure in Maravall(2012)

Examples

```
air_seas <-
     seasonal::seas(AirPassengers, arima.model='(0 1 1)(0 1 1)',
                    forecast.maxlead = 36, slidingspans = '',
                    series.save = 'b1',
                    transform.function = 'log')
air_ftest_prob <- get_seasonal_ftest_prob(air_seas)
```

`get_seasonal_theta` *Seasonal Moving Average from Airline Model*

Description

Get the value of a seasonal moving average coefficient estimated from an airline model.

Usage

```
get_seasonal_theta(
  seas_obj = NULL,
  freq = 12,
  this_index = 1,
  return_string = TRUE,
  significant_digits = 3
)
```

Arguments

`seas_obj`	A `seas` object for a single series generated from the `seasonal` package. This is a required entry.
`freq`	A numeric scalar, the frequency of the time series. Default is 12.
`this_index`	An integer scalar, an index of the vector values to be passed. Acceptable values are `1` (seasonal MA coefficient value), `2` (seasonal MA coefficent standard error), or `3` (t-value of the Seasonal MA coefficient). Default is `1`.
`return_string`	A Logical scalar; indicates whether value returned is a string or numeric. Default is `TRUE`.
`significant_digits`	an integer scalar; significant digits to be saved when a string is returned. Default is `3`.

Value

Character string containing a value related to the seasonal MA coefficient from the regARIMA model fit in the seas object `seas_obj`. The standard error or t-value of the seasonal MA coefficient can be returned depending on the value of `this_index`. If `return_string` is `FALSE`, this is a numeric.

Examples

```
air_seas <- seasonal::seas(AirPassengers, transform.function = 'log',
                        arima.model = '(0 1 1)(0 1 1)', x11='')
this_seasonal_theta <- get_seasonal_theta(air_seas, return_string = FALSE)
```

`get_transform` *Get transformation*

Description

Get transformation from the `seas` object of a single time series

Usage

```
get_transform(seas_obj = NULL)
```

Arguments

`seas_obj`	`seas` object generated from a call of `seas` on a single time series This is a required entry.

Value

Character string with transformation used to model time series in `seas` run

Examples

```
air_seas <- seasonal::seas(AirPassengers, arima.model = '(0 1 1)(0 1 1)', x11='')
air_trans <- get_transform(air_seas)
```

`get_udg_entry` *returns a specific element of a list of udg entries*

Description

returns a specific element of a list of udg entries

Usage

```
get_udg_entry(this_seas, this_key, this_index = 0, convert = TRUE)
```

Arguments

`this_seas`	`seas` object for a single series
`this_key`	character scalar; keyword found in UDG output generated by `X-13ARIMA-SEATS`.
`this_index`	integer scalar; index of entry in vector to extract. If set to 0 (the default), get the last entry.
`convert`	logical scalar; if `TRUE`, convert character to numeric object. Default is `TRUE`.

Value

The `this_index` element of the array returned from the UDG entry for `this_key`

Examples

```
air_seas_short <- seasonal::seas(AirPassengers, series.span = ',1960.9',
                    arima.model='(0 1 1)(0 1 1)',
                    forecast.maxlead = 36, slidingspans = '',
                    transform.function = 'log')
fcst_tstat <- get_udg_entry(air_seas_short, 'forctval01')
```

`get_udg_index` *Index for entry in UDG list*

Description

Return index for entry in UDG list

Usage

```
get_udg_index(udg_list = NULL, this_key = NULL)
```

Arguments

`udg_list`	List object generated by `udg()` function of the `seasonal` package. This is a required entry.
`this_key`	Keyword found in udg files generated by X-13ARIMA-SEATS This is a required entry.

Value

An integer denoting which element in the udg output matches the key provided by the user. If there is no match, the function returns the number 0.

Examples

```
ukgas_seas <- seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                             x11='', transform.function = 'log', forecast.maxlead=20,
                             check.print = c( 'pacf', 'pacfplot' ))
ukgas_udg <- seasonal::udg(ukgas_seas)
ukgas_udg_index_a <- get_udg_index(ukgas_udg, this_key='a')
```

get_window *Subspan time series*

Description

Generate subspan of time series

Usage

```
get_window(X = NULL, plot_start = NULL, plot_end = NULL)
```

Arguments

X	Time Series object This is a required entry.
plot_start	Integer vector of length 2; Starting date for plot. Default is starting date for the time series.
plot_end	Integer vector of length 2; Starting date for plot. Default is ending date for the time series.

Value

generate subspan of time series `X` specified by `plot_start` and `plot_end`.

Examples

```
air50 <- get_window(AirPassengers, plot_start = c(1950,1), plot_end = c(1959,12))
```

input_saved_x13_file *Import File Saved by X-13ARIMA-SEATS*

Description

Import data from a file saved by the X-13ARIMA-SEATS program

Usage

```
input_saved_x13_file(filename = NULL, pos = 2, ncol = 2)
```

Arguments

filename	Character string, filename of a file saved by the `X-13ARIMA-SEATS` program. This is a required entry.
pos	Integer scalar, column of data to be extracted from `filename`. Default is 2.
ncol	Integer scalar, number of columns of data that exist within `filename`. Default is 2.

Value

A time series array

Examples

```
## Not run:
airline.sa <- input_saved_x13_file("airline.d11")

## End(Not run)
```

---

make_diag_df *Generate diagnostic summary data frame*

Description

Generate diagnostic summary data frame

Usage

```
make_diag_df(
  this_data_names = NULL,
  this_acf_test = NULL,
  this_d11f_test = NULL,
  this_spec_peak_test = NULL,
  this_spec_peak_ori_test = NULL,
  this_qs_test = NULL,
  this_qs_rsd_test = NULL,
  this_qs_seasonal_test = NULL,
  this_model_test = NULL,
  this_sspan_test = NULL,
  this_m7_test = NULL,
  this_q2_test = NULL,
  return_this = "both"
)
```

Arguments

`this_data_names`
: vector object with names of time series used in seasonal adjustment. This is a required entry.

`this_acf_test`
: list object with results from test of regARIMA residual ACF

`this_d11f_test`
: list object with results from test of D11F

`this_spec_peak_test`
: list object with results from testing for spectral peaks in the seasonally adjusted series

`this_spec_peak_ori_test`
: list object with results from testing for spectral peaks in the original series

`this_qs_test`
: list object with results from QS test

`this_qs_rsd_test`
: list object with results from residual QS test

`this_qs_seasonal_test`
: list object with results from seasonal QS test

`this_model_test`
: list object with results from model diagnostics test

this_sspan_test
: list object with results from sliding spans test

this_m7_test
: list object with results from M7 test

this_q2_test
: list object with results from Q2 test

return_this
: Character string; what the function returns - 'why' returns why the test failed or received a warning, 'test' returns test results, or 'both'. Default is 'both'.

Value

A data frame with X-13 Diagnostics, with the elements not expressed as factors

Examples

```
unemp_seasonal_filter <- lapply(unemployment_list, function(x)
     try(optimal_seasonal_filter(x, use_msr = TRUE)))
unemp_seas_list <- seasonal::seas(unemployment_list,
                     x11 = '', slidingspans = '',
                     arima.model = "(0 1 1)(0 1 1)",
                     transform.function = 'log',
                     forecast.maxlead=60,
                     check.print = c( 'pacf', 'pacfplot' ),
                     list = list(
          list(x11.seasonalma = unemp_seasonal_filter$n3000013),
          list(x11.seasonalma = unemp_seasonal_filter$n3000014),
          list(x11.seasonalma = unemp_seasonal_filter$n3000025),
          list(x11.seasonalma = unemp_seasonal_filter$n3000026)
                     ))
unemp_seas_update <-
     Filter(function(x) inherits(x, "seas"), unemp_seas_list)
unemp_acf <- lapply(unemp_seas_update, function(x)
  try(acf_test(x, return_this = 'both')))
unemp_d11f <- lapply(unemp_seas_update, function(x)
  try(d11f_test(x, p_level = 0.05, return_this = 'both')))
unemp_spec_peak <- lapply(unemp_seas_update, function(x)
  try(spec_peak_test(x, return_this = 'both')))
unemp_spec_peak_ori <- lapply(unemp_seas_update, function(x)
  try(spec_peak_test(x, this_spec = "spcori", return_this = 'both')))
unemp_qs <- lapply(unemp_seas_update, function(x)
  try(qs_test(x, test_full = FALSE, p_limit_fail = 0.01,
              p_limit_warn = 0.05, return_this = 'both')))
unemp_qs_rsd <- lapply(unemp_seas_update, function(x)
  try(qs_rsd_test(x, test_full = FALSE, p_limit_fail = 0.01,
                  p_limit_warn = 0.05, return_this = 'both')))
unemp_qs_seasonal <- lapply(unemp_seas_update, function(x)
  try(qs_seasonal_test(x, test_full = FALSE,
                       p_limit_pass = 0.01, p_limit_warn = 0.05,
                       robust_sa = FALSE, return_this = 'both')))
unemp_model <- lapply(unemp_seas_update, function(x)
  try(model_test(x, return_this = 'both')))
unemp_sspan <- lapply(unemp_seas_update, function(x)
  try(sspan_test(x, sf_limit = 15, change_limit = 35,
      return_this = 'both')))
unemp_m7 <- lapply(unemp_seas_update, function(x)
  try(mq_test(x, return_this = 'both')))
unemp_q2 <- lapply(unemp_seas_update, function(x)
  try(mq_test(x, this_label = 'Q2', return_this = 'both')))
```

```
unemp_names <- names(unemployment_list)
unemp_diag_df <-
    make_diag_df(unemp_names,
                 this_acf_test = unemp_acf,
                 this_d11f_test = unemp_d11f,
                 this_spec_peak_test = unemp_spec_peak,
                 this_spec_peak_ori_test = unemp_spec_peak_ori,
                 this_qs_test = unemp_qs,
                 this_qs_rsd_test = unemp_qs_rsd,
                 this_qs_seasonal_test = unemp_qs_seasonal,
                 this_model_test = unemp_model,
                 this_sspan_test = unemp_sspan,
                 this_m7_test = unemp_m7,
                 this_q2_test = unemp_q2)
```

match_list *List element match*

Description

Returns element of list that matches `this_string`

Usage

```
match_list(this_list, this_string = "fail")
```

Arguments

`this_list`	List of character strings.
`this_string`	Character string to match against elements of the list, ie, `this_string = 'pass'`. Default is `'fail'`

Value

A vector of list element names that match `this_string`. If nothing matches, the function will output the string `'none'`.

Examples

```
unemp_seas <-
      seasonal::seas(unemployment_list, x11 = '',
                     slidingspans = '',
                     transform.function = 'log',
                     arima.model = "(0 1 1)(0 1 1)",
                     forecast.maxlead = 60,
                     check.print = c( 'pacf', 'pacfplot' ))
test_seas_update <-
     Filter(function(x) inherits(x, "seas"), unemp_seas)
test_acf_test <- lapply(test_seas_update, function(x)
     try(acf_test(x, return_this = 'test')))
test_acf_fail <- match_list(test_acf_test, 'fail')
test_acf_warn <- match_list(test_acf_test, 'warn')
test_acf_pass <- match_list(test_acf_test, 'pass')
```

match_list_number *Number of list element matches*

Description

Returns number of elements in list that matches `this_string`

Usage

```
match_list_number(this_list, this_string = "fail")
```

Arguments

`this_list`	List of character strings.
`this_string`	Character string to match against elements of the list, ie, `this_string = 'pass'`. Default is `'fail'`.

Value

The number of list items that match `this_string`.

Examples

```
unemp_seas <-
     seasonal::seas(unemployment_list, x11 = '',
                    slidingspans = '',
                    transform.function = 'log',
                    arima.model = "(0 1 1)(0 1 1)",
                    forecast.maxlead = 60,
                    check.print = c( 'pacf', 'pacfplot' ))
test_seas_update <-
     Filter(function(x) inherits(x, "seas"), unemp_seas)
test_acf_test <-
     lapply(test_seas_update, function(x)
           try(acf_test(x, return_this = 'test')))
test_acf_number_fail <-
     match_list_number(test_acf_test, 'fail')
test_acf_number_warn <-
     match_list_number(test_acf_test, 'warn')
test_acf_number_pass <-
     match_list_number(test_acf_test, 'pass')
```

member_of_list *Member of list*

Description

Determines if a name is a member of a list

Usage

```
member_of_list(this_list = NULL, this_name = NULL)
```

Arguments

this_list	A list of objects. This is a required entry.
this_name	character string; element name of this_list. This is a required entry.

Value

returns TRUE if this_name is an element of this_list, FALSE otherwise

Examples

```
emp_seas_list <- seasonal::seas(employment_list,
                      slidingspans = '', x11 = "",
                      transform.function = 'log',
                      arima.model = "(0 1 1)(0 1 1)",
                      forecast.maxlead=36,
                      check.print = c( 'pacf', 'pacfplot' ))
emp_seas_update <-
     Filter(function(x) inherits(x, "seas"), emp_seas_list)
if (member_of_list(emp_seas_update, 'n2000014')) {
    ## Not run: save_spec_file(emp_seas_update$n2000014, 'n2000014',
                  this_directory      = "X:\\seasonalAdj\\testing\\sautilities",
                  this_data_directory = "X:\\seasonalAdj\\cps_dec_2022\\dat",
                  data_file_name      = "n2000014.dat")
## End(Not run)
}
```

---

model_test *Tests Time Series Model.*

Description

Tests whether the time series model has acceptable diagnostics.

Usage

```
model_test(
  seas_obj = NULL,
  t_value = 3,
  p_value = 0.05,
  otl_auto_limit = 5,
  otl_all_limit = 5,
  return_this = "test"
)
```

Arguments

seas_obj	Object generated by seas() of the seasonal package. This is a required entry.
t_value	t-statistic limit for regressors. Default is 3.
p_value	p-value limit for regressors. Default is 0.01.
otl_auto_limit	Numeric object; limit for number of automatically identified outliers. Default is 4.

`otl_all_limit`	Numeric object; limit for number of outlier regressors. Default is `6`.
`return_this`	character string; what the function returns - `'test'` or `'both'`. Default is `'both'`.

Value

A text string denoting if the series passed or failed the tests of ARIMA diagnostics.

Examples

```
ukgas_seas <-
   seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                  x11='', transform.function = 'log', forecast.maxlead=20,
                  check.print = c( 'pacf', 'pacfplot' ))
ukgas_model <- model_test(ukgas_seas, t_value=3.0, p_value=0.01, otl_auto_limit=4,
                          otl_all_limit=6)
```

`model_test_why` *Model Test Warning Message*

Description

Generates text on why a time series model is inadequate

Usage

```
model_test_why(
  udg_list = NULL,
  t_value = 3,
  p_value = 0.05,
  otl_auto_limit = 5,
  otl_all_limit = 5,
  return_both = FALSE
)
```

Arguments

`udg_list`	List object generated by `udg()` function of the `seasonal` package. This is a required entry.
`t_value`	Numeric scalar; t-statistic limit for regressors. Default is `3.0`
`p_value`	Numeric scalar; p-value limit for regressors. Default is `0.01`
`otl_auto_limit`	Integer scalar; limit for number of automatically identified outliers. Default is `4`
`otl_all_limit`	Integer scalar; limit for number of automatically identified outliers. Default is `4`
`return_both`	Logical scalar indicating whether the calling function will return both the test results and why the test failed or produced a warning. Default is `TRUE`.

Value

A text string denoting why the series passed or failed a series of tests of ARIMA diagnostics. ukgas_seas <- seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)', x11='', transform.function = 'log', forecast.maxlead=20, check.print = c('pacf', 'pacfplot')) ukgas_udg <- seasonal::udg(ukgas_seas) ukgas_model_why <- model_test_why(ukgas_udg, t_value=3.0, p_value=0.01, otl_auto_limit=4, otl_all_limit=6, return_both = TRUE)

`mq_test` *Test X-11-ARIMA M and Q statistics*

Description

Generates a test for X-11-ARIMA M and Q statistics

Usage

```
mq_test(
  seas_obj = NULL,
  this_label = "m7",
  this_fail_limit = 1.2,
  this_warn_limit = 0.8,
  return_this = "test"
)
```

Arguments

`seas_obj` Object generated by `seas()` of the seasonal package. This is a required entry.

`this_label` Character string; label for an M or Q statistic, such as `'M7'`, `'Q'`, or `'Q2'`. Default is `'m7'`.

`this_fail_limit` Numeric scalar; value above which the M or Q statistic fails. Default is `1.2`.

`this_warn_limit` Numeric scalar; value above which the M or Q statistic gives a warning message if it is less than `this_fail_Limit`; default is `0.8`

`return_this` character string; what the function returns - `'test'` returns test results, `'why'` returns why the test failed or received a warning, or `'both'`. Default is `'test'`.

Value

A text string denoting if series passes or has a warning for residual seasonality. If `D11f` statistic not found, return `'none'`.

Examples

```
ukgas_seas <- seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                             x11='', transform.function = 'log', forecast.maxlead=20,
                             check.print = c( 'pacf', 'pacfplot' ))
ukgas_q <- mq_test(ukgas_seas, this_label = 'q', return_this = 'both')
```

norm_test *Normality Tests for Time Series Models.*

Description

Tests different normality statistics available in X-13ARIMA-SEATS.

Usage

```
norm_test(seas_obj = NULL, this_norm = NULL, return_this = "test")
```

Arguments

seas_obj	Object generated by `seas()` of the `seasonal` package. This is a required entry.
this_norm	Type of normality statistic being extracted; permissable values are `'a'`, `'kurtosis'`, `'skewness'`. This is a required entry.
return_this	Character string; what the function returns - `'test'` returns test results, `'why'` returns why the test failed or received a warning, or `'both'`. Default is `'test'`.

Value

A text string denoting whether the series passed or failed the specific normality test. If improper value is specified for this_norm, return `NULL`. If no statistic is found, return `NA`.

Examples

```
ukgas_seas <-
   seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                  x11 = '', transform.function = 'log', forecast.maxlead = 20,
                  check.print = c( 'pacf', 'pacfplot' ))
ukgas_norm_a <- norm_test(ukgas_seas, 'a')
ukgas_norm_kurtosis <- norm_test(ukgas_seas, 'kurtosis')
ukgas_norm_skewness <- norm_test(ukgas_seas, 'skewness')
```

norm_test_why *Normality Test Warning Message*

Description

generates message for why different normality statistics available in `X-13ARIMA-SEATS` fail.

Usage

```
norm_test_why(udg_list = NULL, this_norm = NULL, return_both = FALSE)
```

Arguments

`udg_list`	List object generated by `udg()` function of the `seasonal` package. This is a required entry.
`this_norm`	Character scalar inidicating type of normality statistic being extracted; permissable values are `'a'`, `'kurtosis'`, `'skewness'`. This is a required entry.
`return_both`	Logical scalar indicating whether the calling function will return both the test results and why the test failed or produced a warning. Default is `FALSE`.

Value

A text string showing why a series failed the specific normality test

Examples

```
ukgas_seas <- seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                             x11='', transform.function = 'log', forecast.maxlead=20,
                             check.print = c( 'pacf', 'pacfplot' ))
ukgas_udg <- seasonal::udg(ukgas_seas)
ukgas_norm_a_why <- norm_test_why(ukgas_udg, 'a', return_both = TRUE)
ukgas_norm_kurtosis_why <- norm_test_why(ukgas_udg, 'kurtosis', return_both = TRUE)
ukgas_norm_skewness_why <- norm_test_why(ukgas_udg, 'skewness', return_both = TRUE)
```

`NP_test` *Non-Parametric test from Maravall (2012)*

Description

Non-Parametric test for seasonality based on Kendall and Ord (1990), and originally due to Friedman from a paper by Maravall. This code is adapted from `kendalls` subroutine in `ansub11.f` from the `X-13ARIMA-SEATS` source code

Usage

```
NP_test(x = NULL)
```

Arguments

`x`	`ts` time series object. This is a required entry.

Value

List object with three elements: `ken` (test statistic), `df` (degrees of freedom), `cv` (test probability)

Examples

```
NP_test_air <- NP_test(AirPassengers)
```

`optimal_seasonal_filter` *Optimal X-11 seasonal moving average selection*

Description

Determine the optimal X-11 seasonal moving average based on the value of the seasonal moving average coefficient from an airline model.

Usage

```
optimal_seasonal_filter(
  this_series = NULL,
  aictest = NULL,
  model = "(0 1 1)(0 1 1)",
  variables = NULL,
  outlier = TRUE,
  trans = NULL,
  missing_code = NULL,
  this_xreg = NULL,
  dp_limits = TRUE,
  use_msr = FALSE,
  use_3x15 = TRUE
)
```

Arguments

`this_series`	A time series object. This is a required entry.
`aictest`	a character string with the entries for the `regression.aictest` argument to the `seas` function from the `seasonal` package. Default is `NULL`, AIC testing not done.
`model`	a character string with the entry for the `arima.model` argument to the `seas` function from the `seasonal` package. Default is `'(0 1 1)(0 1 1)'`. Model should have a `(0 1 1)` seasonal term.
`variables`	a character string with the entries for the `regression.variables` argument to the `seas` function from the `seasonal` package. Default is `NULL`, no regressors added.
`outlier`	logical scalar, if `TRUE` outlier identification is done in the call to the `seas` function from the `seasonal` package. Default is `TRUE`.
`trans`	characater scalar, a character string with the entry for the `transform.function` argument to the `seas` function. Default is `NULL`, and the entry `auto` will be used.
`missing_code`	numeric scalar, a number with the entry for the `series.missingcode` argument to the `seas` function. Default is `NULL`, no missing value code is used.
`this_xreg`	numeric matrix, a user defined regressor matrix to be used in the model estimation. Default is `NULL`, no user-defined regressors are used.
`dp_limits`	logical scalar, if `TRUE` limits from Deputot and Planas will be used to choose the moving average, else limits from Bell Chow and Chu will be used. Default is `TRUE`.

use_msr	logical scalar, if TRUE result of MSR selection will be used if model cannot be estimated, otherwise function will return a NULL value. Default is FALSE.
use_3x15	logical scalar, if TRUE 3x15 seasonal filter will be returned if chosen, otherwise function will return a 3x9 value. Default is TRUE.

Value

The optimal X-11 seasonal filter, unless the airline model cannot be estimated.

Examples

```
this_seasonal  <-
   optimal_seasonal_filter(shoes2008, aictest = c('td', 'easter'), use_msr = TRUE)
this_seasonal2 <-
   optimal_seasonal_filter(shoes2008, aictest = c('td', 'easter'), dp_limits = FALSE,
                           use_msr = TRUE)
unemp_seasonal_filter <- lapply(unemployment_list, function(x)
     try(optimal_seasonal_filter(x, dp_limits = FALSE, use_msr = TRUE)))
```

---

overall_seasonal_test_1

First overall sasonality test from Maravall (2012)

Description

Conduct the first overall test for seasonality as laid out in Maravall (2012)

Usage

```
overall_seasonal_test_1(this_seas, this_series = "a1", take_log = TRUE)
```

Arguments

this_seas	seas object for a single series
this_series	character string; the table used to generate the AR(30) spectrum. Default is "a1".
take_log	logical scalar; indicates if the AR spectrum is generated from the log of the data. Default is TRUE.

Value

A list with 3 elements: QStest (test probability for QS), NPtest (test probability for NP), and result (character string with test result - possible values of either "evidence of seasonality" and "no evidence of seasonality")

Examples

```
air_seas <- seasonal::seas(AirPassengers,
                   arima.model='(0 1 1)(0 1 1)',
                   forecast.maxlead = 36, slidingspans = '',
                   transform.function = 'log')
first_test <- overall_seasonal_test_1(air_seas)
```

overall_seasonal_test_2
Second overall sasonality test from Maravall (2012)

Description

Conduct the second overall test for seasonality as laid out in Maravall (2012)

Usage

```
overall_seasonal_test_2(
  seas_obj = NULL,
  this_ar_spec_cv = NULL,
  this_series = "b1",
  take_log = TRUE,
  take_diff = TRUE
)
```

Arguments

seas_obj	seas object generated by the seasonal package. This is a required entry.
this_ar_spec_cv	List object with two elements - 99 and 95 percent critical values for the frequencies of the AR(30) spectrum as generated by the gen_ar_spec_cv function.
this_series	character string; the table used to generate the AR(30) spectrum. Default is "b1".
take_log	logical scalar; indicates if the AR spectrum is generated from the log of the data. Default is TRUE.
take_diff	logical scalar; indicates if the data is differenced before the AR spectrum is generated. Default is TRUE.

Value

A list with 5 elements: QStest (test probability for QS), NPtest (test probability for NP), Ftest (test probability for model based seasonal F-test), spectrum (character string with test result - possible values of either "evidence of seasonal peak", "no evidence of seasonal peak"), and result (character string with test result - possible values of either "strong seasonal", "weak seasonal", "no seasonal".

Examples

```
air_seas <- seasonal::seas(AirPassengers,
                    arima.model='(0 1 1)(0 1 1)',
                    series.save = "b1",
                    forecast.maxlead = 36, slidingspans = '',
                    transform.function = 'log')
ar30_spec_cv <- gen_ar_spec_cv(1000, 97, 12)
second_test <- overall_seasonal_test_2(air_seas, ar30_spec_cv)
```

`process_list` *Process list object of numbers*

Description

Process list object of numbers and return names of elements that are either greater than or less than a limit

Usage

```
process_list(
  this_list = NULL,
  this_limit = NULL,
  abs_value = FALSE,
  greater_than = TRUE
)
```

Arguments

`this_list`	List of numeric values. The elements should be scalars, not arrays. This is a required entry.
`this_limit`	Numeric scalar which serves as the limit of the numbers stored in `this_list`. This is a required entry.
`abs_value`	Logical scalar that indicates whether the absolute value is taken of the numbers before the comparison is made. (default is `FALSE`)
`greater_than`	logical object that specified whether the element names returned are greater than or less than the limit specified in this_limit (default is `TRUE`)

Value

A vector of list element names where the value in `this_list` is greater than or less than the limit specified in `this_limit`. If nothing matches, the function will output the string `'none'`

Examples

```
emp_seas_list <-
  seasonal::seas(employment_data_mts,
                 slidingspans = '', forecast.maxlead=36,
                 arima.model = "(0 1 1)(0 1 1)",
                 transform.function = 'log', x11 = "",
                 check.print = c( 'pacf', 'pacfplot' ))
emp_seas_update <-
    Filter(function(x) inherits(x, "seas"), emp_seas_list)
m7_key          <- get_mq_key('M7')
emp_m7_list     <- lapply(emp_seas_update, function(x)
                          try(get_udg_entry(x, m7_key)))
emp_m7_pass     <- process_list(emp_m7_list, this_limit = 1.0,
                          abs_value = TRUE, greater_than = FALSE)
```

proc_outlier *Extract dates from outlier text*

Description

Process name of outlier regressor to extract the dates associated with the outlier

Usage

```
proc_outlier(this_outlier = NULL, this_freq = 12, add_type = TRUE)
```

Arguments

this_outlier	Character string; outlier regressor. This is a required entry.
this_freq	integer scalar; time series frequency. Default is 12.
add_type	logical scalar; determines if type of outlier is added to the output. Default is TRUE.

Value

list of either year and month/quarter of outlier, or year and month/quarter of start and end of outlier

Examples

```
air_seas <-
   seasonal::seas(AirPassengers, x11='', slidingspans = '',
                  transform.function = 'log', arima.model = '(0 1 1)(0 1 1)',
                  regression.aictest = 'td', forecast.maxlead=36,
                  check.print = c( 'pacf', 'pacfplot' ))
this_auto_outlier <- get_auto_outlier_string(air_seas)
this_outlier      <- proc_outlier(this_auto_outlier)
```

qs_fail_why *QS diagnostic failure message*

Description

generates text explaining why the QS diagnostic failed or generated a warning.

Usage

```
qs_fail_why(
  udg_list = NULL,
  test_full = TRUE,
  test_span = TRUE,
  p_limit_fail = 0.01,
  robust_sa = TRUE,
  return_both = FALSE
)
```

Arguments

`udg_list`	List object generated by `udg()` function of the `seasonal` package. This is a required entry.
`test_full`	Logical scalar indicating whether to test the full series span. Default is `TRUE`.
`test_span`	Logical scalar indicating whether to test the final 8-year span used by the spectrum diagnostic. Default is `TRUE`.
`p_limit_fail`	Numeric scalar; P-value limit for QS statistic for failure. Default is `0.01`.
`robust_sa`	Logical scalar indicating if SA or irregular series adjusted for extremes is included in testing. Default is `TRUE`.
`return_both`	Logical scalar indicating whether the calling function will return both the test results and why the test failed or produced a warning. Default is `FALSE`.

Value

A text string denoting why the series failed the tests of QS diagnostics. ukgas_seas <- seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)', x11='', transform.function = 'log', forecast.maxlead=20, check.print = c('pacf', 'pacfplot')) ukgas_udg <- seasonal::udg(ukgas_seas) ukgas_qs_test <- qs_fail_why(ukgas_udg, test_full = FALSE, p_limit_fail = 0.01, return_both = TRUE)

`qs_rsd_fail_why` *QS diagnostic for regarima residuals failure message*

Description

generates text explaining why the QS diagnostic failed or generated a warning for regARIMA residuals.

Usage

```
qs_rsd_fail_why(
  udg_list = NULL,
  test_full = TRUE,
  test_span = TRUE,
  p_limit_fail = 0.01,
  return_both = FALSE
)
```

Arguments

`udg_list`	List object generated by `udg()` function of the `seasonal` package. This is a required entry.
`test_full`	Logical scalar indicating whether to test the full series span. Default is `TRUE`.
`test_span`	Logical scalar indicating whether to test the final 8-year span used by the spectrum diagnostic. Default is `TRUE`.
`p_limit_fail`	Numeric scalar; P-value limit for QS statistic for warning. Default is `0.01`.
`return_both`	Logical scalar indicating whether the calling function will return both the test results and why the test failed or produced a warning. Default is `FALSE`.

Value

A text string denoting why the series failed the QS test of regARIMA residuals.

Examples

```
ukgas_seas <- seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                             x11='', transform.function = 'log', forecast.maxlead=20,
                             check.print = c( 'pacf', 'pacfplot' ))
ukgas_udg <- seasonal::udg(ukgas_seas)
ukgas_qs_rsd_fail_why <-
  qs_rsd_fail_why(ukgas_udg, test_full = FALSE, p_limit_fail = 0.005, return_both = TRUE)
```

---

qs_rsd_test *QS diagnostic test*

Description

Tests using the QS diagnostic developed by Maravall

Usage

```
qs_rsd_test(
  seas_obj = NULL,
  test_full = TRUE,
  test_span = TRUE,
  p_limit_fail = 0.01,
  p_limit_warn = 0.05,
  return_this = "test"
)
```

Arguments

seas_obj	seas object generated by the seasonal package. This is a required entry.
test_full	Logical scalar indicating whether to test the full series span. Default is TRUE.
test_span	Logical scalar indicating whether to test the final 8-year span used by the spectrum diagnostic. Default is TRUE.
p_limit_fail	Numeric scalar; P-value limit for QS statistic for failure. Default is 0.01.
p_limit_warn	Numeric scalar; P-value limit for QS statistic for warning. Default is 0.05.
return_this	character string; what the function returns - 'test' returns test results, 'why' returns why the test failed or received a warning, or 'both'. Default is 'test'.

Value

A text string denoting if the regarima residuals passed or failed tests for residual seasonality using the QS diagnostics. Can test the entire series or the last 8 years or both.

Examples

```
ukgas_seas <- seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                             x11='', transform.function = 'log', forecast.maxlead=20,
                             check.print = c( 'pacf', 'pacfplot' ))
ukgas_qs_test_rsd <- qs_rsd_test(ukgas_seas, test_full = FALSE, p_limit_fail = 0.01,
                                 p_limit_warn = 0.05, return_this = 'both')
```

---

qs_rsd_warn_why   *Residual QS diagnostic warning message.*

Description

generates text explaining why the QS diagnostic failed or generated a warning for regARIMA residuals.

Usage

```
qs_rsd_warn_why(
  udg_list = NULL,
  test_full = TRUE,
  test_span = TRUE,
  p_limit_warn = 0.05,
  return_both = FALSE
)
```

Arguments

udg_list	List object generated by udg() function of the seasonal package. This is a required entry.
test_full	Logical scalar indicating whether to test the full series span. Default is TRUE.
test_span	Logical scalar indicating whether to test the final 8-year span used by the spectrum diagnostic. Default is TRUE.
p_limit_warn	Numeric scalar; P-value limit for QS statistic for warning. Default is 0.05.
return_both	Logical scalar indicating whether the calling function will return both the test results and why the test failed or produced a warning. Default is FALSE.

Value

A text string denoting why the series generated a warning message for the QS of regARIMA residuals.

Examples

```
ukgas_seas <- seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                             x11='', transform.function = 'log', forecast.maxlead=20,
                             check.print = c( 'pacf', 'pacfplot' ))
ukgas_udg <- seasonal::udg(ukgas_seas)
ukgas_qs_rsd_warn <-
   qs_rsd_warn_why(ukgas_udg, test_full = FALSE, p_limit_warn = 0.05, return_both = TRUE)
```

qs_seasonal_fail_why *QS Test for original series*

Description

Tests using the QS diagnostic developed by Maravall to determine if the original series is seasonal

Usage

```
qs_seasonal_fail_why(
  udg_list = NULL,
  test_full = TRUE,
  test_span = TRUE,
  p_limit_warn = 0.05,
  robust_sa = TRUE,
  return_both = FALSE
)
```

Arguments

udg_list	List object generated by udg() function of the seasonal package. This is a required entry.
test_full	Logical scalar indicating whether to test the full series span Default is TRUE.
test_span	Logical scalar indicating whether to test the final 8-year span used by the spectrum diagnostic. Default is TRUE.
p_limit_warn	Numeric scalar; P-value limit for QS statistic for warning Default is 0.05.
robust_sa	Logical scalar indicating if original series adjusted for extremes is included in testing. Default is FALSE.
return_both	Logical scalar indicating whether the calling function will return both the

Value

A text string denoting if the series passed or failed the tests of ARIMA diagnostics.

Examples

```
ukgas_seas <- seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                             x11='', transform.function = 'log', forecast.maxlead=20,
                             check.print = c( 'pacf', 'pacfplot' ))
ukgas_udg <- seasonal::udg(ukgas_seas)
ukgas_qs_fail_seasonal <-
  qs_seasonal_fail_why(ukgas_udg, test_full = FALSE,
                       p_limit_warn = 0.05, robust_sa = FALSE, return_both = FALSE)
```

qs_seasonal_test *QS seasonal tests*

Description

Tests using the QS diagnostic developed by Maravall to determine if the original series is seasonal

Usage

```
qs_seasonal_test(
  seas_obj = NULL,
  test_full = TRUE,
  test_span = TRUE,
  p_limit_pass = 0.01,
  p_limit_warn = 0.05,
  robust_sa = TRUE,
  return_this = "test"
)
```

Arguments

`seas_obj`	`seas` object generated by the `seasonal` package. This is a required entry.
`test_full`	Logical scalar indicating whether to test the full series span Default is `TRUE`.
`test_span`	Logical scalar indicating whether to test the final 8-year span used by the spectrum diagnostic. Default is `TRUE`.
`p_limit_pass`	Numeric scalar; P-value limit for QS statistic for passing Default is `0.01`.
`p_limit_warn`	Numeric scalar; P-value limit for QS statistic for warning Default is `0.05`.
`robust_sa`	Logical scalar indicating if original series adjusted for extremes is included in testing. Default is `TRUE`.
`return_this`	Character string; what the function returns - `'test'` returns test results, `'why'` returns why the test failed or received a warning, or `'both'`. Default is `'test'`.

Value

A text string denoting if the series passed or failed tests for seasonality using the QS diagnostics. Can test the entire series or the last 8 years or both.

Examples

```
ukgas_seas <-
   seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                  x11='', transform.function = 'log', forecast.maxlead=20,
                  check.print = c( 'pacf', 'pacfplot' ))
ukgas_qs_test_seasonal <-
   qs_seasonal_test(ukgas_seas, test_full = FALSE, p_limit_pass = 0.01,
                    p_limit_warn = 0.05, robust_sa=FALSE, return_this = 'both')
```

qs_seasonal_warn_why *Warning or error messages for QS seasonal diagnostic*

Description

Tests using the QS diagnostic developed by Maravall to determine if the original series is seasonal

Usage

```
qs_seasonal_warn_why(
  udg_list = NULL,
  test_full = TRUE,
  test_span = TRUE,
  p_limit_pass = 0.05,
  robust_sa = TRUE,
  return_both = FALSE
)
```

Arguments

udg_list	List object generated by udg() function of the seasonal package. This is a required entry.
test_full	Logical scalar indicating whether to test the full series span Default is TRUE.
test_span	Logical scalar indicating whether to test the final 8-year span used by the spectrum diagnostic. Default is TRUE.
p_limit_pass	Numeric scalar; P-value limit for QS statistic for passing. Default is 0.05.
robust_sa	Logical scalar indicating if original series adjusted for extremes is included in testing. Default is FALSE.
return_both	Logical scalar indicating whether the calling function will return both the test results and why the test failed or produced a warning. Default is FALSE.

Value

A text string denoting if the series had a worning message from the tests for seasonality using the QS diagnostics. Can test the entire series or the last 8 years or both.

Examples

```
ukgas_seas <-
   seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                  x11='', transform.function = 'log', forecast.maxlead=20,
                  check.print = c( 'pacf', 'pacfplot' ))
ukgas_udg <- seasonal::udg(ukgas_seas)
ukgas_qs_warn_seasonal <-
   qs_seasonal_warn_why(ukgas_udg, test_full = FALSE, p_limit_pass = 0.025,
                        robust_sa=FALSE, return_both = TRUE)
```

qs_series *QS diagnostic test on a number of series*

Description

Apply QS Tests to a list of seas objevts

Usage

```
qs_series(
  seas_obj_list = NULL,
  this_stat = "qsori",
  less_than = TRUE,
  p_limit = 0.01
)
```

Arguments

seas_obj_list	list object of seas object generated by the seasonal package. This is a required entry.
this_stat	Character string that specifies which QS statistic is being tested. Allowable values are 'qsori', 'qsorievadj', 'qsrsd', 'qssadj', 'qssadjevadj', 'qsirr', 'qsirrevadj', 'qssori', 'qssorievadj', 'qssrsd', 'qsssadj', 'qsssadjevadj', 'qssirr', 'qssirrevadj'. Default is "qsori".
less_than	Logical scalar which indicates if the test is going to be QS < p_limit (less_than = TRUE) or QS > p_limit (less_than = FALSE). Default is TRUE.
p_limit	Numeric scalar; P-value limit for QS statistic. Default is 0.01.

Value

A vector of list element names that have the given QS statistic either less than or greater than the given P-value limit. If nothing matches, the function will output the string 'none'.

Examples

```
emp_seas_list <-
    seasonal::seas(employment_list,
                   x11 = '', slidingspans = '',
                   arima.model = "(0 1 1)(0 1 1)",
                   transform.function = 'log',
                   regression.aictest = NULL,
                   forecast.maxlead=60,
                   check.print = c( 'pacf', 'pacfplot' ))
test_seas_update <-
     Filter(function(x) inherits(x, "seas"), emp_seas_list)
test_qs_names <-
     qs_series(test_seas_update, 'qssori', less_than = FALSE, p_limit=0.025)
```

qs_test *QS Test for residual seasonality*

Description

Tests using the QS diagnostic developed by Maravall on seasonally adjusted series and the irregular component

Usage

```
qs_test(
  seas_obj = NULL,
  test_full = TRUE,
  test_span = TRUE,
  p_limit_fail = 0.01,
  p_limit_warn = 0.05,
  robust_sa = TRUE,
  return_this = "test"
)
```

Arguments

seas_obj	seas object generated by the seasonal package. This is a required entry.
test_full	Logical scalar indicating whether to test the full series span. Default is TRUE.
test_span	Logical scalar indicating whether to test the final 8-year span used by the spectrum diagnostic. Default is TRUE.
p_limit_fail	Numeric scalar; P-value limit for QS statistic for failure. Default is 0.01.
p_limit_warn	Numeric scalar; P-value limit for QS statistic for warning. Default is 0.05.
robust_sa	Logical scalar indicating if SA or irregular series adjusted for extremes is included in testing. Default is TRUE.
return_this	character string; what the function returns - 'test' returns test results, 'why' returns why the test failed or received a warning, or 'both'. Default is 'test'.

Value

A text string denoting if the series passed or failed tests 1for residual seasonality using the QS diagnostics. Can test the entire series or the last 8 years or both.

Examples

```
ukgas_seas <-
   seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                  x11='', transform.function = 'log', forecast.maxlead=20,
                  check.print = c( 'pacf', 'pacfplot' ))
ukgas_qs_test <- qs_test(ukgas_seas, test_full = FALSE, p_limit_fail = 0.01,
                         p_limit_warn = 0.05, return_this = 'both')
```

qs_warn_why *warning message for QS Test for residual seasonality*

Description

generates text explaining why the QS diagnostic generated a warning.

Usage

```
qs_warn_why(
  udg_list = NULL,
  test_full = TRUE,
  test_span = TRUE,
  p_limit_warn = 0.05,
  robust_sa = TRUE,
  return_both = FALSE
)
```

Arguments

udg_list	List object generated by udg() function of the seasonal package. This is a required entry.
test_full	Logical scalar indicating whether to test the full series span Default is TRUE.
test_span	Logical scalar indicating whether to test the final 8-year span used by the spectrum diagnostic. Default is TRUE.
p_limit_warn	Numeric scalar; P-value limit for QS statistic for warning. Default is 0.05.
robust_sa	Logical scalar indicating if SA or irregular series adjusted for extremes is included in testing. Default is TRUE.
return_both	Logical scalar indicating whether the calling function will return both

Value

A text string denoting if the series passed or failed the tests of ARIMA diagnostics.

Examples

```
ukgas_seas <-
   seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                  x11='', transform.function = 'log', forecast.maxlead=20,
                  check.print = c( 'pacf', 'pacfplot' ))
ukgas_udg <- seasonal::udg(ukgas_seas)
ukgas_qs_test <- qs_warn_why(ukgas_udg, test_full = FALSE, p_limit_warn = 0.025, return_both = TRUE)
```

replace_na *Replace NA*

Description

Replace NA with a string or number

Usage

```
replace_na(this_vec = NULL, replace_string = "NA", replace_number = NULL)
```

Arguments

this_vec	Vector object. This is a required entry.
replace_string	Character scalar which replaces the NAs in the vector. Default is 'NA'.
replace_number	Number which replaces the NAs in the vector. Default is the NA is replaced by the string in replace_string.

Value

A vector with all NAs replaced by either a character string or a number.

Examples

```
sample_vec <- c(rnorm(25), NA, rnorm(24))
sample_vec_missing  <- replace_na(sample_vec, replace_string = 'Missing')
sample_vec_missing_number  <- replace_na(sample_vec, replace_number = -9999)
```

r_terror *TERROR for R*

Description

A function that duplicates the functionality of the TERROR software (Caporello and Maravall 2004) that performs quality control on time series based on one step ahead forecasts

Usage

```
r_terror(
  this_series = NULL,
  max_lead = 36,
  log_transform = TRUE,
  aictest = NULL,
  terror_lags = 1
)
```

Arguments

`this_series`	Time series array. This is a required entry.
`max_lead`	Number of forecasts generated by the seas run. Default is 36.
`log_transform`	logical scalar, if TRUE `transform.function` will be set to `log` Default is `TRUE`.
`aictest`	a character string with the entries for the `regression.aictest` argument to the `seas` function from the `seasonal` package. Default is `NULL`.
`terror_lags`	Integer scalar for number of forecast lags from the end of series we'll collect t-statistics. Must be either 1, 2, or 3.

Value

t-statistics generated by out of sample forecast error for the last 1 to 3 observation of each series in the list.

Examples

```
air_terror <- r_terror(AirPassengers, log_transform = TRUE,
                       aictest = c('td', 'easter'), terror_lags = 3)
```

---

r_terror_list — *TERROR for R (applied to a list of series)*

Description

Function that duplicates the functionality of the TERROR software (Caporello and Maravall 2004) that performs quality control on time series based on one step ahead forecasts

Usage

```
r_terror_list(
  this_data_list = NULL,
  this_lead = 36,
  this_log = TRUE,
  this_aictest = NULL,
  this_terror_lags = 1
)
```

Arguments

`this_data_list`	List of time series (all series in list should be the same frequency and have the same ending date.)
`this_lead`	Number of forecasts generated by the seas run. Default is 36.
`this_log`	logical scalar, if TRUE `transform.function` will be set to `log` in the call to the `seas` function, otherwise `auto` will be used. Default is `TRUE`.
`this_aictest`	a character string with the entries for the `regression.aictest` argument to the `seas` function from the `seasonal` package. Default is `NULL`.
`this_terror_lags`	Integer scalar for number of forecast lags from the end of series where t-statistics are collected. Must be either 1, 2, or 3.

Value

list of t-statistics generated by out of sample forecast error for the last 1 to 3 observation of each series in the list.

Examples

```
emp_terror <- r_terror_list(employment_list, this_log = FALSE,
                             this_lead = 60, this_terror_lags = 3)
```

---

save_metafile   *Generate X-13ARIMA-SEATS metafile*

Description

Generates external metafile for spec files generated from a list of `seas` objects

Usage

```
save_metafile(
  this_seas_list = NULL,
  this_name_vec = NULL,
  metafile_name = NULL,
  this_directory = NULL,
  this_spec_directory = NULL,
  this_output_code = NULL,
  this_output_directory = NULL,
  include_directory = FALSE
)
```

Arguments

`this_seas_list`
- list of seas objects the metafile will be generated from. This is a required entry.

`this_name_vec` vector of character string; vector of series names from the list of seas objects that will be saved. Default is all elements of the seasonal object list `this_seas_list` are saved.

`metafile_name`
- character string; base name of metafile to be generated. If not specified, use name of list input as metafile name. Note - do not specify the `".mta"` file extension.

`this_directory`
- optional directory where the meta file is stored. If not specified, the metafile will be saved in the current working directory.

`this_spec_directory`
- optional directory where the spec files are stored. If not specified, the spec files are saved in the current working directory.

`this_output_code`
- optional character code added to the end of the names in `this_name_vec` to form the output name. If not specified, the metafile will not have alternate output file name(s).

this_output_directory
: • optional directory where the output files are stored. If not specified, the output files are saved in the current working directory.

include_directory
: • logical scalar; if TRUE, include directory specified in this_directory with file name output. Otherwise, output only names in this_name_vec. Default is FALSE. Note that the argument this_directory must also be specified.

Value

Generates metafile that can be used directly with the X-13ARIMA-SEATS program.

Examples

```
unemp_seas_list <- seasonal::seas(unemployment_list,
                       slidingspans = '', x11 = '',
                       arima.model = "(0 1 1)(0 1 1)",
                       transform.function = 'log',
                       forecast.maxlead=36,
                       check.print = c( 'pacf', 'pacfplot' ))
unemp_seas_update <-
     Filter(function(x) inherits(x, "seas"), unemp_seas_list)
## Not run: save_metafile(unemp_seas_update, metafile_name = 'unemp',
              this_directory = 'X:\\seasonalAdj\\testing\\sautilities',
              this_spec_directory = 'X:\\seasonalAdj\\testing\\spc',
              this_output_directory = 'X:\\seasonalAdj\\testing\\out',
              include_directory = TRUE)
## End(Not run)
```

---

save_seas_object *Save seas objects*

Description

stores seas command to reproduce the seas object this_seas_object into the file file_name.r

Usage

```
save_seas_object(
  this_seas_object = NULL,
  file_name = NULL,
  series_name = NULL,
  data_list = NULL,
  list_element = NULL,
  user_reg = NULL,
  this_window = FALSE,
  this_directory = NULL,
  this_sep = "_",
  print_out = FALSE
)
```

Arguments

this_seas_object	seasonal object. This is a required entry.
file_name	character string; file name where seas object is stored; default is the name of the seasonal object.
series_name	character string; name of time series object used by the seas object; default is the name of the seasonal object.
data_list	character string; name of the list object that holds data; there is no default.
list_element	character string; name of the list element used as data; default is the name of the seasonal object.
user_reg	character string; name of a time series matrix containing user defined regressors; there is no default. If not set, will set variables related to user defined regressors to NULL in the static version of the seas object.
this_window	logical indicator variable; determines if a span of the original series If FALSE, the entire series will be used in the saved file.
this_directory	character string; optional directory where the spec file is stored.
this_sep	character string; separator between elements of the file name. Default is "_".
print_out	logical indicator variable; determines if an out() function is printed at the end of the script. If FALSE, the out() function is commented out. Default is FALSE.

Value

stores the seas command to reproduce the seas object this_seas_object into the file file_name.r - if file_name is not specified, the name of the seasonal object will be used to form the output file name.

Examples

```
ukgas_seas <-
   seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                  x11 = '', transform.function = 'log', forecast.maxlead = 20,
                  check.print = c( 'pacf', 'pacfplot' ))
## Not run: save_seas_object(ukgas_seas, file_name = "ukgas_seas", series_name = "ukgas",
                 print_out = TRUE)
## End(Not run)
```

---

save_series *Save Series*

Description

Save a user-defined regression array or matrix with time series attributes to an external ASCII file in X-13ARIMA-SEATS' datevalue format

Usage

```
save_series(this_series = NULL, this_file = NULL)
```

Arguments

`this_series` double precision time series array to be saved. This is a required entry.

`this_file` character string; name of file time series array to be saved to. This is a required entry.

Value

file with user-defined regressors will be produced

Examples

```
ukgas_seas <-
   seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                  x11='', transform.function = 'log', forecast.maxlead=20,
                  slidingspans = '', check.print = c( 'pacf', 'pacfplot' ))
ukgas_sa <- seasonal::final(ukgas_seas)
## Not run: save_series(ukgas_sa, 'ukgas_sa.txt')
```

---

save_spec_file *Save spec file representation of* seas *object*

Description

stores the spec file representation of the seas object `this_seas_object` into the file `file_name.spc`

Usage

```
save_spec_file(
  this_seas_object = NULL,
  file_name = NULL,
  this_directory = NULL,
  this_data_directory = NULL,
  data_file_name = NULL,
  xreg_file_name = NULL,
  this_user_name = NULL,
  this_title = NULL
)
```

Arguments

`this_seas_object` `seasonal` object. This is a required entry.

`file_name` character string; file name where `seas` object is stored; default is the name of the `seasonal` object

`this_directory` character string; optional directory where the spec file is stored.

`this_data_directory` character string; optional directory where the data files are stored. Default is no change in `file` entry in the spec file.

`data_file_name` character string; optional external file name where data file is stored. Path should be included with file name if data file is not in working directory; quotes will be added by the routine. Default is no change in `file` entry in the spec file.

`xreg_file_name` character string; optional external file name where user defined regressors are stored. Path should be included with file name if data file is not in working directory; quotes will be added by the routine. Default is no change in `file` entry in the spec file.

`this_user_name` vector of character strings; optional names for the user-defined regressors. Should only appear if `xreg_file_name` is specified.

`this_title` character string; optional custom title; quotes will be added by the routine. Default is no change in `title` entry in the spec file.

Value

stores the spec file representation of the `seas` object `this_seas_object` into the file `file_name.spc`

Examples

```
ukgas_seas <- seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                             x11='', transform.function = 'log', forecast.maxlead=20,
                             check.print = c( 'pacf', 'pacfplot' ))
## Not run: save_spec_file(ukgas_seas, 'ukgas',
                        data_file_name = "ukgas.dat",
                        this_directory = "X:\\seasonalAdj\\testing\\sautilities",
                        this_title = "Production run for quarterly UK Gas")
## End(Not run)
```

---

save_spec_file_vec *stores the spec file representation of the* seas *object* this_seas_object *into the file* file_name.spc

---

Description

stores the spec file representation of the `seas` object `this_seas_object` into the file `file_name.spc`

Usage

```
save_spec_file_vec(
  this_seas_object_list = NULL,
  this_name_vec = NULL,
  this_directory = NULL,
  this_data_directory = NULL,
  this_ext = ".dat",
  this_title_list = NULL,
  this_title_base = NULL,
  this_xreg_list = NULL,
  this_user_list = NULL,
  make_metafile = FALSE,
  this_metafile_name = NULL,
  this_meta_directory = NULL,
  this_output_directory = NULL,
  include_directory = FALSE
)
```

Arguments

- `this_seas_object_list`: list of seasonal objects. This is a required entry.
- `this_name_vec`: vector of character string; vector of series names from the list of seas objects that will be saved. Default is all elements of the seasonal object list this_seas_object_list are saved.
- `this_directory`: character string; optional directory where the spec file is stored.
- `this_data_directory`: character string; optional directory where the data files are stored. Data files are assumed to have the same names as in this_name_vec with the file extension specified in this_ext. Default is no change in file entry in the spec file.
- `this_ext`: character string; file extension for data files. Default is ".dat".
- `this_title_list`: list of character strings with the titles for each series. Default is to set title to the series name.
- `this_title_base`: character string; optional base for custom title; series name will be added at the end of the title; quotes will be added by the routine. Default is to set title to the series name.
- `this_xreg_list`: list of character strings with the filenames of user defined regressors or NULL for each series. Default is to not set regression.file for the individual series.
- `this_user_list`: list of vectors of character strings with the names of user defined regressors or NULL for each series. Default is to not set regression.file for the individual series.
- `make_metafile`: logical scalar; if TRUE, generate a makefile for this set of files; do not otherwise. Default is FALSE.
- `this_metafile_name`:
  - character string; base name of metafile to be generated. If not specified, use name of list input as metafile name. Note - do not specify the ".mta" file extension.
- `this_meta_directory`:
  - optional directory where the meta file is stored. If not specified, the metafile will be saved in the current working directory.
- `this_output_directory`:
  - optional directory where the output files are stored in the metafile. If not specified, the output files are saved in the current working directory.
- `include_directory`:
  - logical scalar; if TRUE, include directory specified in this_directory with file name output. Otherwise, output only names in this_name_vec. Default is FALSE.

Value

stores the spec file representation of the seas object this_seas_object into the file file_name.spc.

Examples

```
unemp_seas_list <-
   seasonal::seas(unemployment_list, slidingspans = '',
                  arima.model = "(0 1 1)(0 1 1)",
```

```
                  transform.function = 'log',
                  regression.aictest = NULL,
                  forecast.maxlead=36,
                  check.print = c( 'pacf', 'pacfplot' ))
test_seas_update <-
     Filter(function(x) inherits(x, "seas"), unemp_seas_list)
## Not run: save_spec_file_vec(test_seas_update,
                   this_name_vec = c('n3000013', 'n3000014', 'n3000025', 'n3000026'),
                   this_data_directory = 'X:\\seasonalAdj\\testing\\data',
                   this_directory = 'X:\\seasonalAdj\\testing\\sautilities',
                   this_meta_directory = 'X:\\seasonalAdj\\testing\\sautilities',
                   this_title_base = 'Production Run for US Unemployment : ',
                   make_metafile = TRUE, include_directory = TRUE)
## End(Not run)
```

`seasonal_ftest` *Model-based F-Test for Time Series Models.*

Description

Model based test for seasonality based on stable seasonal regressors

Usage

```
seasonal_ftest(
  seas_obj = NULL,
  p_limit_fail = 0.01,
  p_limit_warn = 0.05,
  return_this = "test"
)
```

Arguments

seas_obj	object generated by `seas()` of the seasonal package. This is a required entry.
p_limit_fail	Numeric scalar; P-value limit for model based seasonal F-statistic for passing. Default is `0.01`.
p_limit_warn	Numeric scalar; P-value limit for model based seasonal F-statistic for a warning. Default is `0.05`.
return_this	character string; what the function returns - `'test'` returns test results, `'why'` returns why the test failed or received a warning, or `'both'`. Default is `'test'`.

Value

A text string denoting if the series passed or failed tests for seasonality using the model based F-test diagnostic.

Examples

```
m_air <-
  seasonal::seas(AirPassengers, transform.function = 'log', arima.model = '(0 1 1)',
                 regression.variables = c('seasonal', 'td'), x11='')
this_seasonal_ftest <- seasonal_ftest(m_air, return_this = 'both')
```

set_critical_value *Set outlier critical value*

Description

Set outlier critical value using the Ljung algorithm as given in Ljung, G. M. (1993). On outlier detection in time series. Journal of Royal Statistical Society B 55, 559-567.

Usage

```
set_critical_value(number_observations = NULL, cv_alpha = 0.01)
```

Arguments

`number_observations`	number of observations tested for outliers This is a required entry.
`cv_alpha`	alpha for critical value

Value

outlier critical value generated by the algorithm given in Ljung (1993). The critical value in X-13 is different as it is adjusted to allow for smaller values to approximate the normal distribution.

Examples

```
this_critical_value <- set_critical_value(12, 0.025)
```

set_legend_position *generate position of plot legend*

Description

Generate position code for the `legend` command based on the series being plotted.

Usage

```
set_legend_position(
  data_matrix = NULL,
  this_plot_start = NULL,
  this_plot_freq = 12,
  time_disp = 3,
  value_disp = 1/6,
  default_code = "top"
)
```

Arguments

- `data_matrix` numeric matrix; matrix where all series being plotted are stored as columns. This is a required entry.
- `this_plot_start` Integer scalar; start date of the plot. This is a required entry.
- `this_plot_freq` Integer scalar; Frequency of time series plotted. Default is 12.
- `time_disp` Integer scalar; number of observations on the x-axis taken up by the legend. Default is 3.
- `value_disp` Numeric scalar; factor representing the percentage of the y axis taken up by the legend. Default is 1/6.
- `default_code` Character string; default position code if the corners are not available. Default is `"top"`. Possible values are `"bottomright"`, `"bottom"`, `"bottomleft"`, `"left"`, `"topleft"`, `"topright"`, `"top"`, `"right"` and `"center"`.

Value

Position codes for the legend command. Possible values are `"bottomright"`, `"bottom"`, `"bottomleft"`, `"topleft"`, `"topright"` and the value of `default_code`.

Examples

```
shoes_seas <-
    seasonal::seas(shoes2007, slidingspans = "", transform.function = "log", x11 = "",
                   forecast.maxlead=36, check.print = c( "pacf", "pacfplot" ))
this_series <- shoes2007
this_sa     <- seasonal::final(shoes_seas)
this_legend_position <-
    set_legend_position(cbind(this_series, this_sa), start(this_series),
                        this_plot_freq = 4, time_disp = 8, value_disp = 1/8,
                        default_code = "top")
```

`shoes2007` *Retail sales of shoes, 2007*

Description

A time series object

Usage

```
shoes2007
```

Format

Retail sales of shoes ending in December of 2007

shoes2008	*Retail sales of shoes, 2008*

Description

A time series object

Usage

```
shoes2008
```

Format

Retail sales of shoes ending in April of 2008

spec_peak_fail_why	*Failure text for spectral peaks*

Description

generate text on why spectral peaks are flagged

Usage

```
spec_peak_fail_why(
  udg_list = NULL,
  peak_level = 6,
  this_spec = "spcsa",
  return_both = FALSE
)
```

Arguments

udg_list	• list object generated by `udg()` function of the `seasonal` package. This is a required entry.
peak_level	Integer scalar - limit to determine if a frequency has a spectral peak.
this_spec	text string with the spectrum being tested allowable entries are `'spcori'`, `'spcsa'`, `'spcirr'`, `'spcrsd'`. Default is `'spcori'`.
return_both	Logical scalar indicating whether the calling function will return both the test results and why the test failed or produced a warning. Default is `FALSE`.

Value

A text string denoting if the series passed the tests of spectrum diagnostics, or why the series did not pass. Note that for `'spcori'`, the series fails

Examples

```
air_seas <- seasonal::seas(AirPassengers, transform.function = 'log',
                          arima.model = '(0 1 1)(0 1 1)', x11 = '')
air_seas_udg <- seasonal::udg(air_seas)
this_spec_peak_fail_why <-
    spec_peak_fail_why(air_seas_udg, this_spec = 'spcori', return_both = TRUE)
```

---

spec_peak_test *Test for spectral peaks*

Description

Test if spectral peaks are flagged

Usage

```
spec_peak_test(
  seas_obj = NULL,
  peak_level = 6,
  peak_warn = 3,
  this_spec = "spcsa",
  return_this = "test"
)
```

Arguments

seas_obj	object generated by seas() of the seasonal package. This is a required entry.
peak_level	Integer scalar - limit to determine if a frequency has a spectral peak. Default is 6.
peak_warn	Integer scalar - limit to produce a warning that a frequency may have a spectral peak. Default is 3.
this_spec	text string with the spectrum being tested. Allowable entries are 'spcori', 'spcsa', 'spcirr', 'spcrsd'. Default is 'spcori'.
return_this	character string; what the function returns - 'test' returns test results, 'why' returns why the test failed or received a warning, or 'both'. Default is 'test'.

Value

A text string denoting if the series passed or failed the tests of spectrum diagnostics. Note that for spcori, the series fails if none of the frequencies tested had peaks.

Examples

```
air_seas <- seasonal::seas(AirPassengers, transform.function = 'log',
                          arima.model = '(0 1 1)(0 1 1)', x11 = '')
this_spec_peak_test <- spec_peak_test(air_seas, this_spec = 'spcori', return_this = 'both')
```

spec_peak_warn_why *Warning message for spectral peaks*

Description

generate warning message related to spectral peaks

Usage

```
spec_peak_warn_why(
  udg_list = NULL,
  peak_warn_level = 3,
  this_spec = "spcsa",
  return_both = FALSE
)
```

Arguments

- `udg_list` List object generated by `udg()` function of the `seasonal` package. This is a required entry.
- `peak_warn_level` Integer scalar - limit to produce a warning that a frequency may have a spectral peak. Default is 3.
- `this_spec` text string with the spectrum being tested. Allowable entries are `'spcori'`, `'spcsa'`, `'spcirr'`, `'spcrsd'`. Default is `'spcori'`.
- `return_both` Logical scalar indicating whether the calling function will return both the test results and why the test failed or produced a warning. Default is `FALSE`.

Value

A text string denoting if the series passed the tests of spectrum diagnostics, or why the series did not pass. Note that for spcori, the series fails if none of the frequencies tested had peaks

Examples

```
air_seas <-
   seasonal::seas(AirPassengers, transform.function = 'log',
                  arima.model = '(0 1 1)(0 1 1)', x11 = '')
air_seas_udg <- seasonal::udg(air_seas)
this_spec_peak_warn_why <-
    spec_peak_warn_why(air_seas_udg, this_spec = 'spcori', return_both = TRUE)
```

sspan_test *Sliding Spans Diagnostic*

Description

Tests using the sliding spans diagnostic

Usage

```
sspan_test(
  seas_obj = NULL,
  sf_limit = 25,
  change_limit = 40,
  additivesa = FALSE,
  return_this = "test"
)
```

Arguments

seas_obj	object generated by seas() of the seasonal package. This is a required entry.
sf_limit	Numeric object; limit for the percentage of seasonal spans flagged. Default is 25.
change_limit	Numeric object; limit for the percentage of month-to-month changes flagged. Default is 40.
additivesa	logical scalar; if true, the adjustment is assumed to be additive; default is FALSE.
return_this	character string; what the function returns - 'test' returns test results, 'why' returns why the test failed or received a warning, or 'both'. Default is 'test'.

Value

A text string denoting if the series passed or failed the tests of sliding spans diagnostics.

Examples

```
ukgas_seas <- seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                             x11='', transform.function = 'log', forecast.maxlead=20,
                             slidingspans = '', check.print = c( 'pacf', 'pacfplot' ))
ukgas_sspan_test <-
   sspan_test(ukgas_seas, sf_limit = 15, change_limit = 35, return_this = 'both')
```

sspan_test_why *Sliding Spans Diagnostic Warning Messages*

Description

Generate text on why Tests using the sliding spans diagnostic fail

Usage

```
sspan_test_why(
  udg_list = NULL,
  sf_limit = 25,
  change_limit = 40,
  additivesa = FALSE,
  return_both = FALSE
)
```

Arguments

udg_list	List object generated by udg() function of the seasonal package. This is a required entry.
sf_limit	Numeric object; limit for the percentage of seasonal spans flagged. Default is 25.
change_limit	Numeric object; limit for the percentage of month-to-month changes flagged. Default is 40.
additivesa	logical scalar; if true, the adjustment is assumed to be additive; default is FALSE.
return_both	Logical scalar indicating whether the calling function will return both the test results and why the test failed or produced a warning. Default is TRUE.

Value

A text string denoting if the series passed the tests of sliding spans diagnostics diagnostics, or why the series failed.

Examples

```
ukgas_seas <- seasonal::seas(UKgas, series.period = 4, arima.model = '(0 1 1)(0 1 1)',
                             x11='', transform.function = 'log', forecast.maxlead=20,
                             check.print = c( 'pacf', 'pacfplot' ))
ukgas_seas_udg <- seasonal::udg(ukgas_seas)
ukgas_sspan_test_why <-
   sspan_test_why(ukgas_seas_udg, sf_limit = 15, change_limit = 35, return_both = TRUE)
```

---

static_with_outlier *add outliers to* seas *object*

Description

add arguments from the outlier spec to a seas object

Usage

```
static_with_outlier(
  this_seas_object = NULL,
  new_data = NULL,
  outlier_span = ",",
  outlier_types = "ao,ls"
)
```

Arguments

`this_seas_object`
: `seasonal` object. This is a required entry.

`new_data`
: time series object; updated data set from the data used to generate `this_seas_object`. This is a required entry.

`outlier_span`
: character string; sets the argument `outlier.span`. Default is `","`).

`outlier_types`
: character string; sets the argument `outlier.types`. Default is `"ao,ls"`).

Value

an updated static `seas` object with `outlier` arguments included.

Examples

```
shoes_seas <-
   seasonal::seas(shoes2007, slidingspans = '', transform.function = 'log', x11 = '',
                  forecast.maxlead = 60)
shoes_seas_outlier <-
   static_with_outlier(shoes_seas, shoes2008, outlier_types = 'all')
```

---

static_with_outlier_list *add outliers to list of* seas *object*

Description

add outlier arguments to each element of a list of `seas` objects

Usage

```
static_with_outlier_list(
  seas_obj_list = NULL,
  new_data_list = NULL,
  outlier_span = ",",
  outlier_types = "ao,ls"
)
```

Arguments

`seas_obj_list`
: list of seasonal objects. This is a required entry.

`new_data_list`
: list of time series objects; updated data sets from the data used to generate `seas_obj_list`. This is a required entry.

`outlier_span`
: character string; sets the argument `outlier.span`. Default is `","`.

`outlier_types`
: character string; sets the argument `outlier.types`. Default is `"ao,ls"`.

Value

a list of updated static seas object with outlier arguments included.

Examples

```
xt_seas_old <-
   seasonal::seas(xt_data_old, slidingspans = '',
                  transform.function = 'log',
                  x11 = '', forecast.maxlead = 60)
xt_outlier_seas <-
   static_with_outlier_list(xt_seas_old, xt_data_new)
```

---

udg_series *Process a list of* seas *elements*

Description

Process a list of seas elements to find the elements that are greater than or less than a particular limit for a diagnostic

Usage

```
udg_series(
  seas_obj_list = NULL,
  this_key = "autoout",
  this_limit = 5,
  this_abs = FALSE,
  greater_than = TRUE
)
```

Arguments

seas_obj_list	• list of seas objects generated by the seasonal package. This is a required entry.
this_key	• character string containing keyword of the udg function that returns a numeric value. Default is 'autoout'.
this_limit	• numeric object which serves as the limit of the diagnostic referred to in this_key. Default is '5'
this_abs	Logical scalar that indicates whether the absolute value is taken of the numbers before the comparison is made. (default is FALSE)
greater_than	• logical object that specified whether the element names returned are greater than or less than the limit specified in this_limit. Default is TRUE.

Value

A vector of list element names where this_key is greater than or less than the limit specified in this_limit. If nothing matches, the function will output the string 'none'

Examples

```
emp_seas_list <- seasonal::seas(employment_data_mts,
                       slidingspans = '', transform.function = 'log',
                       x11 = '', arima.model = "(0 1 1)(0 1 1)",
                       forecast.maxlead=36, check.print = c( 'pacf', 'pacfplot' ))
emp_seas_update <-
   Filter(function(x) inherits(x, "seas"), emp_seas_list)
xt_bad_m7 <-
   udg_series(emp_seas_update, this_key = 'f3.m07', this_limit = 1.2)
xt_bad_q2 <-
   udg_series(emp_seas_update, this_key = 'f3.qm2', this_limit = 1.2)
```

`unemployment_data_mts` *US Unemployment Series, four main components in an mts object*

Description

#' An mts object of the four main components of US Unemployment expressed as time series objects that end in December, 2022

Usage

```
unemployment_data_mts
```

Format

An mts object with 4 time series elements in four columns:

n3000013 Unemployed Males 16-19

n3000014 Unemployed Females 16-19

n3000025 Unemployed Males 20+

n3000026 Unemployed Females 20+

`unemployment_list` *US Unemployment Series, four main components in a list object*

Description

#' A list object of the four main components of US Unemployment expressed as time series objects that end in December, 2022

Usage

```
unemployment_list
```

Format

A list object with 4 time series elements:

n3000013 Unemployed Males 16-19

n3000014 Unemployed Females 16-19

n3000025 Unemployed Males 20+

n3000026 Unemployed Females 20+

---

update_diag_matrix *Update Diagnostic Matrix*

Description

Update the matrix of diagnostics used to generate the diagnostic data frame in `make_diag_df`.

Usage

```
update_diag_matrix(
  this_diag_list = NULL,
  this_test_list = NULL,
  this_label = NULL
)
```

Arguments

`this_diag_list`	list object with elements for seasonal adjustment or modeling diagnostic, titles, and the number of columns. This is a required entry.
`this_test_list`	list object of a specific seasonal adjustment or modeling diagnostic. This is a required entry.
`this_label`	character string; name of diagnostic in `this_test_list`. This is a required entry.

Value

list object with updated elements for seasonal adjustment or modeling diagnostic, titles, and the number of columns.

Examples

```
unemp_seas_list <- seasonal::seas(unemployment_list,
           x11 = '', slidingspans = '',
           arima.model = "(0 1 1)(0 1 1)",
           transform.function = 'log',
           regression.aictest = NULL,
           forecast.maxlead=60,
           check.print = c( 'pacf', 'pacfplot' ))
test_seas_update <-
     Filter(function(x) inherits(x, "seas"), unemp_seas_list)
test_acf <- lapply(test_seas_update, function(x) try(acf_test(x, return_this = 'both')))
test_names <- names(xt_data_new)
num_names <- length(test_names)
```

```
all_diag_list <- list(n = 0, diag = 0, titles = 0)
if (!is.null(test_acf)) {
    if (length(test_acf) < num_names) {
        this_acf_test <- fix_diag_list(test_acf, test_names, return_this = 'both')
    }
    all_diag_list <-
        update_diag_matrix(all_diag_list, test_acf, "ACF")
}
```

`update_vector` *Update vector.*

Description

Fill unspecified elements of a vector with the first element of the input series

Usage

```
update_vector(this_series = NULL, this_num = NULL)
```

Arguments

`this_series`	Original time series. This is a required entry.
`this_num`	Length of updated series. Must be more than the length of `this_series`. This is a required entry.

Value

an updated vector of length `this_num` augmented with the first value of the input series.

Examples

```
this_vector <- c(1,2)
updated_vector <- update_vector(this_vector, 4)
```

`which_error` *Check list for try errors*

Description

Checks list for try errors, returning element names with errors

Usage

```
which_error(this_list = NULL)
```

Arguments

`this_list`	list object which potentially contains `'try-error'` class objects.

Value

vector of the names of list elements that are 'try-error' class objects. If the list contains no 'try-error' class objects, the function will return NULL.

Examples

```
unemp_seas_list <-
  seasonal::seas(unemployment_list, slidingspans = '',
                 transform.function = 'log', forecast.maxlead = 36,
                 arima.model = '(0 1 1)(0 1 1)',
                 check.print = c( 'pacf', 'pacfplot' ))
unemp_seas_update <-
     Filter(function(x) inherits(x, "seas"), unemp_seas_list)
unemp_seas_errors <- which_error(unemp_seas_update)
```

---

xt_data_list *US Building Permits*

Description

A list object with 12 components of US Building Permits expressed as time series objects

Usage

```
xt_data_list
```

Format

A list object with 12 time series elements:

mw1u Midwest one family building permits

mwto Midwest total building permits

ne1u Northeast one family building permits

neto Northeast total building permits

so1u South one family building permits

soto South total building permits

we1u West one family building permits

weto West total building permits

us1u US one family building permits

us24 US 2-4 family building permits

us5p US 5+ family building permits

usto US total family building permits

xt_data_new *US Building Permits, One Family Buildings (new)*

Description

A list object of US One family Building Permits for four regions expressed as time series objects that end in October, 2006

Usage

```
xt_data_new
```

Format

A list object with 4 time series elements:

mw1u Midwest one family building permits

ne1u Northeast one family building permits

so1u South one family building permits

we1u West one family building permits

xt_data_old *US Building Permits, One Family Buildings (old)*

Description

A list object of US One family Building Permits for four regions expressed as time series objects that end in December, 2005

Usage

```
xt_data_old
```

Format

A list object with 4 time series elements:

mw1u Midwest one family building permits

ne1u Northeast one family building permits

so1u South one family building permits

we1u West one family building permits

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