Package 'critpath'

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Type Package

Title Setting the Critical Path

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Description Solving the problem of project management using CPM (Critical Path Method), PERT (Program Evaluation and Review Technique) and LESS (Least Cost Estimating and Scheduling) methods. The package sets the critical path, schedule and Gantt chart. In addition, it allows you to draw a graph with marked critical activities. For more information about project management, see: Taha H. A. (2017, ISBN:978-1-292-16554-7), Konarzewska I., Jewczak M., Kucharski A. (2020, ISBN:978-83-8220-112-3), Rama Murthy P. (2007, ISBN:978-81-224-2944-2).

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R topics documented:

`cpmexample1` *Dataset for the CPM method*

Description

Fictitious data that is used in the examples. In this dataset, the activities occur on the edges

Usage

```
cpmexample1
```

Format

A data frame composed of predetermined columns:

from starting activity node

to final activity node

label activity label

time duration of the activity

`lessexample1` *Dataset for the LESS method*

Description

Fictitious data that is used in the examples. In this dataset, the activities occur on the edges

Usage

```
lessexample1
```

Format

A data frame composed of predetermined columns:

from starting activity node

to final activity node

label activity label

time normal duration of the activity

bound_time the shortest duration of the activity

norm_cost normal cost of the activity

bound_cost boundary cost of the activity

`pertexample1` *Dataset for the CPM method*

Description

Fictitious data that is used in the examples. In this dataset, the activities occur on the edges

Usage

```
pertexample1
```

Format

A data frame composed of predetermined columns:

from starting activity node

to final activity node

label activity label

opt_time optimistic duration of activity

likely_time the most likely duration of the activity

pes_time pesimistic duration of activity

plot_alap *An ALAP chart*

Description

An ALAP chart

Usage

```
plot_alap(yourlist, bar_size = 10)
```

Arguments

yourlist	List of objects that make up the solution to the project management problem.
bar_size	Thickness of the bar drawn for activity (set to 10 by default).

Value

Draws an ALAP (activities start and finish As Late As Possible) chart broken down into critical ("CR") and non-critical ("NC") activities. Marks the slack of time.

Examples

```
x <- solve_pathAOA(cpmexample1, deterministic = TRUE)
plot_alap(x)
```

plot_asap *An ASAP chart*

Description

An ASAP chart

Usage

```
plot_asap(yourlist, bar_size = 10)
```

Arguments

yourlist	List of objects that make up the solution to the project management problem.
bar_size	Thickness of the bar drawn for activity (set to 10 by default).

Value

Draws an ASAP (activities start and finish As Soon As Possible) chart broken down into critical ("CR") and non-critical ("NC") activities. Marks the slack of time.

Examples

```
x <- solve_pathAOA(cpmexample1, deterministic = TRUE)
plot_asap(x)
```

`plot_crit_pathAOA` *Graph with marked critical path*

Description

Graph with marked critical path

Usage

```
plot_crit_pathAOA(yourlist, fixed_seed = 23)
```

Arguments

`yourlist`	Data frame describing the problem
`fixed_seed`	Optional parameter setting random seed to user value to get similar looking plots each time the function is run (set to 23 by default).

Value

The function draws the graph along with the critical path by means of the DiagrammeR package functions.

Examples

```
x <- solve_pathAOA(cpmexample1, TRUE)
plot_crit_pathAOA(x)
```

`plot_gantt` *A Gantt chart*

Description

A Gantt chart

Usage

```
plot_gantt(yourlist, bar_size = 10)
```

Arguments

`yourlist`	List of objects that make up the solution to the project management problem.
`bar_size`	Thickness of the bar drawn for activity (set to 10 by default).

Value

Draws a Gantt chart broken down into critical ("CR") and non-critical ("NC") activities. Marks the slack of time.

Examples

```
x <- solve_pathAOA(cpmexample1, deterministic = TRUE)
plot_gantt(x)
```

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plot_graphAOA *Graph without critical path*

Description

Graph without critical path

Usage

```
plot_graphAOA(input_data, fixed_seed = 23)
```

Arguments

input_data	Data frame describing the problem.
fixed_seed	Optional parameter setting random seed to user value to get similar looking plots each time the function is run (set to 23 by default).

Value

The function draws a relationship graph between activities without solving the problem and thus without marking critical activities.

Examples

```
plot_graphAOA(cpmexample1)
```

plot_norm *The cumulative distribution function of the normal distribution*

Description

The cumulative distribution function of the normal distribution

Usage

```
plot_norm(yourlist)
```

Arguments

yourlist	List of objects making up the solution to the project management problem

Value

Draws a graph of the normal distribution with the expected directive term from the PERT method and the standard deviation for this term. The chart also includes lines indicating the schedules of the risk-taker and the belayer.

Examples

```
y <- solve_pathAOA(pertexample1, deterministic = FALSE)
plot_norm(y)
```

plot_TC *Total cost change plot*

Description

Total cost change plot

Usage

```
plot_TC(your_list)
```

Arguments

your_list	List containing solved problem

Value

Based on the results of the LESS method, a graph of the total cost value of all iterations is created

Examples

```
z <- solve_lessAOA(lessexample1, 50, 15)
plot_TC(z)
```

solve_lessAOA *Determines the solution using the LESS method*

Description

Determines the solution using the LESS method

Usage

```
solve_lessAOA(input_data, ICconst, ICslope)
```

Arguments

input_data	Data frame containing the graph structure and activity durations. The frame consists of 7 columns (the order matters): 1. from The number of the node where the activity starts. 2. to The number of the node where the activity ends. 3. label Activity labels. 4. time Normal duration of the activity. 5. bound_time Boundary (the shortest possible) duration of activities. 6. norm_cost Normal costs. 7. bound_cost Boundary costs.
ICconst	Intercept of the indirect cost function.
ICslope	Slope of the indirect cost function.

Value

A list made of a graph and a result set.

Examples

```
z <-  solve_lessAOA(lessexample1, 50, 15)
```

solve_pathAOA *Finds a solution using CPM and PERT methods*

Description

Finds a solution using CPM and PERT methods

Usage

```
solve_pathAOA(input_data, deterministic = TRUE)
```

Arguments

`input_data` Data frame containing the structure of the graph and the duration of the activity. For the CPM method there will be 4 columns (the order is important, not the name of the column):

1. `from` The number of the node where the activity starts.
2. `to` The number of the node where the activity ends.
3. `label` Activity labels.
4. `time` Activities duration.

For the PERT method there will be 4 columns (the order is important, not the name of the column):

1. `from` The number of the node where the activity starts.
2. `to` The number of the node where the activity ends.
3. `label` Activity labels.
4. `opt_time` Optimistic duration of activities.
5. `likely_time` The most likely duration of the activity.
6. `pes_time` Pessimistic duration of activities.

`deterministic` A logical parameter specifying the solution method. If set to `TRUE` (default), the CPM method is used. If is set to `FALSE`, the PERT method is used.

Value

The list is made of a graph, schedule and selected partial results.

Examples

```
x <- solve_pathAOA(cpmexample1, deterministic = TRUE)
y <- solve_pathAOA(pertexample1, deterministic = FALSE)
```

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