Package ‘critpath’

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Type Package

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Description

Fictitious data that is used in the examples. 6 activities, 5 nodes. 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
**Dataset for the CPM method**

**Description**

Example from Miszczyńska D., Miszczyński M. "Wybrane metody badań operacyjnych" (2000, ISBN:83-907712-0-9). 10 activities, 8 nodes. In this dataset, the activities occur on the edges and a list of direct predecessors has been added.

**Usage**

**Format**

A data frame composed of predetermined columns:

- **label**: activity label
- **pred**: preceding activities
- **time**: duration of the activity

**Dataset for the LESS method**

**Description**

Fictitious data that is used in the examples. 6 activities, 5 nodes. In this dataset, the activities occur on the edges.

**Usage**

**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
lessexample2  
*Dataset for the LESS method*

**Description**

Example from Miszczyńska D., Miszczyński M. "Wybrane metody badań operacyjnych" (2000, ISBN:83-907712-0-9). In this dataset, the activities occur on the edges and a list of direct predecessors has been added.

**Usage**

lessexample2

**Format**

A data frame composed of predetermined columns:

- `label` activity label
- `pred` preceding activities
- `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 PERT method*

**Description**

Fictitious data that is used in the examples. 9 activities, 8 nodes. 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
Description

Example from Miszczyńska D., Miszczyński M. "Wybrane metody badań operacyjnych" (2000, ISBN:83-907712-0-9). 10 activities, 8 nodes. In this dataset, the activities occur on the edges and a list of direct predecessors has been added.

Usage

pertexample2

Format

A data frame composed of predetermined columns:

- **label**: activity label
- **pred**: preceding activities
- **opt_time**: optimistic duration of activity
- **likely_time**: the most likely duration of the activity
- **pes_time**: pesimistic duration of activity

### PERT_newprob

*Probability for the given directive term*

Description

Probability for the given directive term

Usage

PERT_newprob(new_DT, yourlist)

Arguments

- **new_DT**: The given project completion date. The parameter must be greater than zero.
- **yourlist**: List of objects that make up the solution to the project management problem.

Value

This function calculates the probability of completing the project within the time specified by the user. A normal distribution was assumed.

Examples

```r
y <- solve_pathAOA(pertexample1, deterministic = FALSE)
Pert_newprob(new_DT = 30, y)
```
**PERT_newtime**

A new directive term for any probability

**Description**
A new directive term for any probability

**Usage**
PERT_newtime(new_prob = 0.5, yourlist)

**Arguments**
- **new_prob**: Probability of the project completion. Default set to 0.5.
- **yourlist**: List of objects that make up the solution to the project management problem.

**Value**
This function computes a new directive term for a probability given by the user. A normal distribution was assumed.

**Examples**

```r
y <- solve_pathAOA(pertexample1, deterministic = FALSE)
Pert_newtime(new_prob = 0.3, y)
```

---

**plot_alap**

An ALAP chart

**Description**
An ALAP chart

**Usage**
plot_alap(yourlist, show_dummy = FALSE, bar_size = 10)

**Arguments**
- **yourlist**: List of objects that make up the solution to the project management problem.
- **show_dummy**: Decides whether dummy activities should be included in the chart. If so, set it to TRUE (set to FALSE by default).
- **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

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

Description

An ASAP chart

Usage

```r
plot_asap(yourlist, show_dummy = FALSE, bar_size = 10)
```

Arguments

- `yourlist` List of objects that make up the solution to the project management problem.
- `show_dummy` Decides whether dummy activities should be included in the chart. If so, set it to `TRUE` (set to `FALSE` by default).
- `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

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

A Gantt chart

Description

A Gantt chart

Usage

plot_gantt(yourlist, show_dummy = FALSE, bar_size = 10)

Arguments

yourlist List of objects that make up the solution to the project management problem.
show_dummy Decides whether dummy activities should be included in the chart. If so, set it to TRUE (set to FALSE by default).
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)

plot_graphAOA

A graph of connections between nodes

Description

A graph of connections between nodes

Usage

plot_graphAOA(input_data, predecessors = FALSE, solved = NULL, fixed_seed = 23)

Arguments

input_data Data frame describing the problem.
predecessors TRUE if the user data contains a list of immediately preceding activities
solved List of objects that make up the solution to the project management 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 graph showing dependencies between nodes. The "solved" parameter determines whether there is a critical path in the graph. In that case, you must solve the problem first. In the examples below, the function first draws the graph only on the basis of the data frame and then after determining the critical path.

Examples

```r
plot_graphAOA(cpmexample1)
x <- solve_pathAOA(cpmexample1, TRUE)
plot_graphAOA(solved = x)
```

---

**plot_norm**

*The cumulative distribution function of the normal distribution*

Description

The cumulative distribution function of the normal distribution

Usage

```r
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

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

**Total cost change plot**

**Description**
Total cost change plot

**Usage**

```r
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**

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

---

solve_lessAOA

**Determines the solution using the LESS method. Relationships between activities can be given as a list of predecessors or start and end node numbers.**

**Description**
Determines the solution using the LESS method. Relationships between activities can be given as a list of predecessors or start and end node numbers.

**Usage**

```r
solve_lessAOA(input_data, ICconst, ICslope, predecessors = FALSE)
```

**Arguments**

`input_data` Data frame containing the graph structure and activity durations. For the LESS method and start/end nodes you need 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.
For the LESS method and predecessors list you need 6 columns (the order matters):

1. **label** Activity labels.
2. **pred** List of predecessors.
3. **time** Normal duration of the activity.
4. **bound_time** Boundary (the shortest possible) duration of activities.
5. **norm_cost** Normal costs.
6. **bound_cost** Boundary costs.

**Value**

A list made of a graph and a result set.

**Examples**

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

**Description**

Finds a solution using CPM and PERT methods. Relationships between activities can be given as a list of predecessors or start and end node numbers.

**Usage**

```r
solve_pathAOA(
  input_data,
  deterministic = TRUE,
  predecessors = FALSE,
  pert_param = 0
)
```
Arguments

**input_data**
Data frame containing the structure of the graph and the duration of the activity. For the CPM method and start/end nodes you need 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 CPM method and predecessors list you need 3 columns (the order is important, not the name of the column):

1. *label* Activity labels.
2. *pred* List of predecessors.
3. *time* Activities duration.

For the PERT method and start/end nodes you need 6 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.

For the PERT method and predecessors list you need 5 columns (the order is important, not the name of the column):

1. *label* Activity labels.
2. *pred* List of predecessors.
3. *opt_time* Optimistic duration of activities.
4. *likely_time* The most likely duration of the activity.
5. *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.

**predecessors**
TRUE if the user data contains a list of immediately preceding activities. If set to FALSE (default), start and end nodes are used. If is set to TRUE, predecessors list is used.

**pert_param**
A parameter that controls the method of calculating the expected value and variance in the PERT method. 0 - classic formula (default), 1 - 1st and 99th percentile of the beta distribution, 2 - 5th and 95th percentile of the beta distribution, 3 - 5th and 95th percentiles of the beta distribution with modification by (Perry and Greig, 1975), 4 - Extended Pearson’s and Tukey’s formula (Pearson and Tukey, 1965), 5 - Golenko-Ginzburg’s full formula (Golenko-Ginzburg, 1988), 6 - Golenko-Ginzburg’s reduced formula (Golenko-Ginzburg, 1988), 7 - Farnum’s and Stanton’s formula (Farnum and Stanton, 1987).
**solve_pathAOA**

**Value**

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

**Examples**

```r
x <- solve_pathAOA(cpmexample1, deterministic = TRUE)
y <- solve_pathAOA(pertexample1, deterministic = FALSE)
x <- solve_pathAOA(cpmexample2, deterministic = TRUE, predecessors = TRUE)
y <- solve_pathAOA(pertexample2, deterministic = FALSE, predecessors = TRUE)
```
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