# CATIA V5 Knowledgeware

## Version 5 Release 16

KWA – Knowledge Advisor

(Revised from CATIA V5R4 training material- Light bulb exercise, 2000, Dassault Systemes)

A- 1

By Dickson Sham

Knowledge Advisor
User Interface

Knowledge Advisor

**Parameters**

**Rule –**
A list of actions to be performed if the condition is satisfied

**Relations (Formulas, Rules, Checks, Design Tables)**

**Check –**
Can display a warning to inform the user in case of violation

**Knowledge Inspector –** preview the results of changing parameter values

**Formula** – defines how a parameter is to be calculated with respect to other parameter(s)

**Design Table –** Each row of the table defines a configuration of a set of parameters

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Knowledge Advisor

# Design Process of Exercise 1

Socket Type is driven by a parameter

Create User parameters in a Part

Create a Rule in a Part

Create User parameters in a Assembly (Product)

Create Rules in the Assembly to link the
Assembly's parameters with the Parts' parameters

Create Checks

Use the Knowledge Inspector (**What-if** or **How-to**)

Create a Design Table
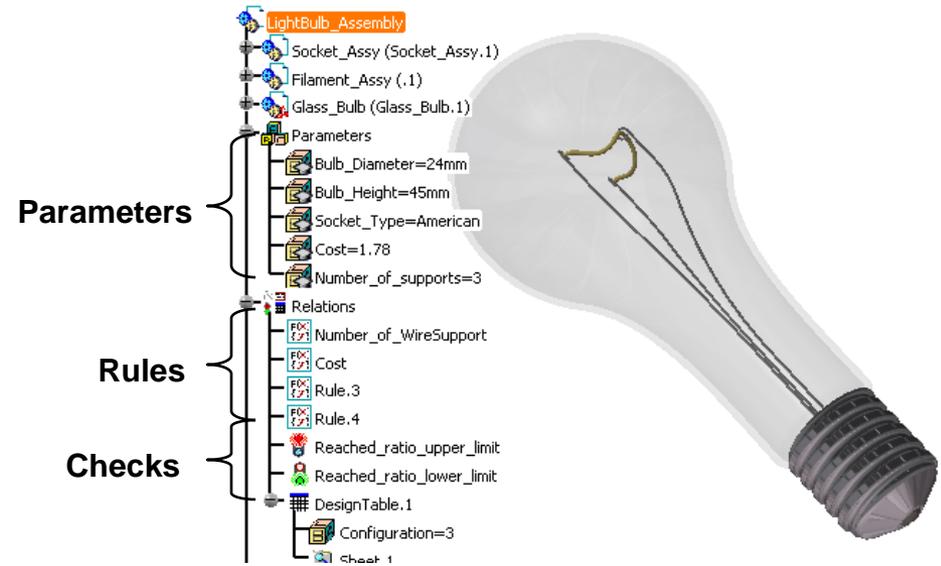
**Parameters**

**Rules**

**Checks**

**Design Table**

| Bulb_Diameter | Bulb_Height | Socket_Type |
|---|---|---|
| 24 | 34 | American |
| 24 | 40 | American |
| 24 | 45 | American |
| 32 | 45 | European |
| 32 | 32 | European |

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# Exercise 1

## Hightlights

- **Embed knowledge within the design of a light bulb assembly using formulas, rules and checks**

- **Define alternatives of design using a a Design Table**

- **Determine the impacts and dependencies of a parameter modification using the knowledge inspector**

## (1) Environment Settings :-

- Select "**Tools/options…/General/Parameters and Measure/Knowledge**" on the top menu

- Check "With Value" for Parameter Tree View

- Select "**Tools/options…/Infrastructure/Product Structure/Tree Customization**"

- Activate **Parameters** and **Relations**

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Knowledge Advisor
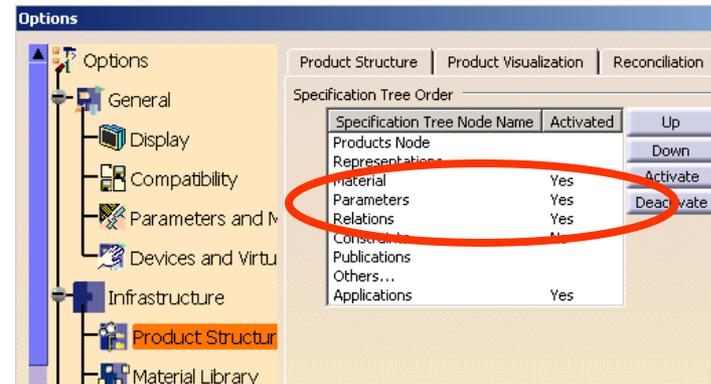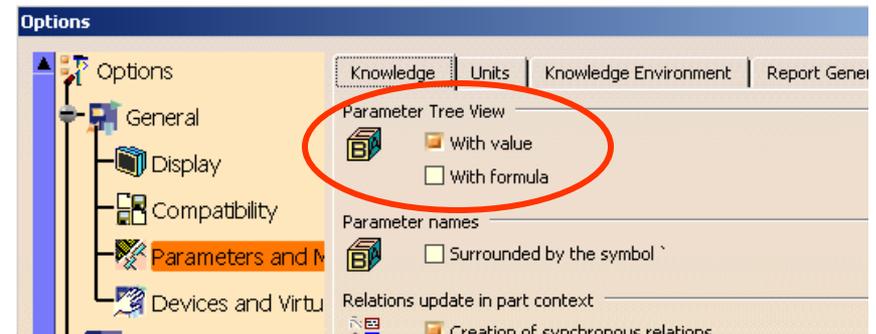
# Exercise 1

**(1) Con't :-**

- Select "**Tools/options…/Infrastructure/Part Infrastructure/Display**
- Check **Parameters** and **Relations**
- Click ok to complete

**(2) File Open :-**

- File Open **CATKWA_Socket.CATpart**
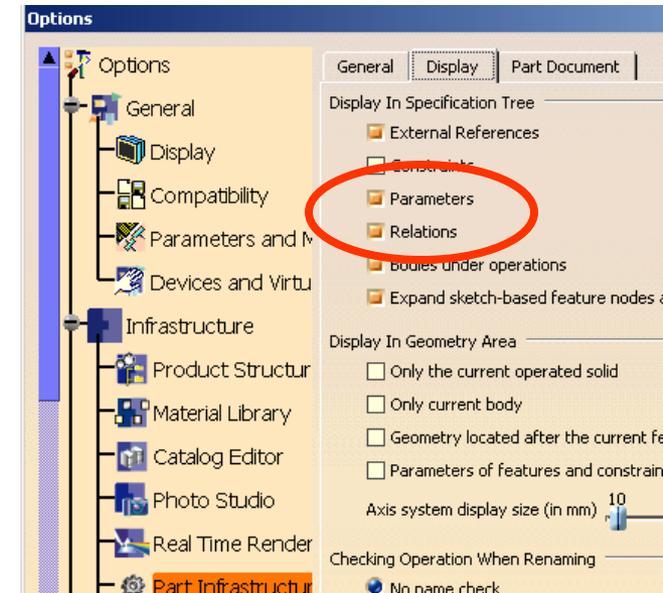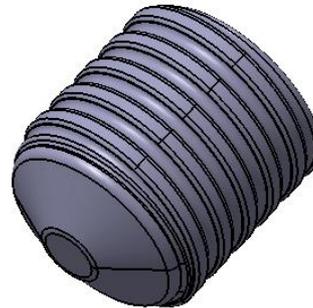
**(3) Create a User Parameter :-**

- Click "**Formula**" icon
- Click "**New Parameter of type**" (String) button
- Rename String.1 to "Type"
- Click ok to complete

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**Knowledge Advisor**

# Exercise 1

## (3) Con't :-

• Double-click "Type=" on the tree and right-click on the entry box

• Select "**Add Multiple Values…"**

• Enter "**American**" and press "Enter" on the keyboard

• Enter "**European**" and press "Enter" again

• Click ok to complete

• Click ok again
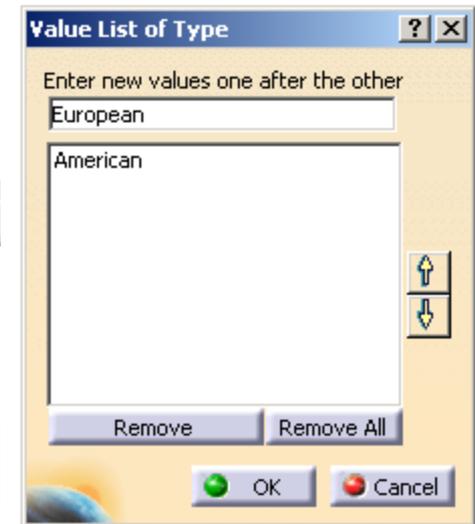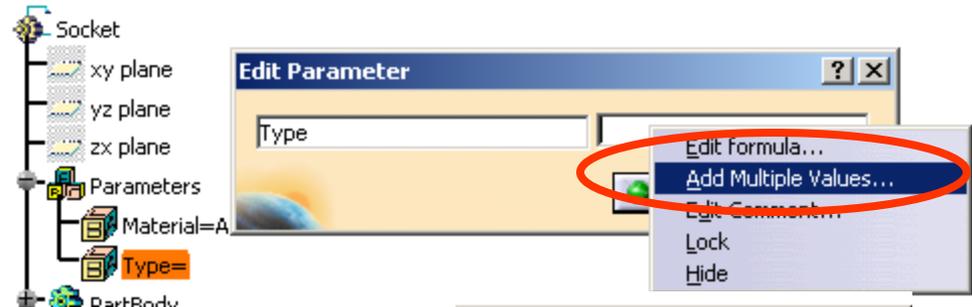
## (4) Create a Rule:-

• Select **"Start/Knowledgeware/Knowledge Advisor"** on the top menu

• Click "**Rule**" icon

• Click ok to accept the default name "Rule.1"
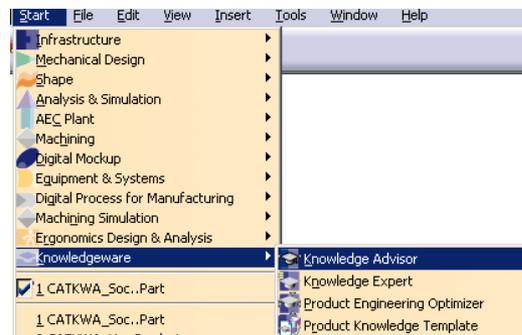
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# Exercise 1

**(4) Con't :-**

- Create an If-then-Else case as shown

- (If Type is equal to American, the screw thread will be activated but the Pin will be deactivated;

- If Type is equal to European, the case will be reversed)

- Click ok to complete. Rule.1 is now on the tree

**Rule Editor : Rule.1 Active**
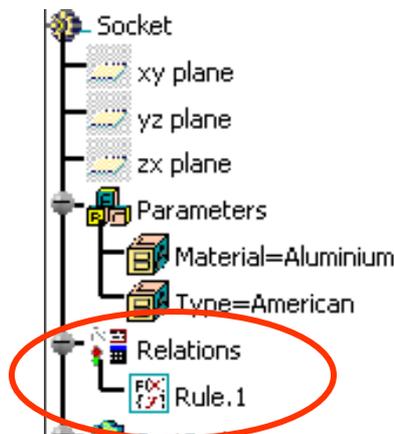
```
if Type =="American"
{
        PartBody\Slot.1\Activity=true
        PartBody\EdgeFillet.2\Activity =true
        PartBody\Pad.2\Activity =false
        PartBody\EdgeFillet.3\Activity =false
}
else
{
        PartBody\Slot.1\Activity=false
        PartBody\EdgeFillet.2\Activity =false
        PartBody\Pad.2\Activity =true
        PartBody\EdgeFillet.3\Activity =true
        }
```

| Dictionary | Members of Parameters | Members of All |
|---|---|---|
| Parameters | All | PartBody\Sketch.2\Activity |
| Keywords | Renamed parameters | PartBody\Sketch.2\AbsoluteAxis\Activity |
| Design Table | Boolean | PartBody\Sketch.2\Radius.5\Radius |
| Operators | Length | PartBody\Sketch.2\Radius.5\Activity |
| Pointer on value functions | Angle | PartBody\Pad.1\FirstLimit\Length |
| Point Constructors | Integer | PartBody\Pad.1\SecondLimit\Length |
| Law | CstAttr_Mode | PartBody\Pad.1\ThickThin1 |
| Line Constructors | String | PartBody\Pad.1\ThickThin2 |
| Circle Constructors | Pressure | PartBody\Pad.1\Activity |
| String | Real | PartBody\Slot.1\ThickThin1 |
| Direction Constructors | Density | PartBody\Slot.1\ThickThin2 |
| List | Inverse temperature | PartBody\Sketch.3\Activity |
| Measures | Plane | PartBody\Sketch.3\AbsoluteAxis\Activity |
| | Solid | |

OK    Apply    Cancel

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Socket
- xy plane
- yz plane
- zx plane
- Parameters
  - Material=Aluminium
  - Type=American
- Relations
  - Rule.1

**Knowledge Advisor**

# Exercise 1

**Type =American**

### (5) Test the Rule :-

- Double-Click "Type" on the tree
- Change it to American (we should see the screw thread)
- Change it to European (the screw thread should be deactivated but the pin appears)

**Type =European**

deactivated

deactivated
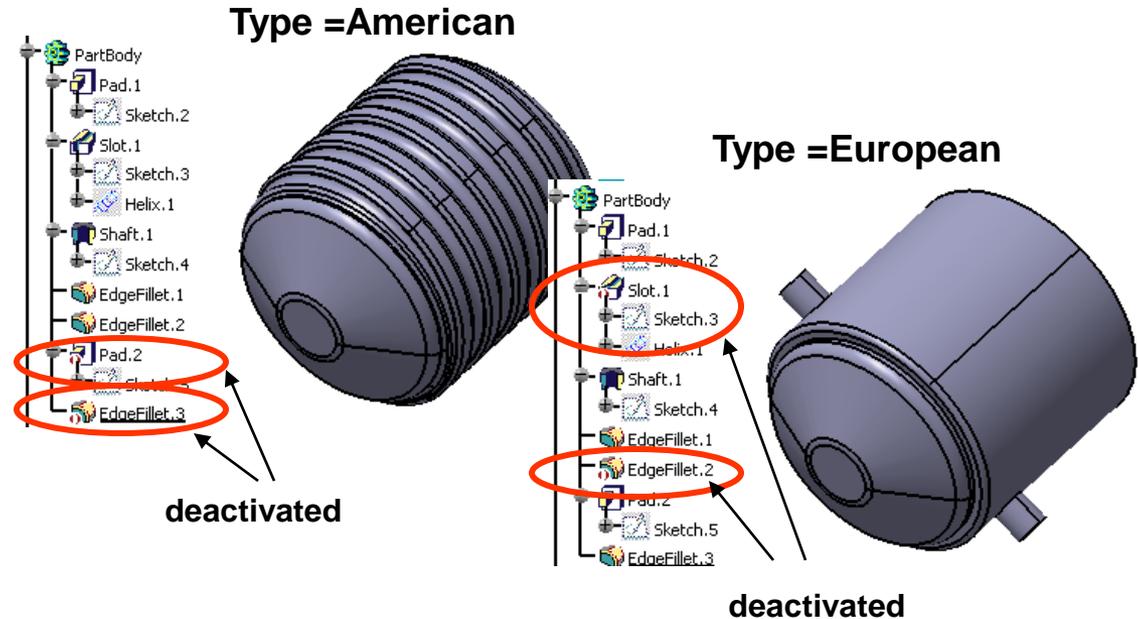
### (6) Save the File

### (7) Assembly File Open:-

- File Open "CATKWA_LightBulb_Assy_Start.CATProduct"

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**Knowledge Advisor**

# Exercise 1

## (8) Create User Parameters on Assembly Tree :-



- Click "**Formula**" icon
- Click "**New Parameter of type**" (Length) button
- Rename Real.1 to "Bulb_Diameter"

- Click "**New Parameter of type**" (Length) button again
- Rename Real.2 to "Bulb_Height"

- Click "**New Parameter of type**" (String) with (Multiple Values) button
- Type "American" and press "Enter"
- Type "European" and press "Enter"
- Rename String.1 to "Socket_Type"

- Click "**New Parameter of type**" (Real) button again
- Rename Real.3 to "Cost"

- Click "**New Parameter of type**" (Integer) button again
- Rename Integer.1 to "Number_of_supports"

- **Click ok to complete**

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**Then, change Bulb_Diameter to 24mm; Bulb_Height to 35mm**

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# Exercise 1

## (9) Create Rules on Assembly Tree :-

• Click "**Rule**" icon

• Rename as "Number_of_Wiresupport"

• Type in

```
/**/
if Bulb_Diameter >30 mm
{
        Number_of_supports  = 4
}
else  Number_of_supports = 3
```

• Click ok to complete

• Click "**Rule**" icon again

• Rename as "Cost"

• Type in

```
/**/
if Socket_Type  == "American"
{
        Cost= 0.25 + (Bulb_Diameter /50mm) +(Bulb_Height /50mm)+ (Number_of_supports * 0.05)
}

else if Socket_Type == "European"
{
        Cost= 0.20 + (Bulb_Diameter /50mm) +(Bulb_Height /50mm)+ (Number_of_supports * 0.05)
}
```

Reactive Feat...

LightBulb_Assembly
Socket_Assy (Socket_Assy.1)
Filament_Assy (.1)
Glass_Bulb (Glass_Bulb.1)
Parameters
Bulb_Diameter=24mm
Bulb_Height=35mm
Socket_Type=American
Cost=1.58
Number_of_supports=3
Relations
Number_of_WireSupport
Cost
Applications
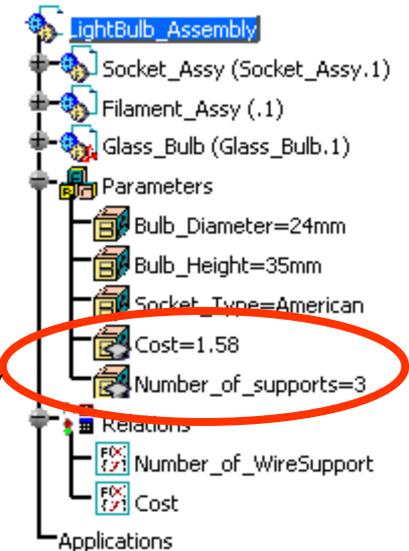
Now, the two parameters are controlled by the rules

• Click ok to complete                A- 10

# Exercise 1

**(9) Cont' :-**

• Click "**Rule**" icon

• Click ok to accept the default name

• Type in

```
Glass_Bulb\PartBody\Sketch.1\Offset.65\Offset =Bulb_Height
Glass_Bulb\Radius_Bulb =Bulb_Diameter /2
Socket\Type =Socket_Type
Filament_Support\WireSupport_Height =Glass_Bulb\PartBody\Sketch.1\Offset.65\Offset -(Bulb_Diameter /2)
```

• Click ok to complete

• Click "**Rule**" icon again

• Click ok to accept the default name

• Type in

• Click ok to complete
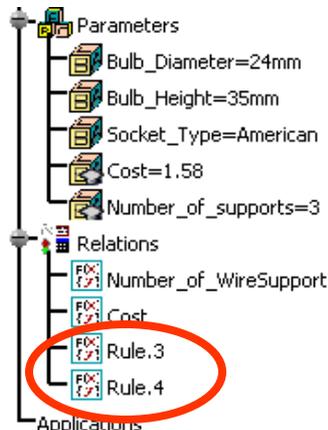
```
/**/
if Number_of_supports  == 3
{
        Filament_Support\PartBody\CircPattern.1\AngularNumber=3
        Filament_Support\PartBody\CircPattern.1\AngularSpacing=90deg
        `Filament\Geometrical Set.1\Point.4\Length` =1.5mm
        `Filament\Geometrical Set.1\Point.5\Length` =1.2mm
        `Filament\Geometrical Set.1\Point.6\Length` =0mm
        `Filament\Geometrical Set.1\Point.7\Length` =1.2mm
        `Filament\Geometrical Set.1\Point.8\Length` =1.5mm
}
if Number_of_supports  == 4
{
        Filament_Support\PartBody\CircPattern.1\AngularNumber=4
        Filament_Support\PartBody\CircPattern.1\AngularSpacing=60deg
        `Filament\Geometrical Set.1\Point.4\Length` =1.5mm
        `Filament\Geometrical Set.1\Point.5\Length` =0mm
        `Filament\Geometrical Set.1\Point.6\Length` =1.5mm
        `Filament\Geometrical Set.1\Point.7\Length` =0mm
        `Filament\Geometrical Set.1\Point.8\Length` =1.5mm
}
```

Parameters
- Bulb_Diameter=24mm
- Bulb_Height=35mm
- Socket_Type=American
- Cost=1.58
- Number_of_supports=3

Relations
- Number_of_WireSupport
- Cost
- Rule.3
- Rule.4

Applications

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Knowledge Advisor

# Exercise 1

## (9) Test the Rules :-

- Double-Click "Bulb_Diameter" on the tree and Enter 32mm
- Double-Click "Bulb_Height" on the tree and Enter 45mm
- Double-Click "Socket_Type" on the tree and Select  European
- (The workbench should be automatically switched to Assembly Design)
- Click "Update" icon

CLICK

The Bulb is resized; The number of filaments becomes 4; The socket is changed to be European
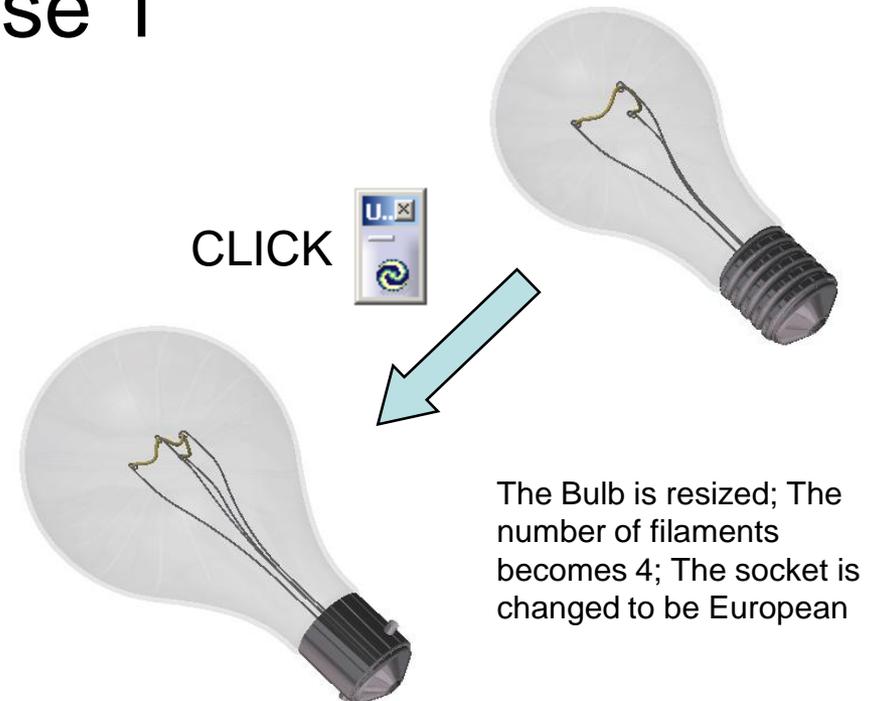
## (10) Create a Check :-

- Select **"Start/Knowledgeware/Knowledge Advisor"** on the top menu

- Click "**Check**" icon

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**Knowledge Advisor**
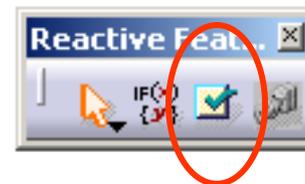
# Exercise 1

**(10) Cont' :-**

- Rename it as "Reached_Ratio_Upper_Limit"

- Click ok

- Type in : **Bulb_Height /Bulb_Diameter <1.7**

- Select "Warning" for Type of Check

- Click the message box and Type in: **Ratio has reached its upper limit!**

- Click ok to complete


- Click "**Check**" icon again

- Rename it as "Reached_Ratio_Lower_Limit"

- Click ok

- Type in : **Bulb_Height /Bulb_Diameter >1.125**

- Select "Warning" for Type of Check

- Click the message box and Type in: **Ratio has reached its lower limit!**

- Click ok to complete
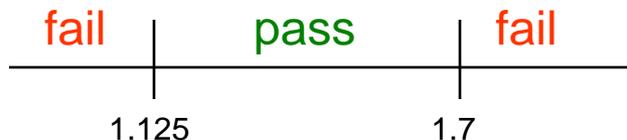
Green Light:
Current Ratio is
not out of upper
limit
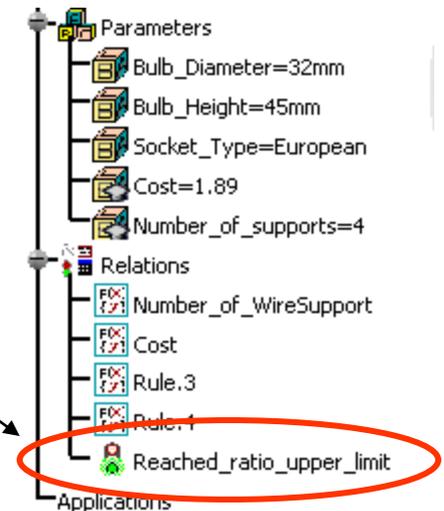
Both lights are
Green:

Current Ratio is
between the upper
limit and the lower
limit



fail   pass   fail

1.125    1.7   A- 13

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**Knowledge Advisor**
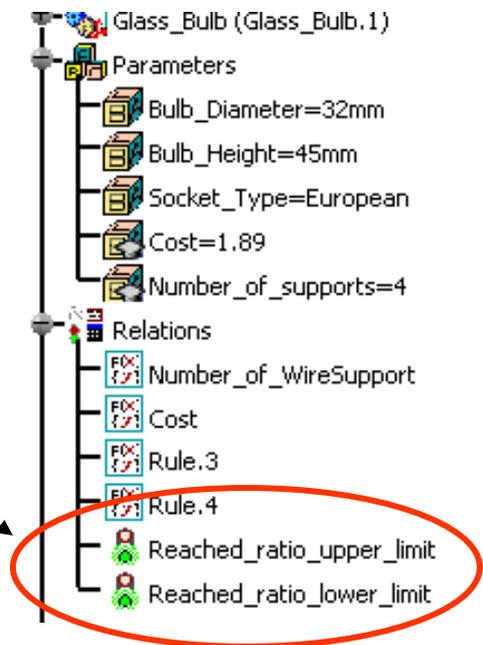
# Exercise 1

**(11) Using Knowledge Inspector :-**

- Click "**Knowledge Inspector**" icon

- Select "**What if**" as Agents (default)

- Select **Bulb_Height** under the Name heading

- Change the value from 45mm to <u>55mm</u>

- Click **Apply** button

- (A warning message pops out, saying that Ratio has reached its upper limit. The Check turns RED.)

- (We can see the new values of the related parameters on the list)

- Click **Cancel** button so that the change does not take effect.

## Knowledge Inspector

| Agents | Options | Filters |
|---|---|---|
| ● What If  ○ How To | ☐ Geometric Update  ☐ Show All Parameters | Filter Name : * |
| | | Filter Type : All |

| Dvn | Name | Value |
|---|---|---|
| | Socket_Type | European |
| | Bulb_Height | 55mm |
| | Bulb_Diameter | 32mm |
| | Filament_Support\Body.1\Sketch.1\Radius.12\Radius | 0.5mm |
| | Filament_Support\WireSupport_Radius | 4.8mm |

**Parameter**

Bulb_Height          Equals 55mm

**Then**

| Parameters | Relation Name | InitialVa... | Var | OldValue | Var | NewValue |
|---|---|---|---|---|---|---|
| Bulb_Height | | 45mm | = | 45mm | < | 55mm |
| ............. | ............. | .......... | ..... | ........ | ... | .......... |
| Relations\Reached_ratio_upp... | | true | = | true | > | false |
| Filament_Support\WireSuppor... | Rule.3 | 29mm | = | 29mm | < | 39mm |
| Filament_Support\Body.1\Ske... | WireSupport_Heig... | 3.625mm | = | 3.625mm | < | 4.875mm |
| Filament_Support\Body.1\Ske... | WireSupport_Heig... | 7.25mm | = | 7.25mm | < | 9.75mm |
| Filament_Support\Body.1\Ske... | WireSupport_Heig... | 9.667mm | = | 9.667mm | < | 13mm |
| Glass_Bulb\PartBody\Sketch.... | Rule.3 | 45mm | = | 45mm | < | 55mm |
| Cost | Cost | 1.89 | = | 1.89 | < | 2.09 |

Back    Forward

● OK    ● Apply    ● Cancel

Parameters
- Bulb_Diameter=32mm
- Bulb_Height=55mm
- Socket_Type=European
- Cost=2.09
- Number_of_supports=4

Relations
- Number_of_WireSupport
- Cost
- Rule.3
- Rule.4
- Reached_ratio_upper_limit
- Reached_ratio_lower_limit

Applications

**Reached_ratio_upper_limit**

⚠ Ratio has reached its upper limit!

OK

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**Knowledge Advisor**

# Exercise 1

## (12) Create a Design Table :-

- Click "**Design Table**" icon
- Type "Bulb_Catalog" as Name
- Click the dot for **Create a design table with current parameters values**
- Click ok to create
- Select the following parameters under the **Parameters to insert** heading and click the **Add** button after each selection:
  - Bulb_Diameter
  - Bulb_Height
  - Socket_Type
- Click ok to accept
- Name the file as "Bulb_Catalog"
- Click **Save** to save it

- Click "Edit Table…" button to open the Excel spreadsheet
- Key in the values as shown
- Save and close the file

- Click ok to complete the Design Table  A- 15
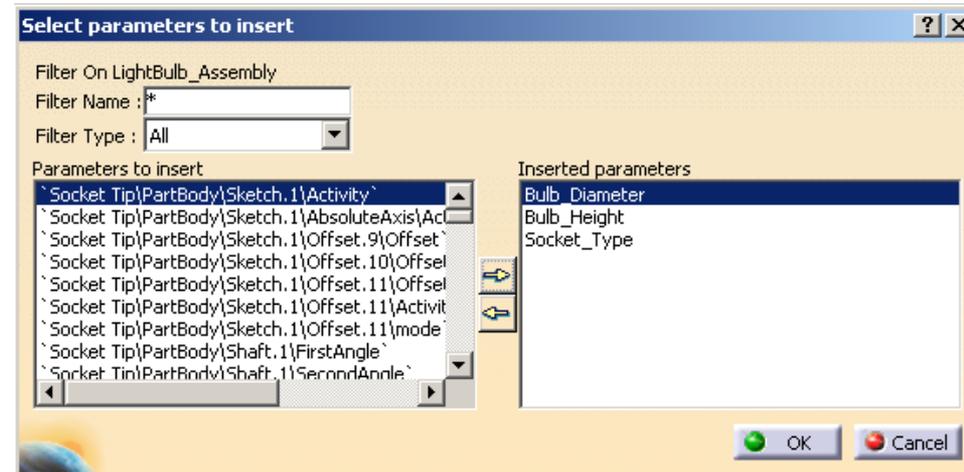
| Bulb_Diameter | Bulb_Height | Socket_Type |
|---------------|-------------|-------------|
| 24 | 34 | American |
| 24 | 40 | American |
| 24 | 45 | American |
| 32 | 45 | European |
| 32 | 32 | European |

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# Exercise 1

**(13) Test the Design Table :-**

- Select **Configuration.2** on Design Table

- Double-Click the Top of the product tree "LightBulb_Assembly"

- (The workbench is switched back to Assembly Design again)

- Click "Update" icon

- (Two Green lights: All Checks are passed)



Configuration.2

**Both Green**

- Select **Configuration.3** on Design Table

- *A warning message pops out (Ratio has reached its upper limit!)*

- Double-Click the Top of the product tree "LightBulb_Assembly"

- (The workbench is switched back to Assembly Design again)

- Click "Update" icon

- (One Red, One Green: Ratio reached its upper limit)



Configuration.3

Reached_ratio_upper_limit

Ratio has reached its upper limit!

OK

**One Red**, **One Green**

END of Exercise 1      A- 16

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