Open Command-oriented Geometric Graphics Generator

OpenCG^3 Specification Version 0.2.10

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Command Tokens

Regular Expressions

$$\mathbb{N} \coloneqq \{\ \alpha \mid \alpha \in \texttt{[0-9]+}\ \}$$

$$\mathbb{R} \coloneqq \{\ \alpha \mid \alpha \in \texttt{[+\textbackslash{}-]?([0-9]*[.])?[0-9]+}\ \} \qquad \Rightarrow \mathbb{R} \supset \mathbb{N}$$

$$\mathbb{S} \coloneqq \{\ \alpha \mid \alpha \in \texttt{'(.*?)'|[.0-9A-Za-z+\textbackslash{}-]+}\ \} \qquad \Rightarrow \mathbb{S} \supset \mathbb{R}$$

$$\mathbb{W} \coloneqq \{\ \alpha \mid \alpha \in \texttt{[\textbackslash{}t]}\} \qquad \text{whitespace}$$

Descriptions

- The matching mechanism abides by the maximal munch rule.
- Each command is whitespace-insensitive except being quoted by a pair of single quotation marks (`'`).

Command Grammars

Context-Free Expansions

$$\mathbf{C} \rightarrow \mathbf{A}\,\mathbf{C} \mid \texttt{;} \mid \texttt{EOL}$$

$$\mathbf{A} \rightarrow \mathbf{T}(\mathbf{A}) \mid \mathbf{V}(\mathbf{A}) \mid \mathbf{S}(\mathbf{A}) \mid \mathbf{L}(\mathbf{A}) \mid \mathbf{L}(\mathbf{A}, \mathbf{A}, \cdots, \mathbf{A}) \mid \mathbb{N} \mid \mathbb{R} \mid \mathbb{S}$$

$$\begin{array}{l||l}
\mathbf{T}(\Pi) \equiv \Pi : n\,) \rightarrow \texttt{(}\ \Sigma(\Pi, n)\ \texttt{)} & \\
\mathbf{V}(\Pi) \equiv \Pi : n\,\rangle \rightarrow \texttt{<}\ \Sigma(\Pi, n)\ \texttt{>} & \Sigma(\Pi, n) \rightarrow \overbrace{\Pi\ \cdots\ \Pi}^{n \text{ items}} \qquad \text{(identical)} \\
\mathbf{S}(\Pi) \equiv \Pi : n\,\} \rightarrow \texttt{\{}\ \Sigma(\Pi, n)\ \texttt{\}} & \mathbf{L}(\Pi) \equiv \mathbb{L}\,[\,\Pi : n\,] \rightarrow \texttt{[}\ \Sigma(\Pi, n)\ \texttt{]}
\end{array}$$

$$\mathbf{L}(\Pi_1, \Pi_2, \cdots, \Pi_{n-1}, \Pi_n) \equiv \mathbb{L}\,[\,\Pi_1\,\Pi_2 \cdots \Pi_{n-1}\,\Pi_n\,] \rightarrow \texttt{[}\ \Pi_1 \cdots \Pi_n\ \texttt{]}$$

Descriptions

- Each command starts from $\mathbf{C}$ and ends with a `;` or an `EOL`.
- Non-terminal symbol expansions are prior than function expansions except that symbols are used for describing arguments of a command.

Command Parsing

Escape Sequence

- `\x` is an escape sequence.
- If `x` is `\`, then it is treated as a single backslash.
- If `x` is `EOL` which may vary from platforms, then the sequence is omitted.
- Otherwise, the sequence is ignored and triggers a warning by default.

Error Handling

- Physical lines are separated by an `EOL`.
- Logical lines are separated by either a semicolon or an unescaped `EOL`.
- If the command cannot be parsed by the grammar, then all the characters on the same logical line will be discarded.

System Hierarchy

Classes

- Classes are split into two categories, top and bottom.
- Top classes are class window, class camera, and data classes.
- Bottom classes are class attrib and class group.
- Data classes are split into primitive classes and compound classes.
- Primitive classes are class point, etc.
- Compound classes are class line, class polygon, etc.

Objects

- An object is instantiated from a class aforementioned.
- An object has an unique name throughout the category of its class.

Relations

- References are bidirectional and can be created or deleted via commands.

Perspective Projection

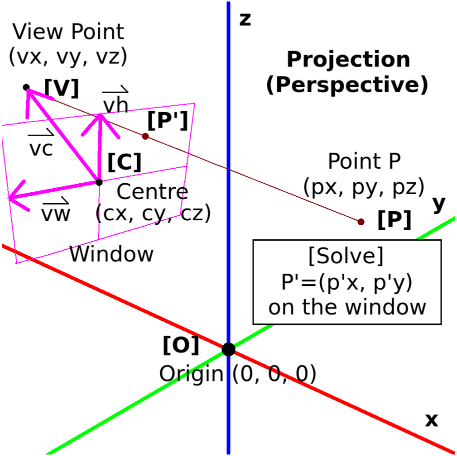

Figure: Projection in Euclidean $\mathbb{R}^3$ Space

Create a Window

Command

$$\texttt{create window}\ \ \underline{\mathbb{S}\ \ \underline{\mathsf{label}^{\mathsf{w}}}} \tag{1}$$

Parametres

- $\underline{\mathsf{label}^{\mathsf{w}}}$: the name of the object instantiated from the class window

Examples

```
create window main
```

Delete a Window

Command

`delete window` $\mathbb{S}$ label^{w} $\mathbb{S}$ string (2)

Parametres

- label^{w} : the name of the object instantiated from the class window
- string : the text printed right after exiting the session

Examples

```
delete window main
delete window main 'Have a nice day.'
```

Create a Camera

Command

$$\texttt{create camera}\ \ \underline{\underline{\mathbb{S}\ \underline{\text{label}^{\text{c}}}}}\ \ \underline{\underline{\mathbb{R}:3)\ \underline{\text{centre}}}}\ \ \underline{\underline{\mathbb{R}:3\rangle:2)\ \underline{\text{plane}}}}\ \ \underline{\underline{\mathbb{R}:3\rangle\ \underline{\text{sight}}}} \tag{3}$$

Parametres

- $\underline{\text{label}^{\text{c}}}$: the name of the object instantiated from the class camera
- $\underline{\text{centre}}$: the world coordinate (c_x, c_y, c_z) of the centre of the viewport
- $\underline{\text{plane}}$: the horizontal and the vertical vertors $(\vec{v_w}, \vec{v_h})$ of the viewport
- $\underline{\text{sight}}$: the reverse line of sight $\vec{v_c}$ from $\underline{\text{centre}}$ to the camera

Examples

```
create camera z-top (0 0 1) (<1 0 0> <0 1 0>) <0 0 1>
```

Select a Camera

Command

$$\texttt{select camera}\ \underline{\mathbb{S}\ \underline{\text{label}^{\text{c}}}}\ \underline{\mathbb{S}\ \underline{\text{label}^{\text{w}}}} \tag{4}$$

Parametres

- $\underline{\text{label}^{\text{c}}}$: the name of the object instantiated from the class camera
- $\underline{\text{label}^{\text{w}}}$: the name of the object instantiated from the class window

Examples

```
select camera z-top main
```

Create Points

Command

$$\texttt{create point}\quad \underline{\mathbb{S}\ \ \underline{\mathsf{label}^{\mathsf{p}}} : \}}\qquad \underline{\mathbb{R} : 3)\ \underline{\mathsf{coord}}} \tag{5}$$

$$\texttt{create point}\quad \underline{\mathbb{S}\ \ \underline{\mathsf{label}^{\mathsf{p}}} : \geqslant n\,)}\ \ \underline{\mathbb{R} : 3)\ \underline{\mathsf{coord}} : n\,)} \tag{6}$$

Parametres

- $\underline{\mathsf{label}^{\mathsf{p}}}$: the name of the object instantiated from the class point
- $\underline{\mathsf{coord}}$: the world coordinate (p_x, p_y, p_z) of the object named $\underline{\mathsf{label}^{\mathsf{p}}}$

Examples

```
create point 'origin'   (0 0 0)
create point {X-1 X-2}  (1 0 0)
create point (Y-1 Z-1) ((0 1 0)(0 0 1))
```

Delete Points

Command

$$\texttt{delete point} \quad \underline{\mathbb{S}\ \ \underline{\mathsf{label}^{\mathsf{p}}}\ :\ \}} \tag{7}$$

Parametres

- $\underline{\mathsf{label}^{\mathsf{p}}}$: the name of the object instantiated from the class point

Examples

```
delete point  origin
delete point {origin 'random-point'}
```

Create Attributes

Command

$$\texttt{create attrib}\ \underline{\mathbb{S}\ \underline{\text{attrib}} : \}}\ \ \underline{\mathbb{L}\,[\,\mathbb{L}\,[\,\mathbb{S}\ \underline{\text{class}^{t}}\ \mathbb{S}\ \underline{\text{property}}\ \mathbf{A}\ \underline{\text{value}}\,] :]} \tag{8}$$

$$\texttt{create attrib}\ \underline{\mathbb{S}\ \underline{\text{attrib}} :)}\ \ \underline{\mathbb{L}\,[\,\mathbb{L}\,[\,\mathbb{S}\ \underline{\text{class}^{t}}\ \mathbb{S}\ \underline{\text{property}}\ \mathbf{A}\ \underline{\text{value}}\,] :]} \tag{9}$$

Parametres

- attrib : the name of the object instantiated from the class attrib
- class^{t} : the name of one of the top classes
- property : the property of the object of class^{t}
- value : the value of property in designated format

Examples

```
create attrib (magenta dashed-and-translucent-green) \
[[point fill-hsv (300 1.0 1.0)] \
 [line style dashed] [line fill-rgba [(0 255 0) 0.5]]]
```

Attach Attributes

Command

$$\texttt{attach attrib}\ \ \underline{\mathbb{S}\ \ \underline{\text{attrib}} :)}\ \ \underline{\mathbb{S}\ \ \underline{\text{label}} : \}} \tag{10}$$

$$\texttt{attach attrib}\ \ \underline{\mathbb{S}\ \ \underline{\text{attrib}} :)}\ \ \underline{\mathbb{S}\ \ \underline{\text{label}} :)} \tag{11}$$

Parametres

- attrib : the name of the object instantiated from the class attrib
- label : the name of the object instantiated from one of the top classes

Examples

```
attach attrib  red          point-0
attach attrib (red large)   point-1
attach attrib  blue        {point-2 rect-0}
attach attrib (5px black)  {point-3 circ-0}
attach attrib (red thick)  (point-4 line-0 triangle-0)
```

Assign Operations

Command

`assign operat` $\underline{\mathbb{S}\ \text{action}}$ $\underline{\mathbb{S}\ \text{class}}$ $\underline{\mathbb{N}\ \text{repeat}\ [= \infty]}$ (12)

Parametres

- action : the name of the corresponding action of class
- class : the name of one of the classes
- repeat : the amount of the commands emitting operation names

Examples

```
assign operat create point 2
x-axis (1 0 0)
y-axis (0 1 0)
// Back To Normal
```