

# TikZ Tutorial

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# What Is TikZ?

- PGF: Portble Graphics Format (or “pretty, good, functional”)
- Tikz: Tikz ist *kein* Zeichenprogramm
- Allows creation of vector graphic schemes, charts, diagrams, ...
- Placed inline — ● in the middle of text
- In floats

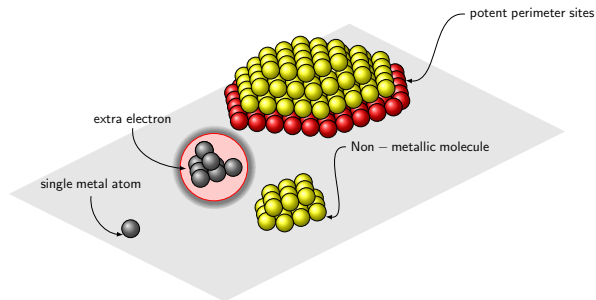


Figure: A tikzpicture

# The Good and the Bad

- Pros
  - Programatically draw with exact precision
  - Consistent typography
  - Very fast for simple graphics
- Cons
  - Steep learning curve
  - No WYSIWYG
  - Changes require recompile

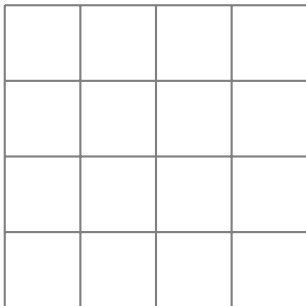
# TONS of help online

- Manual and primer: [www.ctan.org/pkg/pgf](http://www.ctan.org/pkg/pgf)
  - Search the document! e.g. search `/tikz/every node`
- Huge example repository: [www.texample.net/tikz/](http://www.texample.net/tikz/)
- Vibrant community for specific help: [tex.stackexchange.com/](http://tex.stackexchange.com/)

*Google is your best friend!*  
(try searching for “tikz arrow head size”)

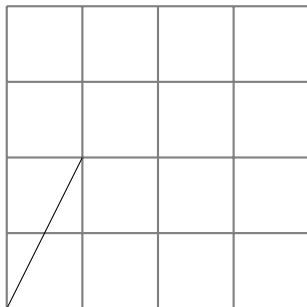
## Example: Drawing a Path

```
\draw[help lines, thick] (0,0) grid (4,4);
```



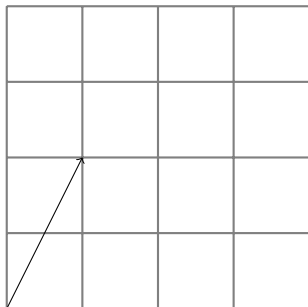
## Example: Drawing a Path

```
\draw[help lines, thick] (0,0) grid (4,4);  
\draw (0,0) -- (1,2);
```



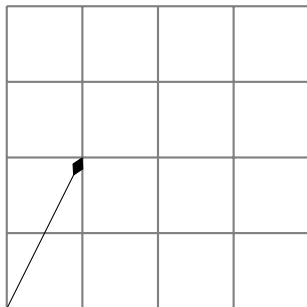
## Example: Drawing a Path

```
\draw[help lines, thick] (0,0) grid (4,4);  
\draw[->] (0,0) -- (1,2);
```



## Example: Drawing a Path

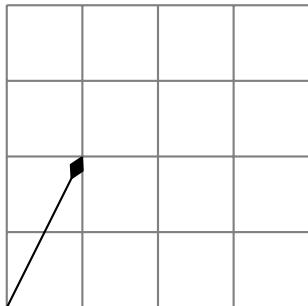
```
\draw[help lines, thick] (0,0) grid (4,4);  
\draw[->,>=diamond] (0,0) -- (1,2);
```





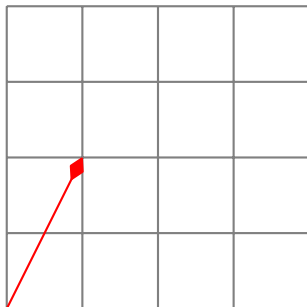
## Example: Drawing a Path

```
\draw[help lines, thick] (0,0) grid (4,4);  
\draw[->,>=diamond,thick] (0,0) -- (1,2);
```



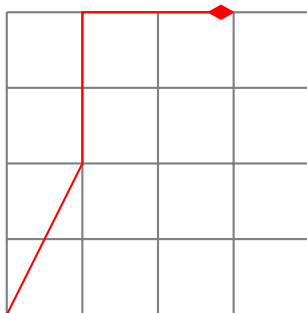
## Example: Drawing a Path

```
\draw[help lines, thick] (0,0) grid (4,4);  
\draw[->,>=diamond,thick,red] (0,0) -- (1,2);
```



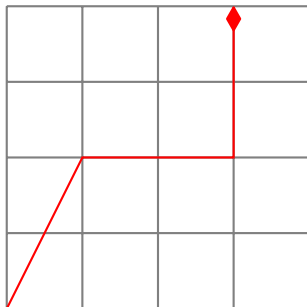
## Example: Drawing a Path

```
\draw[help lines, thick] (0,0) grid (4,4);  
\draw[->,>=diamond,thick,red] (0,0) -- (1,2) -| (3,4);
```



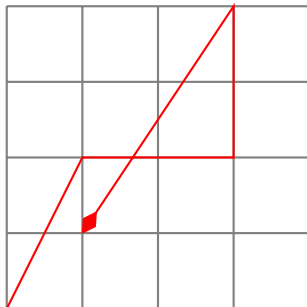
## Example: Drawing a Path

```
\draw[help lines, thick] (0,0) grid (4,4);  
\draw[->,>=diamond,thick,red] (0,0) -- (1,2) |- (3,4);
```



## Example: Drawing a Path

```
\draw[help lines, thick] (0,0) grid (4,4);  
\draw[->,>=diamond,thick,red] (0,0) -- (1,2) -| (3,4) -- (1,1);
```

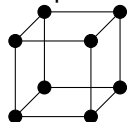


# TikZ Core Concepts: Points

- Points: (1cm,2pt)
- Relative points:

$$\begin{array}{cccc} (5,5) & +(1,0) & ++(1,1) & +(0,1) \\ \downarrow & \downarrow & \downarrow & \downarrow \\ (5,5) & (6,0) & (6,6) & (6,7) \end{array}$$

- Named locations: `node.south`
- 3D points: (1,1,2)



# Tikz Core Concepts: Idea of Paths

- Series of straight or curved lines
- `\path(2em,0) -- (0,0) -- (0,2em) -- cycle`



- Can *act* on paths: draw, fill, shade, clip



- Attributes can be applied mid-path

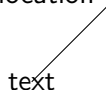


# TikZ Core Concepts: Key-Value Parameters, Nodes

- Attributes are set everywhere with `key=value`



- Nodes are inserted at the current position of a path, or at a specified location



- Nodes can have options too

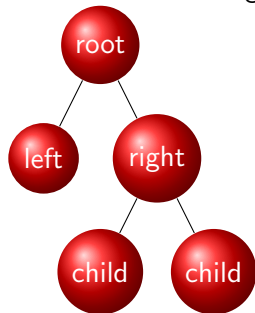


- Nodes can be named to reference their coordinates



# TikZ Core Concepts: Trees

- Nodes can be arranged in trees automatically



# TikZ Core Concepts: Scopes

- Attributes can be applied to all objects in a scope  

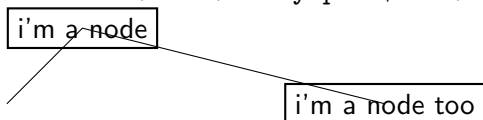
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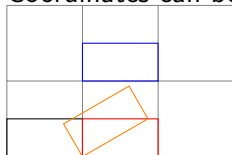
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- Check out `/tikz/every path`, and `/tikz/every node`



# Tikz Core Concepts: Transformations

- Coordinates can be transformed



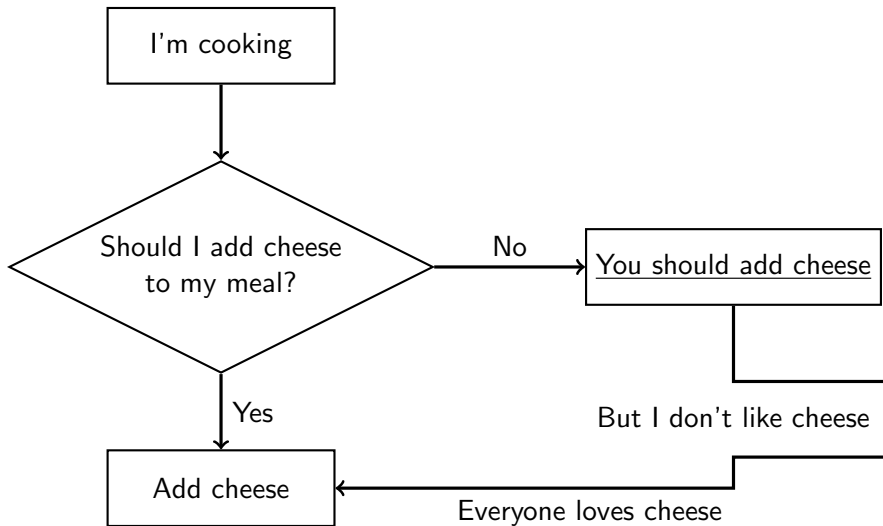
- Nodes can be moved too

i'm a node

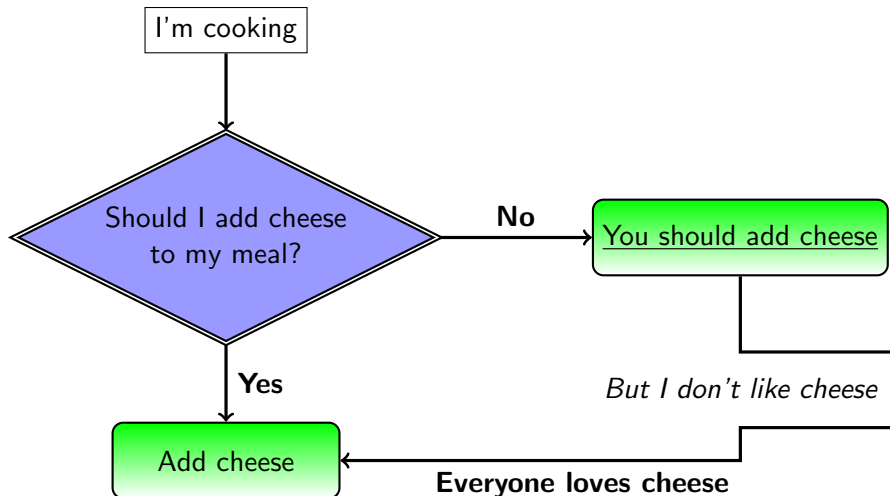


i'm a node too

## Example: Decision Tree



# Styles, Libraries, Colors

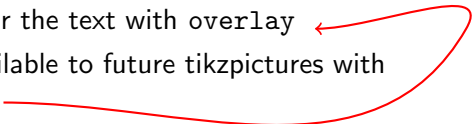


## Example: Hyperlinks

things  
are good  
and bad

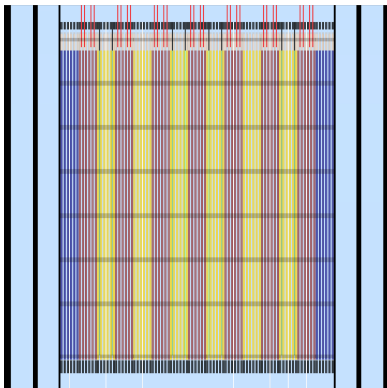
paths  
are cool

# Text Overlays

- You can use tikz over the text with overlay
  - Node names are available to future tikzpictures with remember picture
- 

# Stacked Figures in Beamer

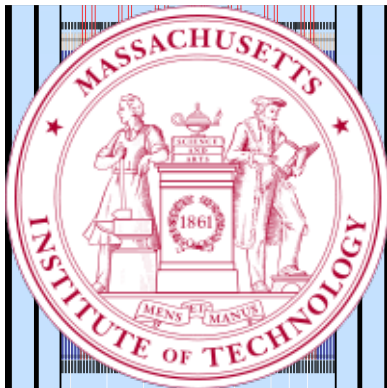
- Stacking pictures in Beamer is easy with overlays



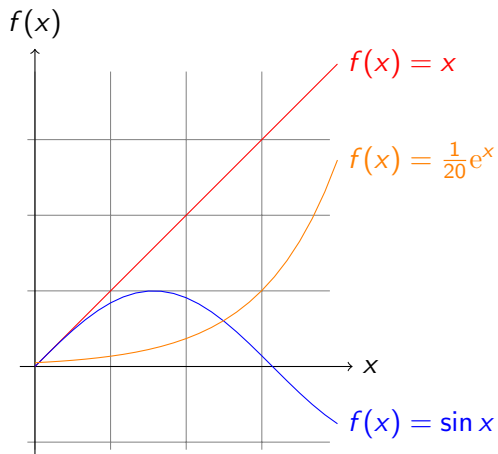


# Stacked Figures in Beamer

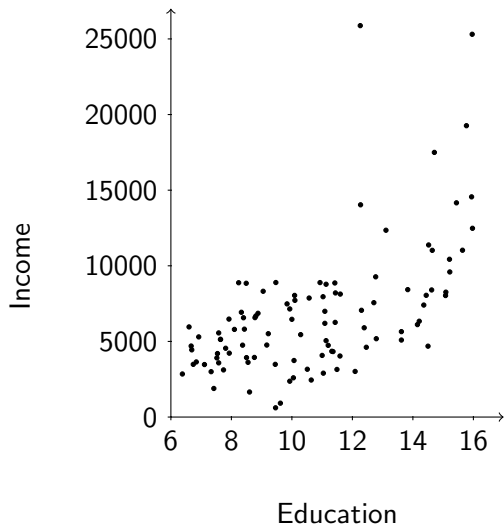
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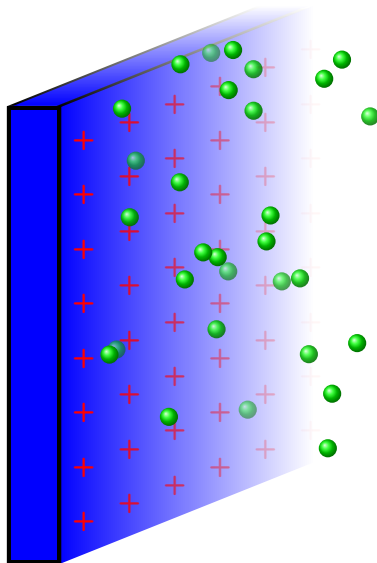
# Plotting Functions



# Plotting Data



## Example: Membrane and Ions



# Example: 3D Random Walk