latextool

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Contents

File: notes.tex

1 Notes and API and TODOs

long verbatim:

```
Testing pagebreak
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```

long console:

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ISSUE: The label in the rect is centered. The problem is the font for a character with greater height will appear lower than another. So for an array of rects of character, the base line of the labels are not the same.

ISSUE: The boundary line are drawn within the bounding box. So joining up rects would mean the common line will look thicker. DONE. See Rect2.

ISSUE:

- Joining rects in a uniform way to get hor and ver arrays and 2d arrays. Allows for containers with finite area, infinite horizontally, infinite vertically.
- Where to put first rect? What's the API? For hor array that grows to the right, only need top-left corner or bottom-left.or center-left. Maybe just specify the absolute corners of the firt rect?
- Allow each element of array to be any shape. Use BaseNode of course.

```
CLEAN UP OF PYTHON-LATEX DRAWING LIBRARY

latextool.py
latextool_basic.py

automata

courses/book/graph.py ----------------> projects/latextool/latextool.py
courses/ciss362-automata/resources/dfa/dfa-backup.py
courses/ciss362-automata/resources/dfa/dfa.py
courses/ciss362-automata/resources/dfa/graph/graph.py
projects/automata/dfa/dfa.py

linked list
courses/math325/n/latex_ds.py
projects/test-latex/xxx/latex_ds.py

array sorting

2d graphs:
courses/math325/n/makegraph/plot.py

================================================================================

automata
```

1d shapes: line or things made up of lines (broom?...) They have

- color
- style
- starting tip: dot, arrow (and arrow style)
- ending tip: dot, arrow (and arrow style)

2d shapes: rect, circle, They have

- boundary is a line. So it has boundary color and boundary style

- interior: color
- minipage

File: testmylist.tex

2 Test mylist

For comparison, this is enumerate:

- Line 1.
- line 2.
- line 3.

After enumerate.

This is with paragraphing within items:

- Line 1. This is a test. This is a test. This is a test. This is a test. This is a test. This is a test. This is a test. This is a test. This is a test.

  Next paragraph. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

- line 2.
- line 3.

A new paragraph after mylist.

`mylist` environment: Vertical spacing between items is set to 0. Also vertical and horizonal paragraph spacing in an item is set to 0.

Testing mylist:

- line 1
- line 2
- line 3

After mylist. Notice that there is no vertical spacing between items. However there is still vertical spacing before and after the mylist.

This is with paragraphing within items:

- Line 1. This is a test. This is a test. This is a test. This is a test. This is a test. This is a test. This is a test. This is a test.
  Next paragraph. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.
- line 2.
- line 3.

A new paragraph after above environment. The next environment is in a new paragraph.

- line 1
- line 2
- line 3

`tightlist` environment: This is the same as mylist except that the vertical spacing before and after the environment is removed. This does not work quite right is the environment is in a paragraph of its own – there will be a little extra vertical spacing before the environment.

Testing tightlist:

- line 1
- line 2
- line 3

After environment.

This is with paragraphing within items:

- Line 1. This is a test. This is a test. This is a test. This is a test. This is a test. This is a test. This is a test. This is a test.
  Next paragraph. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.
- line 2.
- line 3.

A new paragraph after above environment. The next environment is in a new paragraph.

- line 1
- line 2
- line 3

File: execute.tex

3 execute

The `execute` (in `latexbasic_tool.py`) function executes a python string as a program and the stdout is inserted into the latex file:

```
\begin{python}
from latextool_basic import execute
execute(r"""
print "hello world"
""")
\end{python}
```

Here's the result:
hello world

Note that there's some extra whitespace before the hello world. TODO: Need to figure a way to remove the whitespace.

The following does the same except that it first prints the python source in a framed verbatim box:

```
\begin{python}
from latextool_basic import execute
execute(r"""
print "hello world"
""", print_source=True)
\end{python}
```

If `debug` is set to `True`, there are three outputs: the python source, the stderr, and the stdout, all in framed verbatim boxes.

```
\begin{python}
from latextool_basic import execute
execute(r"""
print "hello world"
""", debug=True)
\end{python}
```

If there's an error in the python source, the output will be the same as if `debug` is set to `True`.

TEST: debug=True
PYTHON ERROR. See source, stderr, stdout below

```
print 'hello world'
```

```
hello world
```

```

```

TEST: debug=False

hello world

TEST: print source=True, debug=False

```
print 'hello world'
```

hello world

TEST: Error in source
PYTHON ERROR. See source, stderr, stdout below

```
print hello world
```

```

```

```
File "vwakdwxi.tmp.py", line 1
    print hello world
                    ^
SyntaxError: invalid syntax
```

```
File:  console.tex
```

4 console

NOTE: console function is now the same as the verbatim function.

Here's the spacing between paragraphs. Test test test test test test test test test test test test test test test test test test test test test test test test test test test test test test test.

There a console latex environment and a console function in `latextool_basic`.

TODO: Here's the console environment in latex:

```
hello world
```

Here's the console function call in the python environment:

```
hello world
```

Notice the the second case has a blank line before and after the console window. Fix it.

Here's a python environment that prints hello world, prints a console function return value, prints hello world:
hello world

```
hello world
```

hello world

Note that the spacing is different from the above.

The console is just like verbatim:

```
from latextool_basic import console
print console("hello world")
```

```
hello world
```

However it wraps around:

```
from latextool_basic import console
print console(r'''
line 1 ... hello world hello world hello world
line 2 ... hello world hello world hello world hello world hello world hell
o world hello world hello world hello world hello world hello world hello w
orld hello world hello world hello world hello world hello world hello worl
d hello world hello world hello world
'''.strip())
```

```
line 1 ... hello world hello world hello world
line 2 ... hello world hello world hello world hello world hello world hell
o world hello world hello world hello world hello world hello world hello w
orld hello world hello world hello world hello world hello world hello worl
d hello world hello world hello world
```

You can control the window width:

```
from latextool_basic import console
print console(r'''
line 1 ... hello world hello world hello world
line 2 ... hello world hello world hello world hello world hello world hell
o world hello world hello world hello world hello world hello world hello w
orld hello world hello world hello world hello world hello world hello worl
d hello world hello world hello world
'''.strip(), width=40)
```

```
line 1 ... hello world hello world hello
 world
line 2 ... hello world hello world hello
 world hello world hello world hello wor
ld hello world hello world hello world h
ello world hello world hello world hello
 world hello world hello world hello wor
ld hello world hello world hello world h
ello world hello world
```

You can specify the `wrapmarker` that is used to indicate a line wrap:

```
from latextool_basic import console
print console(r'''
line 1 ... hello world hello world hello world
line 2 ... hello world hello world hello world hello world hello world hell
o world hello world hello world hello world hello world hello world hello w
orld hello world hello world hello world hello world hello world hello worl
d hello world hello world hello world
'''.strip(), width=40, wrapmarker='---> ')
```

```
line 1 ... hello world hello world hello
--->  world
line 2 ... hello world hello world hello
--->  world hello world hello world hello wor
---> ld hello world hello world hello world h
---> ello world hello world hello world hello
--->  world hello world hello world hello wor
---> ld hello world hello world hello world h
---> ello world hello world
```

TODO: Fix non-pagebreak.

How to insert → symbol into verbatim area?

```
File:  python.tex
```

5 Python

There are vertical spacing issues with the python environment. Vertical spacing before and after the python environment has been removed from the python environment in `mypython.tex`.

TEST 1. Python environment with console function call. Line before python environment.

```
hello world
```

Line after the python environment.

TEST 2. One python environment with two console function calls. Line before python environment.

```
hello world 1
```

```
hello world 2
```

Line after the python environment. ISSUE: Note that the two frames are joined up. For the time being do not put two console environment immediately next to each other.

TEST 3. One python environment with two console function calls with one blank line between the console function calls. Line before python environment.

```
hello world 1
```

```
hello world 2
```

Line after the python environment. ISSUE: Note that the two frames are joined up. For the time being do not put two console environment immediately next to each other.

TEST 4. Two python environments with one console function call each. Line before python environment.

```
hello world 1
```

Line between the python environments.

```
hello world 2
```

Line after the second python environment.

TEST 5. This is the console environment in latex (no python).

```
hello world 1
```

Line after.

TEST 6. 1 console environment in latex (no python).

```
hello world 1
```

Line between.

```
hello world 2
```

Line after.

TEST 7. 2 console environments in latex next to each other.

```
hello world 1
```

```
hello world 2
```

Line after.

TEST 8. 1 verbatim environment in latex (no python).

```
hello world 1
```

Line after.

TEST 9. This is 2 Verbatim environments in latex (no python).

```
hello world 1
```

Line between.

```
hello world 2
```

Line after.

TEST 10. 2 Verbatim environments next to each.

```
hello world 1
```

```
hello world 2
```

Line after.

File: verbatim.tex

6 verbatim

The `verbatim` function allows you to create verbatim environments. Executing tex commands in the environment can be easier.

Example:

```
from latextool_basic import verbatim
print verbatim("hello world\nlorem ipsum")
```

```
hello world
lorem ipsum
```

You can have no frame:

```
from latextool_basic import verbatim
print verbatim("hello world\nlorem ipsum", frame=None)
```

```
hello world
lorem ipsum
```

You have line numbers on the left:

```
from latextool_basic import verbatim
print verbatim("hello world\nlorem ipsum", numbers='left')
```

```
1 hello world
2 lorem ipsum
```

You have line numbers on the right:

```
from latextool_basic import verbatim
print verbatim("hello world\nlorem ipsum", numbers='right')
```

```
hello world
lorem ipsum
```

You can escape to a tex command:

```
t = r"""
#include <iostream>

int main()
{
    std::cout << "hello world" << std::endl;
    return 0;
}
"""
from latextool_basic import verbatim
print verbatim(t.strip(), command=['redtext', 'iostream'])
```

```
#include <iostream>

int main()
{
    std::cout << "hello world" << std::endl;
    return 0;
}
```

You can specify a list of words for each tex command:

```
t = r"""
#include <iostream>

int main()
{
    std::cout << "hello world" << std::endl;
    return 0;
}
"""
from latextool_basic import verbatim
print verbatim(t.strip(), command=['redtext', ['iostream', 'std']])
```

```
#include <iostream>

int main()
{
    std::cout << "hello world" << std::endl;
    return 0;
}
```

You can use regular expressions:

```
t = r"""
#include <iostream>

int main()
{
    std::cout << "hello world" << std::endl;
    return 0;
}"""
from latextool_basic import verbatim
print verbatim(t.strip(), command=['redtext', '"[a-z ]*"'])
```

```
#include <iostream>

int main()
{
    std::cout << "hello world" << std::endl;
    return 0;
}
```

WARNING. Since search is by regular expression, be careful to escape metacharacters:

```
from latextool_basic import verbatim
t = r"""
#include <iostream>

int main()
{
    std::cout << "hello world" << std::endl;
    return 0;
}
"""

print verbatim(t.strip(), command=['textbox', r'main\(\)'])
```

```
#include <iostream>

int main()
{
    std::cout << "hello world" << std::endl;
    return 0;
}
```

You can also specify which part of the text should be escaped by specifying 3 numbers: the line number, the starting column number, and the ending column number.

```
t = r"""
#include <iostream>

int main()
{
    std::cout << "hello world" << std::endl;
    return 0;
}
"""
from latextool_basic import verbatim
print verbatim(t.strip(), command=['underline', [4, 4, 13]])
```

```
#include <iostream>

int main()
{
    std::cout << "hello world" << std::endl;
    return 0;
}
```

You can also specify a linenumber and a text:

```
t = r"""
#include <iostream>

int main()
{
    std::cout << "hello world" << std::endl;
    std::cout << "hello world" << std::endl;
    std::cout << "hello world" << std::endl;
    return 0;
}
"""
from latextool_basic import verbatim
print verbatim(t.strip(), command=['textred', [5, 'std::cout']])
```

```
#include <iostream>

int main()
{
    std::cout << "hello world" << std::endl;
    std::cout << "hello world" << std::endl;
    std::cout << "hello world" << std::endl;
    return 0;
}
```

You can have a list of tex commands:

```
from latextool_basic import verbatim
print verbatim("the answer is 42",
               commands=[
                         ['underline', 'the'],
                         ['textbox', ['answer','42']],
                        ]
              )
```

the answer is 42

You can also use the contents of a file like this:

```
from latextool_basic import verbatim
print verbatim(filename='helloworld.cpp')
```

`verbatim` is not exactly a verbatim function: there's line wrap. By default the width is set to 75. You can set the width to 40:

```
from latextool_basic import verbatim
print verbatim("abcdeabcdeabcdeabcdeabcdeabcdeabcdeabcdeabcde", width=10)
```

```
abcdeabcde
abcdeabcde
abcdeabcde
abcdeabcde
abcde
```

You can also specify a string to indicate line wrap like this:

```
from latextool_basic import verbatim
print verbatim("abcdeabcdeabcdeabcdeabcdeabcdeabcdeabcdeabcde", width=10,
               wrapmarker='---> ')
```

```
abcdeabcde
---> abcdeabcde
---> abcdeabcde
---> abcdeabcde
---> abcde
```

TEST 1. Test vertical spacing before and after verbatim(). Before.

```
hello world 1
hello world 2
```

After.

TEST 2. Test vertical spacing between two verbatim() in 1 python environment. Before.

```
frame 1
hello world 1
hello world 2
```

```
frame 2
hello world 1
hello world 2
```

After.

TEST 3. Same as before but print a blank line between the 2 verbatim()s. Before.

```
frame 1
hello world 1
hello world 2
```

```
frame 2
hello world 1
hello world 2
```

After.

TEST 4. Test vertical spacing between 2 python environments, each containing 1 verbatim(), no blank line between the python environments. Before.

```
frame 1
hello world 1
hello world 2
```

```
frame 2
hello world 1
hello world 2
```

After.

TEST 5. For user input in verbatim environment. Before.

```
Please enter x: 42
Please enter y and z: 43 44
Please enter login: jdoe
```

After.

File: textcolor.tex

7 Text Color

Testing \textred: hello world ... $x = 1$ ... $\int x\,dx = \frac{1}{2}x^2 + C$

$$\sin\theta = 0$$

Black again.

```
Testing \verb!\textred!:
\textred{hello world ... $x = 1$ ... $\int x \, dx = \frac{1}{2}x^2 + C$
\[
\sin \theta = 0
\]
}
Black again.
```

Testing \textblue: hello world ... $x = 1$ ... $\int x\,dx = \frac{1}{2}x^2 + C$

$$\sin\theta = 0$$

Black again.

Testing \textwhite:

Black again.

Using underline/textbox with textwhite:

$$\int x\,dx = \frac{1}{2}x^2 + C$$

$$\int x\,dx = \underline{\qquad\qquad}$$

$$\int x\,dx = \boxed{\qquad\qquad}$$

File: table.tex

8 table

```
from latextool_basic import table
print table({0:0, 1:1, 2:4, 3:9, 4:16})
```

0	0
1	1
2	4
3	9
4	16

```
from latextool_basic import table
print table([(1, 2, 3),
             (2, 2, 5),
             (5, 2),
             (-1, 2, 6),
             (1, 2, 3),
            ])
```

1	2	3
2	2	5
5	2	
-1	2	6
1	2	3

```
from latextool_basic import table
print table([(1, 2, 3),
             (2, 2, 5),
             (5, 2),
             (-1, 2, 6),
             (1, 2, 3),
            ],
            col_headings = ['$x$', '$y$', '$z$'])
```

x	y	z
1	2	3
2	2	5
5	2	
-1	2	6
1	2	3

```
from latextool_basic import table
print table([('',  2, 5,  8),
             ('', '', 3,  6),
             ('', '', '', 3),
             ('', '', '', '')
            ],
            col_headings = ['0', '2', '5', '8'],
            row_headings = ['0', '2', '5', '8'])
```

	0	2	5	8
0		2	5	8
2			3	6
5				3
8				

```
from latextool_basic import table
print table([('',  2, 5,  8),
             ('', '', 3,  6),
             ('', '', '', 3),
             ('', '', '', '')
            ],
            col_headings = ['0', '2', '5', '8'],
            row_headings = ['0', '2', '5', '8'],
            topleft_heading = r'$\Delta X$',
           )
```

ΔX	0	2	5	8
0		2	5	8
2			3	6
5				3
8				

Too few row headings:

```
from latextool_basic import table
print table([('',  2, 5,  8),
             ('', '', 3,  6),
             ('', '', '', 3),
             ('', '', '', '')
            ],
            col_headings = ['0', '2', '5', '8'],
            row_headings = ['0', '2'],
            topleft_heading = r'$\Delta X$',
           )
```

ΔX	0	2	5	8
0		2	5	8
2			3	6
				3

Too few col headings

```
from latextool_basic import table
print table([('',  2, 5,  8),
             ('', '', 3,  6),
             ('', '', '', 3),
             ('', '', '', '')
            ],
            col_headings = ['0', '2'],
            row_headings = ['0', '2', '5', '8'],
            topleft_heading = r'$\Delta X$',
           )
```

ΔX	0	2		
0		2	5	8
2			3	6
5				3
8				

Too few rows of data

```
from latextool_basic import table
print table([('',  2, 5,  8),
             ('', '', 3,  6),
            ],
            col_headings = ['0', '2', '5', '8'],
            row_headings = ['0', '2', '5', '8'],
            topleft_heading = r'$\Delta X$',
           )
```

ΔX	0	2	5	8
0		2	5	8
2			3	6
5				
8				

Too few rows of data

```
from latextool_basic import table
print table([('',  2, 5,  8),
             ('', '', 3,  6),
            ],
            col_headings = ['0', '2', '5', '8'],
            row_headings = ['0', '2', '5', '8'],
            topleft_heading = r'$\Delta X$',
           )
```

ΔX	0	2	5	8
0		2	5	8
2			3	6
5				
8				

Column headings only (no row headings). Note that topleft heading does not show.

```
from latextool_basic import table
print table([('',  2, 5,),
             ('', '', 3,),
             ('', '', '',),
             ('', '', '',)
            ],
            col_headings = ['0', '2', '5', '8'],
            topleft_heading = r'$\Delta X$',
           )
```

0	2	5	8
	2	5	
		3	

Row headings only (no column headings). Note that topleft heading does not show.

```
from latextool_basic import table
print table([('',  2, 5,),
             ('', '', 3,),
             ('', '', '',),
             ('', '', '',)
            ],
            row_headings = ['0', '2', '5', '8'],
            topleft_heading = r'$\Delta X$',
           )
```

0		2	5
2			3
5			
8			

File: plot.tex

9 Plot

All drawing go into a `Plot` object. The following should be in a python environment:

```
from latextool_basic import Plot, Circle
p = Plot()
p += Circle(x=1, y=1, r=1)
print p
```

or run in the `execute` function in a python environment:

```
from latextool_basic import execute

s = r"""
from latextool_basic import Plot, Circle
p = Plot()
p += Circle(x=1, y=1, r=1)
print p
"""
execute(s)
```

A centered tikzpicture environment is then inserted.

You can also add a pgf/tikz string to plot:

```
from latextool_basic import Plot, Circle
p = Plot()
p += Circle(x=1, y=1, r=1)
p.add("\draw ...")
print p
```

You can create and store a pdf image in the `tmp/` subdirectory. See next section.

File: grid.tex

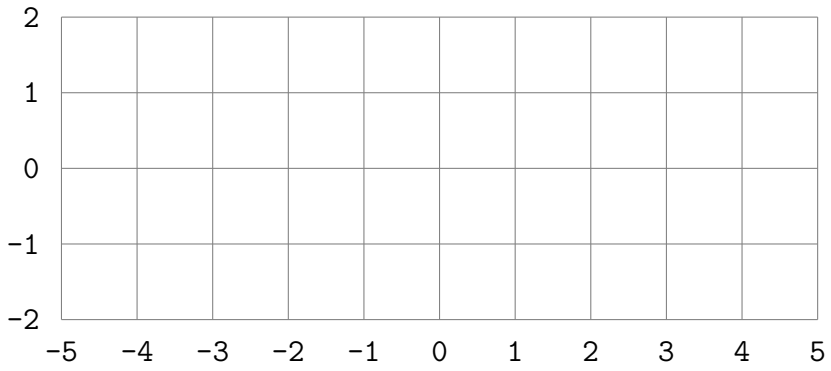
10 Grid

Plot with default grid.

```
from latextool_basic import *
p = Plot()
p += Grid()
print p
```

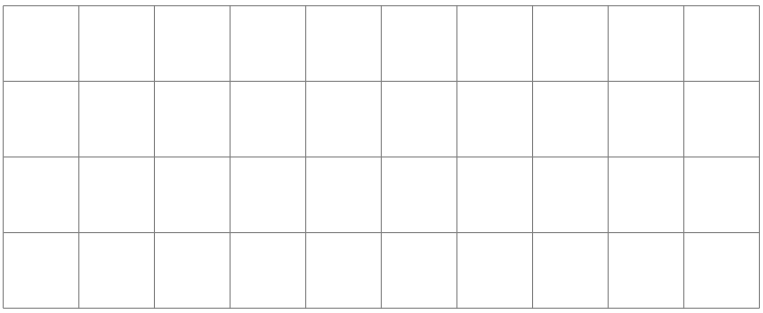
With object grid and bounding box:

```
from latextool_basic import *
p = Plot()
p += Grid(x0=-5, y0=-2, x1=5, y1=2)
print p
```



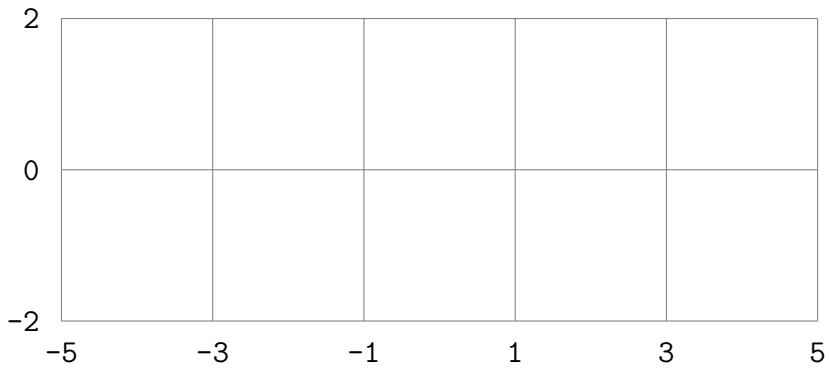
With `label_axis` set to false.

```
from latextool_basic import *
p = Plot()
p += Grid(x0=-5, y0=-2, x1=5, y1=2, label_axes=False)
print p
```



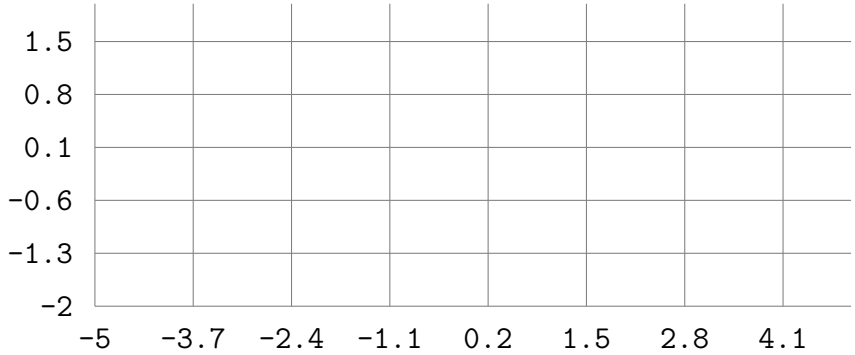
Example. dx = 2, dy = 2.

```
from latextool_basic import *
p = Plot()
p += Grid(x0=-5, y0=-2, x1=5, y1=2, dx=2, dy=2)
print p
```



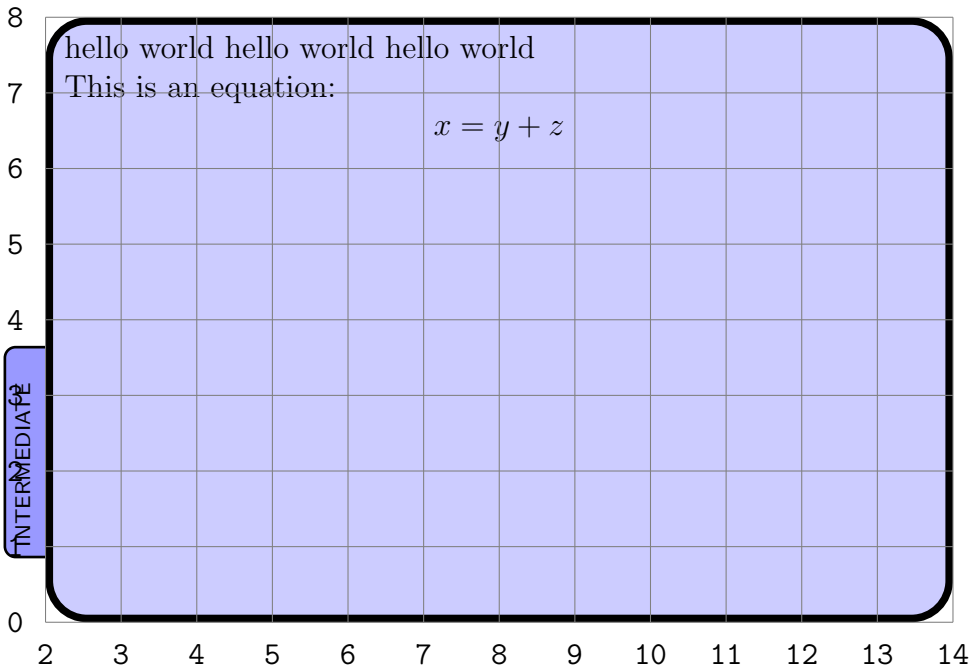
Example. dx = 1.3, dy = 0.7.

```
from latextool_basic import *
p = Plot()
p += Grid(x0=-5, y0=-2, x1=5, y1=2, dx=1.3, dy=0.7)
print p
```



File: tabrect.tex

11 tabrect

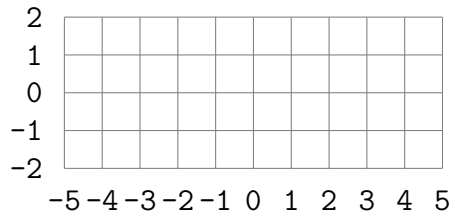



```
from latextool_basic import *
p = Plot()
minipage = r'''
hello world hello world hello world

This is an equation:
\[
x = y + z
\]
'''
p.add(tabrect, x0=2, y0=0, x1=14, y1=8, background='blue!20',
      innersep=0.5, linewidth=0.1, s=minipage)
p += Grid()
print p
```

File: scaling.tex

12 Scaling

```
from latextool_basic import *
p = Plot(scale=0.5)
p.add(grid, x0=-5, y0=-2, x1=5, y1=2)
print p
```



tmp/0cd209905ab75415b1e99c9ca01a5c1b.pdf

File: line.tex

13 Line

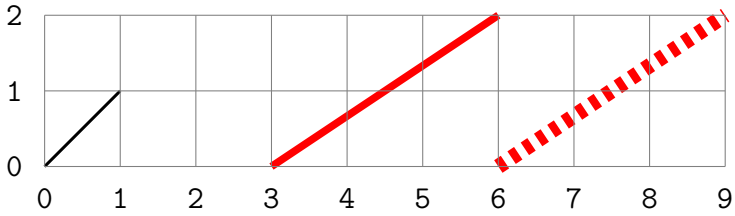
API:

```
from latextool_basic import Line, verbatim
print verbatim(Line.__doc__)
```

```
Line(
    x0=0, y0=0, x1=0, y1=0,
    points=None,
    linecolor='black',
    linewidth='',
    linestyle='',
    startstyle='',
    endstyle='',
    r=0,                    # radius of dot at start or end of line
)

    TODO: Path class
```

TEST 1. Test linecolor, linewidth, startstyle, endstyle

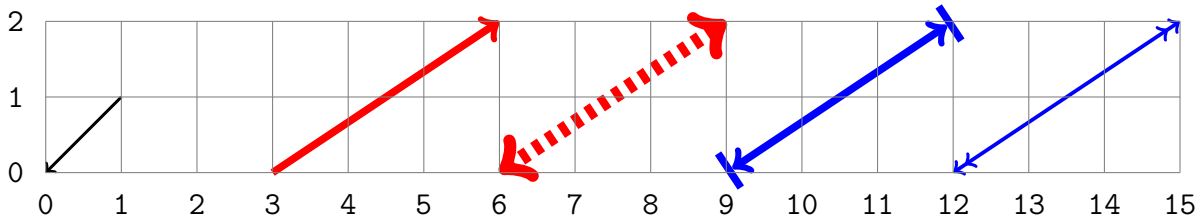
```
from latextool_basic import *
p = Plot()
p += Line(x0=0, y0=0, x1=1, y1=1)
p += Line(x0=3, y0=0, x1=6, y1=2, linecolor='red', linewidth=0.1)
p += Line(x0=6, y0=0, x1=9, y1=2, linecolor='red', linewidth=0.2,
                                  linestyle='dashed')
p += Grid()
print p
```



tmp/7d58b9267620a06511c3637f196482d4.pdf

TEST 2.

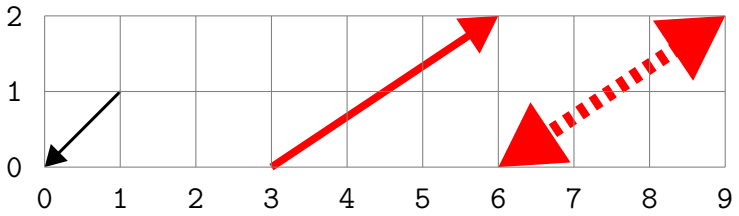
```
from latextool_basic import *
p = Plot()
p += Line(x0=0, y0=0, x1=1, y1=1, startstyle='>')
p += Line(x0=3, y0=0, x1=6, y1=2, linecolor='red', linewidth=0.1,
                                  endstyle='>')
p += Line(x0=6, y0=0, x1=9, y1=2, linecolor='red', linewidth=0.2,
                                  linestyle='dashed',
                                  startstyle='>', endstyle='>')
p += Line(x0=9, y0=0, x1=12, y1=2, linecolor='blue', linewidth=0.1,
                                   startstyle='>|', endstyle='>|')
p += Line(x0=12, y0=0, x1=15, y1=2, linecolor='blue', linewidth=0.05,
                                   startstyle='>>', endstyle='>>')
p += Grid()
print p
```



tmp/332f617f509364876493dcd76f5f1e67.pdf

TEST 3. Test `arrowstyle=triangle`.

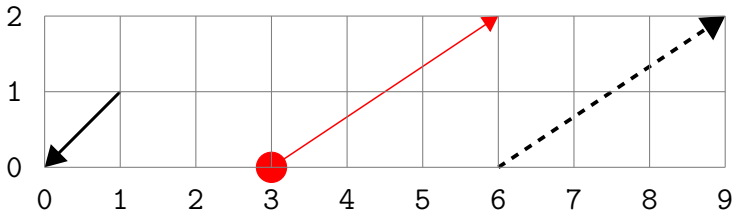
```
from latextool_basic import *
p = Plot()
p += Line(x0=0, y0=0, x1=1, y1=1, startstyle='->', arrowstyle='triangle')
p += Line(x0=3, y0=0, x1=6, y1=2, linecolor='red', linewidth=0.1,
                                  endstyle='->', arrowstyle='triangle')
p += Line(x0=6, y0=0, x1=9, y1=2, linecolor='red', linewidth=0.2,
                                  linestyle='dashed',
                                  startstyle='->', endstyle='->',
                                  arrowstyle='triangle')
p += Grid()
print p
```



tmp/d258d1ad69868e042ab3d90a3d5d1baf.pdf

TEST 4: Test `startstyle='dot'`.

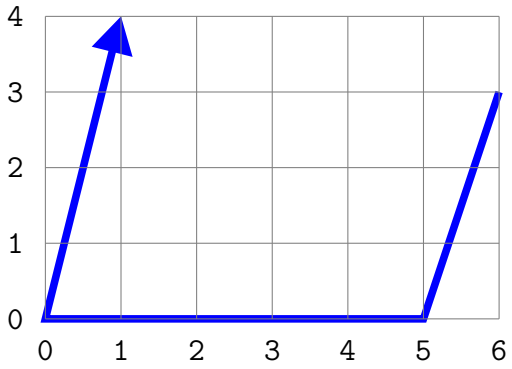
```
from latextool_basic import *
p = Plot()
p += Line(x0=0, y0=0, x1=1, y1=1, startstyle='->',
                                  arrowstyle='triangle', endstyle='dot')
p += Line(x0=3, y0=0, x1=6, y1=2, linecolor='red', linewidth=0.02,
                                  endstyle='->', arrowstyle='triangle',
                                  startstyle='dot', r=0.2)
p += Line(x0=6, y0=0, x1=9, y1=2, linecolor='black', linewidth=0.05,
                                  linestyle='dashed', startstyle='dot',
                                  endstyle='->',  arrowstyle='triangle')
p += Grid()
print p
```



tmp/39c7db097d3c58286d19cff4c9e8d86f.pdf

TEST 5: Test `points`:

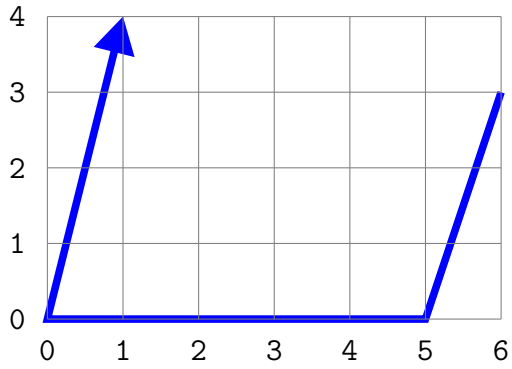
```
from latextool_basic import *
p = Plot()
p += Line(points=[(1,4), (0,0), (5,0), (6,3)],
          linecolor='blue', linewidth=0.1,
          startstyle='->', arrowstyle='triangle', endstyle='dot')
p += Grid()
print p
```



tmp/f249efa473cf03f737c2fc3af84f874f.pdf

Test 6. Testing spacing.

Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

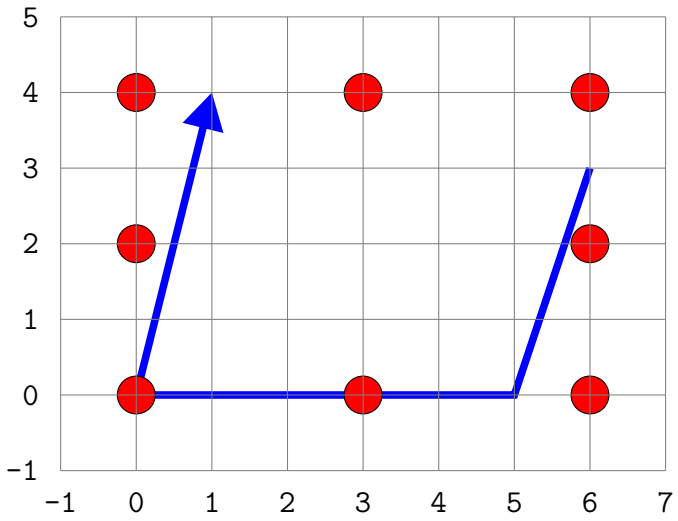


tmp/f249efa473cf03f737c2fc3af84f874f.pdf

Lorem ipsum dolor sit amet, consectetuer adipiscing elit. Ut purus elit, vestibulum ut, placerat ac, adipiscing vitae, felis. Curabitur dictum gravida mauris. Nam arcu libero, nonummy eget, consectetuer id, vulputate a, magna. Donec vehicula augue eu neque. Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Mauris ut leo. Cras viverra metus rhoncus sem. Nulla et lectus vestibulum urna fringilla ultrices. Phasellus eu tellus sit amet tortor gravida placerat. Integer sapien est, iaculis in, pretium quis, viverra ac, nunc. Praesent eget sem vel leo ultrices bibendum. Aenean faucibus. Morbi dolor nulla, malesuada eu, pulvinar at, mollis ac, nulla. Curabitur auctor semper nulla. Donec varius orci eget risus. Duis nibh mi, congue eu, accumsan eleifend, sagittis quis, diam. Duis eget orci sit amet orci dignissim rutrum.

TEST 7. Test boundary points

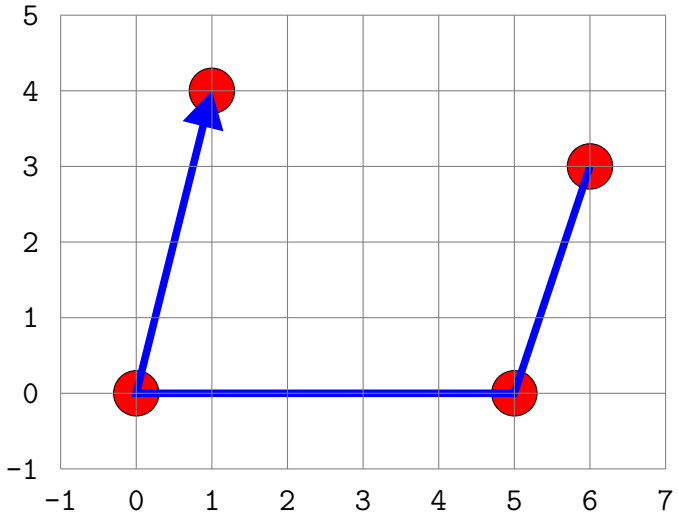
```
from latextool_basic import *
p = Plot()

aline = Line(points=[(1,4), (0,0), (5,0), (6,3)],
             linecolor='blue', linewidth=0.1,
             startstyle='->', arrowstyle='triangle', endstyle='dot')
p += aline
p += Circle(center=aline.top(), r=0.25, background='red')
p += Circle(center=aline.bottom(), r=0.25, background='red')
p += Circle(center=aline.left(), r=0.25, background='red')
p += Circle(center=aline.right(), r=0.25, background='red')
p += Circle(center=aline.topleft(), r=0.25, background='red')
p += Circle(center=aline.topright(), r=0.25, background='red')
p += Circle(center=aline.bottomleft(), r=0.25, background='red')
p += Circle(center=aline.bottomright(), r=0.25, background='red')
p += Grid()
print p
```



tmp/733d09001b40c1edd027adaaac8115e5.pdf

TEST 8. Test points

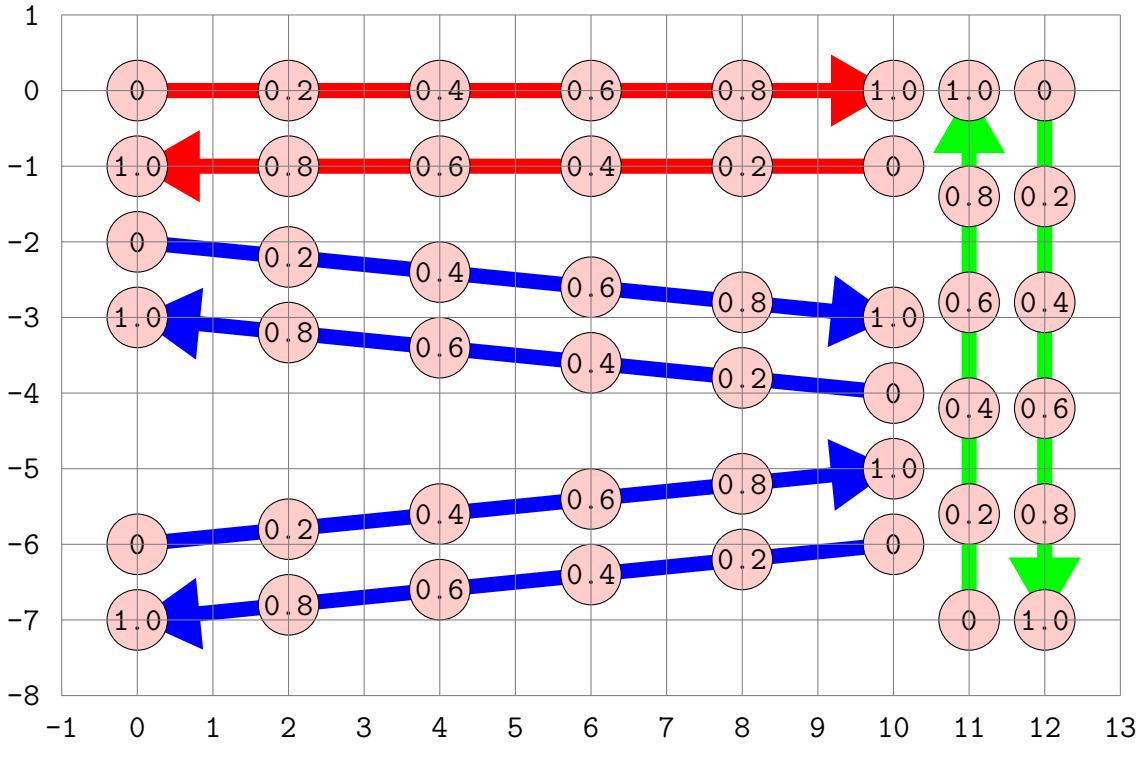
```
from latextool_basic import *
p = Plot()

aline = Line(points=[(1,4), (0,0), (5,0), (6,3)],
             linecolor='blue', linewidth=0.1,
             startstyle='->', arrowstyle='triangle', endstyle='dot')
for point in aline.points:
    p += Circle(center=point, r=0.3, background='red')

p += aline
p += Grid()
print p
```



tmp/a71fd40be4b95d69e67e3550c9601ab0.pdf

TEST 9. Test midpoint for 1 segment.

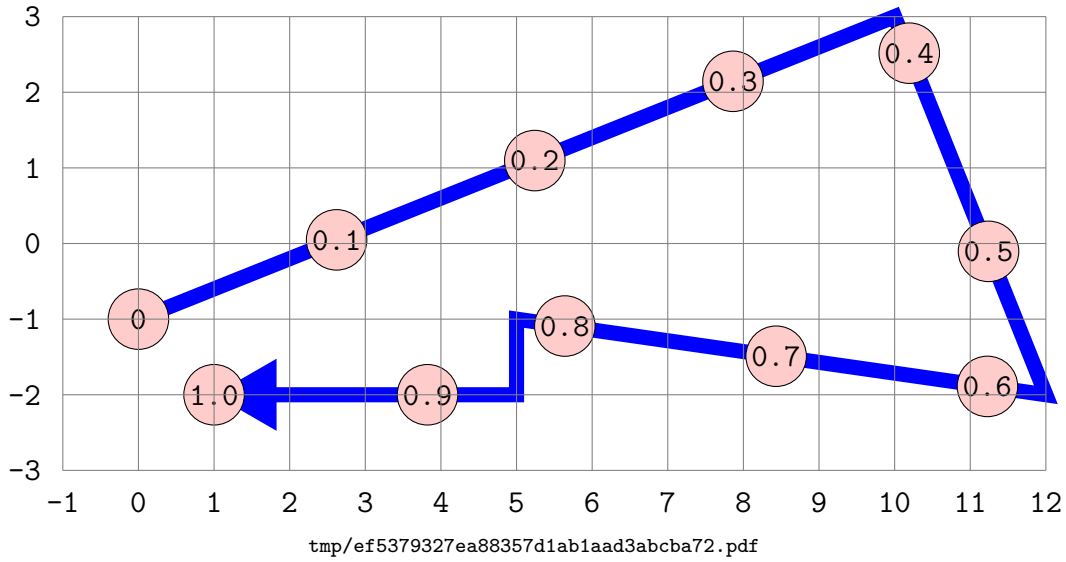
```
from latextool_basic import *
p = Plot()
def linewithpoints(p, points, color1, color2):
    aline = Line(points=points, linecolor=color1, linewidth=0.2,
                 startstyle='dot', arrowstyle='triangle', endstyle='->')
    p += aline
    for i in [0, 0.2, 0.4, 0.6, 0.8, 1.0]:
        p += Circle(center=aline.midpoint(ratio=i), r=0.4,
                    background=color2, label=r'{\texttt{%s}}' % i)
linewithpoints(p, [(0, 0), (10, 0)], 'red', 'red!20')
linewithpoints(p, [(10, -1), (0, -1)], 'red', 'red!20')
linewithpoints(p, [(0, -2), (10, -3)], 'blue', 'red!20')
linewithpoints(p, [(10, -4), (0, -3)], 'blue', 'red!20')
linewithpoints(p, [(0, -6), (10, -5)], 'blue', 'red!20')
linewithpoints(p, [(10, -6), (0, -7)], 'blue', 'red!20')
linewithpoints(p, [(11, -7), (11, 0)], 'green', 'red!20')
linewithpoints(p, [(12, 0), (12, -7)], 'green', 'red!20')
p += Grid()
print p
```



tmp/de5379b3f02496a1f71da3fc2ce24d14.pdf

TEST 10. Test midpoint for 1 segment.

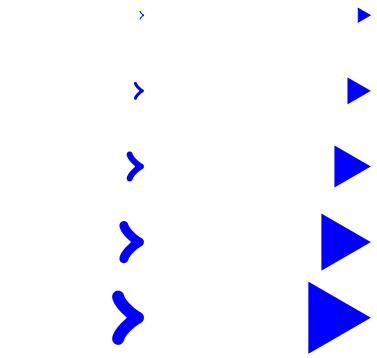
```
from latextool_basic import *
p = Plot()
points = [(0,-1), (10,3), (12,-2), (5,-1), (5,-2), (1,-2)]
aline = Line(points=points, linecolor='blue', linewidth=0.2,
             startstyle='dot', arrowstyle='triangle', endstyle='->')
p += aline
for i in [0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0]:
    p += Circle(center=aline.midpoint(ratio=i), r=0.4,
                background='red!20', label=r'{\texttt{%s}}' % i)
p += Grid()
print p
```



tmp/ef5379327ea88357d1ab1aad3abcba72.pdf

TEST 11. Test short line with arrow tip (basically to test arrow tip).

```
from latextool_basic import *
p = Plot()
for i, x in enumerate([0.2, 0.15, 0.1, 0.05, 0.01]):
    p += Line(points=[(1-x, i), (1, i)], linecolor='blue', linewidth=x,
              endstyle='->')
    p += Line(points=[(4-x, i), (4, i)], linecolor='blue', linewidth=x,
              endstyle='->', arrowstyle='triangle')
#p += Grid()
print p
```



tmp/3a6cd516bd77420c403217a0077bb72e.pdf

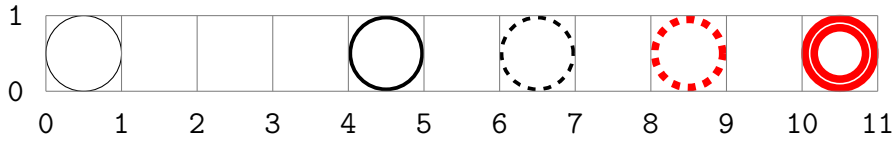
For arrows with line width x, it seems enough to have a length of x.

File: circle.tex

14 circle

Boundary:

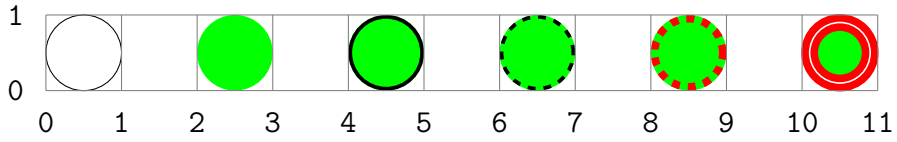
```
from latextool_basic import *
p = Plot()
p += Circle(x=0.5, y=0.5, r=0.5)
p += Circle(x=2.5, y=0.5, r=0.5, linewidth=0)
p += Circle(x=4.5, y=0.5, r=0.5, linewidth=0.05)
p += Circle(x=6.5, y=0.5, r=0.5, linewidth=0.05, linestyle='dashed')
p += Circle(x=8.5, y=0.5, r=0.5, linewidth=0.1, linestyle='dashed',
                                 linecolor='red')
p += Circle(x=10.5, y=0.5, r=0.5, linewidth=0.1, linestyle='double',
                                 linecolor='red')
p += Grid()
print p
```



tmp/40cca88d802adc00e63127b632fe4783.pdf

Background:

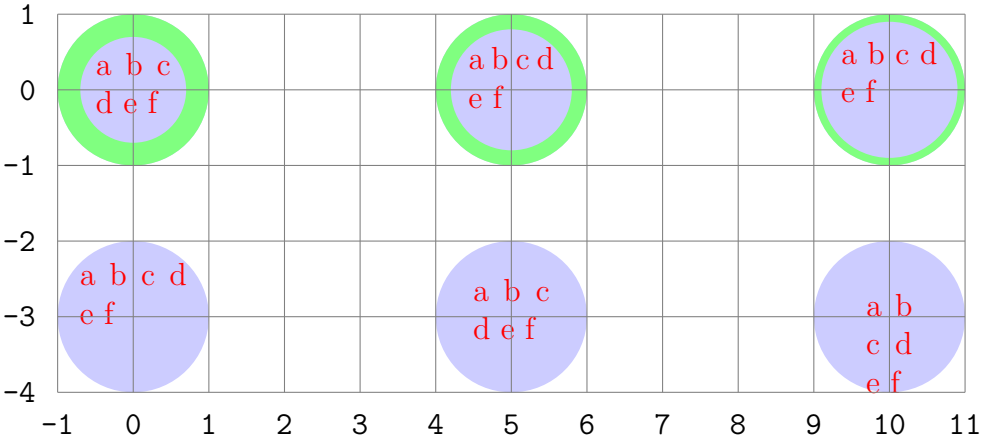
```
from latextool_basic import *
p = Plot()
p += Circle(x=0.5, y=0.5, r=0.5)
p += Circle(x=2.5, y=0.5, r=0.5, linewidth=0, background='green')
p += Circle(x=4.5, y=0.5, r=0.5, linewidth=0.05, background='green')
p += Circle(x=6.5, y=0.5, r=0.5, linewidth=0.05, linestyle='dashed',
                                 background='green')
p += Circle(x=8.5, y=0.5, r=0.5, linewidth=0.1, linestyle='dashed',
                                 linecolor='red', background='green')
p += Circle(x=10.5, y=0.5, r=0.5, linewidth=0.1, linestyle='double',
                                 linecolor='red', background='green')
p += Grid()
print p
```



tmp/f728f2a2a60dd4adbc1a8607f8dd5faa.pdf

Label:

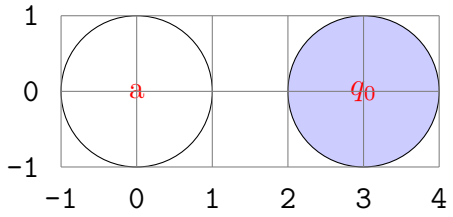
```
from latextool_basic import *
p = Plot()
s = 'a b c d e f'
p += Circle(x=0, y=0, r=1, linecolor='green!50!white', linewidth=0.3,
            background='blue!20!white', foreground='red',innersep=0, s=s)
p += Circle(x=5, y=0, r=1, linecolor='green!50!white', linewidth=0.2,
            background='blue!20!white', foreground='red', innersep=0, s=s)
p += Circle(x=10, y=0, r=1, linecolor='green!50!white', linewidth=0.1,
            background='blue!20!white', foreground='red', innersep=0, s=s)
p += Circle(x=0, y=-3, r=1, linecolor='green!50!white', linewidth=0,
            background='blue!20!white', foreground='red', innersep=0, s=s)
p += Circle(x=5, y=-3, r=1, linecolor='green!50!white', linewidth=0,
            background='blue!20!white', foreground='red',
            innersep=0.2, s=s)
p += Circle(x=10, y=-3, r=1, linecolor='green!50!white', linewidth=0,
            background='blue!20!white', foreground='red',
            innersep=0.4, s=s)
p += Grid()
print p
```



tmp/869e40ade846ccaa08eea9c9a3a136ef.pdf

Foreground:

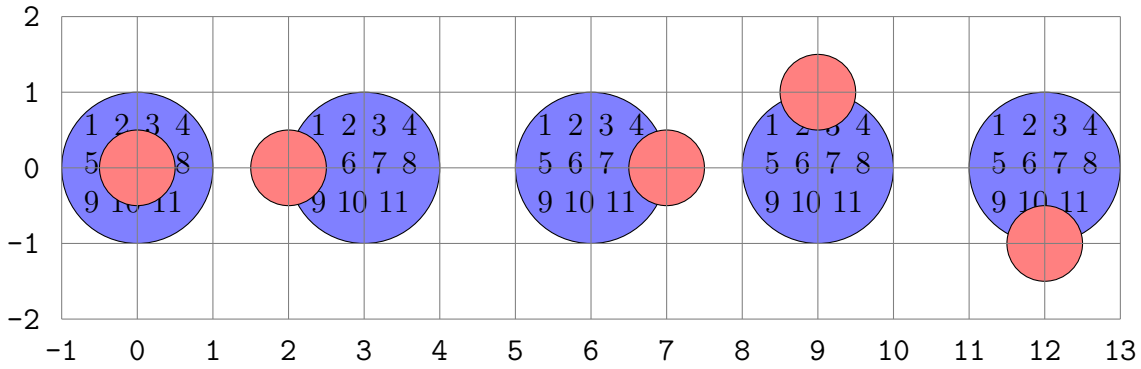
```
from latextool_basic import *
p = Plot()
p += Circle(x=0, y=0, r=1, foreground='red', label='a')
p += Circle(x=3, y=0, r=1, background='blue!20!white',
                           foreground='red', label='$q_0$')
p += Grid()
print p
```



tmp/139205171631562f54a8b67ce058bc02.pdf

Center and boundary of Circle object:

```
s='1 2 3 4 5 6 7 8 9 10 11'
b1 = 'blue!50!white'
b2 = 'red!50!white'

from latextool_basic import *
p = Plot()

c1 = Circle(x=0, y=0, r=1, background=b1, s=s)
c2 = Circle(center=c1.center(), r=0.5, background=b2)
p += c1; p += c2

c1 = Circle(x=3, y=0, r=1, background=b1, s=s)
c2 = Circle(center=c1.left(), r=0.5, background=b2)
p += c1; p += c2

c1 = Circle(x=6, y=0, r=1, background=b1, s=s)
c2 = Circle(center=c1.right(), r=0.5, background=b2)
p += c1; p += c2

c1 = Circle(x=9, y=0, r=1, background=b1, s=s)
c2 = Circle(center=c1.top(), r=0.5, background=b2)
p += c1; p += c2

c1 = Circle(x=12, y=0, r=1, background=b1, s=s)
c2 = Circle(center=c1.bottom(), r=0.5, background=b2)
p += c1; p += c2

p += Grid()
print p
```



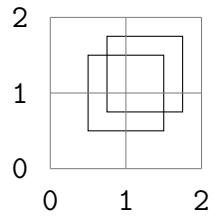
tmp/89fe56398b752925d62e4fc722de596a.pdf

File: rect.tex

15 rect

TEST: Background is '', i.e., totally transparent.

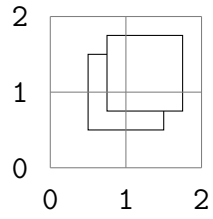
```
from latextool_basic import *
p = Plot()
p += Rect(x0=0.5, y0=0.5, x1=1.5, y1=1.5)
p += Rect(x0=0.75, y0=0.75, x1=1.75, y1=1.75)
p += Grid()
print p
```



tmp/52f83a12d7cb72f506ac1cce11855fe3.pdf

TEST: Background is white

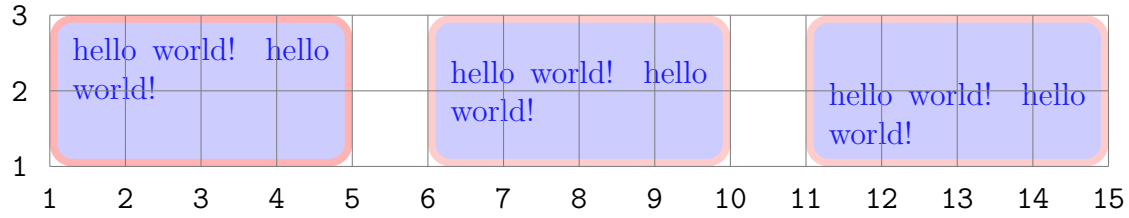
```
from latextool_basic import *
p = Plot()
p += Rect(x0=0.5, y0=0.5, x1=1.5, y1=1.5, background='white')
p += Rect(x0=0.75, y0=0.75, x1=1.75, y1=1.75, background='white')
p += Grid()
print p
```



tmp/3830f16bc2c72b9450fd4ea98db65f24.pdf

TEST border, background, foreground:

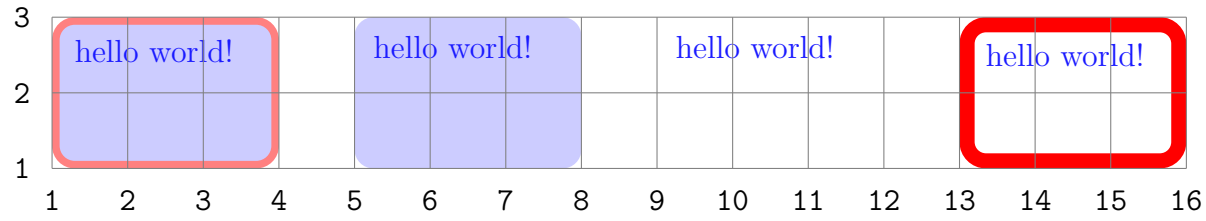
```
from latextool_basic import *
p = Plot()
p += Rect(x0=1, y0=1, x1=5, y1=3,
          radius=0.25, innersep=0.25,
          linecolor='red!30!white', linewidth=0.1,
          background='blue!20!white!', foreground='blue!90!white',
          s='hello world! hello world!', align='t')
p += Rect(x0=6, y0=1, x1=10, y1=3,
          radius=0.25, innersep=0.25,
          linecolor='red!20!white', linewidth=0.1,
          background='blue!20!white!', foreground='blue!90!white',
          s='hello world! hello world!', align='c')
p += Rect(x0=11, y0=1, x1=15, y1=3,
          radius=0.25, innersep=0.25,
          linecolor='red!20!white', linewidth=0.1,
          background='blue!20!white!', foreground='blue!90!white',
          s='hello world! hello world!', align='b')
p += Grid()
print p
```



tmp/cb10f36f2c6b8404d56527cb77e23e83.pdf

TEST border, background, foreground:

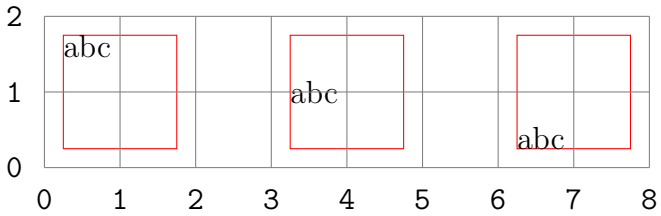
```
from latextool_basic import *
p = Plot(radius=0.25, innersep=0.25,
         linecolor='red!50!white', linewidth=0.1,
         background='blue!20!white', foreground='blue!90!white',
         align='t')
p += RectAdaptor(env=p.env, x0= 1, y0=1, x1= 4, y1=3, s='hello world!')
p.env['linewidth'] = 0
p += RectAdaptor(env=p.env, x0= 5, y0=1, x1= 8, y1=3, s='hello world!')
p.env['background'] = ''
p += RectAdaptor(env=p.env, x0= 9, y0=1, x1= 12, y1=3, s='hello world!')

p.env['background'] = ''
p.env['linecolor'] = 'red'
p.env['linewidth'] = 0.2
p += RectAdaptor(env=p.env, x0= 13, y0=1, x1= 16, y1=3, s='hello world!')

p += Grid()
print p
```



tmp/d311c5d7729829e0252d82b0d6406dfe.pdf

TEST: Align

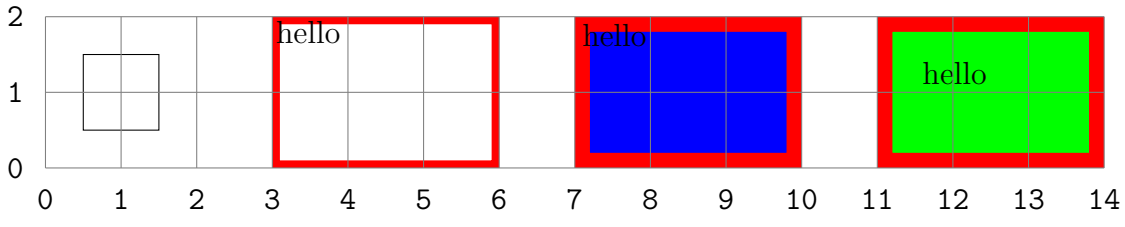
```
from latextool_basic import *
p = Plot()
p += Rect(x0=0.25, y0=0.25, x1=1.75, y1=1.75, s='abc', align='t',
          linecolor='red', foreground='black')
p += Rect(x0=3.25, y0=0.25, x1=4.75, y1=1.75, s='abc', align='c',
          linecolor='red')
p += Rect(x0=6.25, y0=0.25, x1=7.75, y1=1.75, s='abc', align='b',
          linecolor='red')
p += Grid()
print p
```



tmp/232dc548ef790231535854c303ab5d87.pdf

As above but using objects:

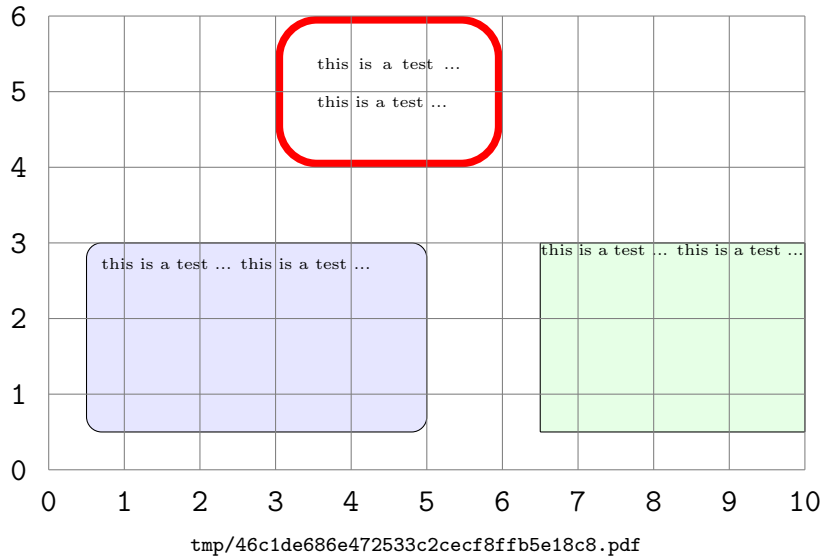
```
from latextool_basic import *
p = Plot()
p += Rect(x0=0.5, y0=0.5, x1=1.5, y1=1.5)
p += Rect(x0=3, y0=0, x1=6, y1=2, linecolor='red', linewidth=0.1, s='hello'
)
p += Rect(x0=7, y0=0, x1=10, y1=2, linecolor='red', background='blue',
          linewidth=0.2, s='hello')
p += Rect(x0=11, y0=0, x1=14, y1=2, linecolor='red', linewidth=0.2,
          background='green',
          innersep=0.5, s='hello')
p += Grid()
print p
```



tmp/968057282568c382a549d0c8f6905885.pdf

rect with rounded corners: (radius of corner is set to innersep by default):

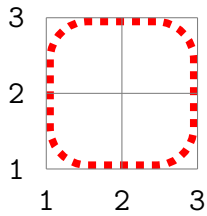
```
from latextool_basic import *
p = Plot()
p += Rect(x0=3, y0=4, x1=6, y1=6, linecolor='red', linewidth=0.1,
          innersep=0.5, radius=0.5,
          s=r'{\tiny this is a test ... this is a test ...}')
p += Rect(x0=0.5, y0=0.5, x1=5, y1=3,
          background='blue!10!white',
          innersep=0.2, radius=0.2,
          s=r'{\tiny this is a test ... this is a test ...}')
p += Rect(x0=6.5, y0=0.5, x1=10, y1=3,
          background='green!10!white',
          innersep=0.01, radius=0.01,
          s=r'{\tiny this is a test ... this is a test ...}')
p += Grid()
print p
```



tmp/46c1de686e472533c2cecf8ffb5e18c8.pdf

line style:

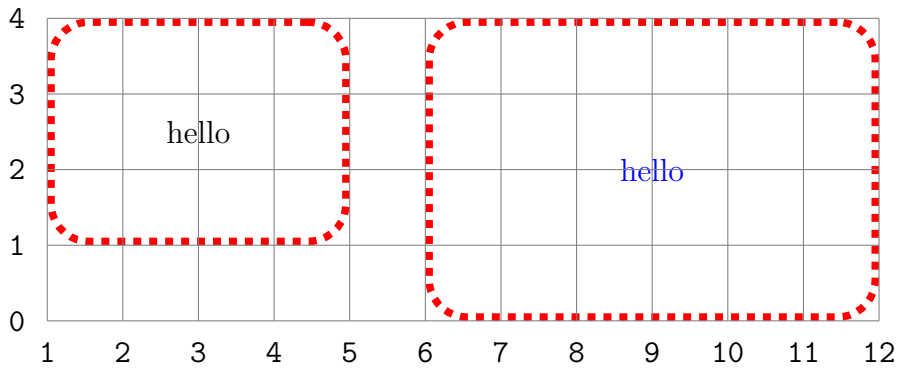
```
from latextool_basic import *
p = Plot()
p += Rect(x0=1, y0=1, x1=3, y1=3,
          linewidth=0.1, linecolor='red',
          radius=0.5, linestyle='dashed')
p += Grid()
print p
```



tmp/e3d3876073dc28cd4f56e77645c13985.pdf

label:

```
from latextool_basic import *
p = Plot()
p += Rect(x0=1, y0=1, x1=5, y1=4,
          linewidth=0.1, linecolor='red',
          radius=0.5, linestyle='dashed', label='hello')
p += Rect(x0=6, y0=0, x1=12, y1=4,
          linewidth=0.1, linecolor='red',
          foreground='blue',
          radius=0.5, linestyle='dashed', label='hello')
p += Grid()
print p
```

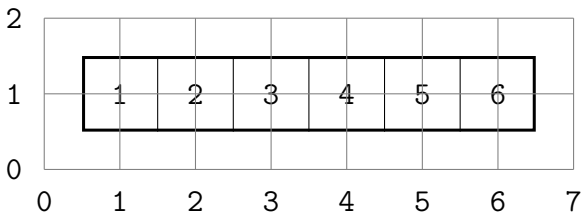


tmp/4ea3539e225df454128f29e9e067651c.pdf

File: array.tex

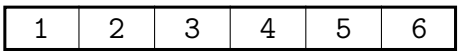
16 array

```
from latextool_basic import Plot, grid, array
p = Plot()
s = array(x0=0.5, y0=0.5, width=1, height=1, xs=[1,2,3,4,5,6])
p.add(s)
p.add(grid, x0=0, y0=0, x1=7, y1=2)
print p
```



tmp/a6f663108152ae74a4f98b53ad72b331.pdf

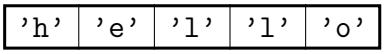
```
from latextool_basic import Plot, array
p = Plot()
s = array(x0=0.5, y0=0.5, width=1, height=0.6, xs=[1,2,3,4,5,6])
p.add(s)
print p
```



tmp/bdffb063efd919ffd955e52c27a8c352.pdf

Array of characters:

```
from latextool_basic import Plot, array
p = Plot()
s = array(x0=0.5, y0=0.5, width=1, height=0.6,
          xs=["'h'","'e'","'l'","'l'","'o'"])
p.add(s)
print p
```



tmp/c43092afc22cca6d4b4c2e4e8247197c.pdf

array with arraylinewidth

```
from latextool_basic import Plot, array
p = Plot()
s = array(x0=0.5, y0=0.5, width=1, height=0.6,
          xs=[1,2,3,4,5,6],
          arraylinewidth=0.2)
p.add(s)
print p
```

tmp/14feeb74f183d9a523a277b89a294469.pdf

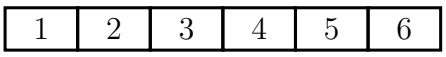
array with celllinewidth

```
from latextool_basic import Plot, array
p = Plot()
s = array(x0=0.5, y0=0.5, width=1, height=0.6,
          xs=[1,2,3,4,5,6],
          celllinewidth=0.1)
p.add(s)
print p
```

tmp/90bebe142d87b27aa9a31ced66f3d13f.pdf

new array2

```
from latextool_basic import Plot, array2
p = Plot()
s = array2(x0=0.5, y0=0.5, width=1, height=0.6,
           vs=[1,2,3,4,5,6],
           celllinewidth=0.04)
p.add(s)
print p
```



tmp/5136b13ea4abf9754cd5468d85c9aa7e.pdf

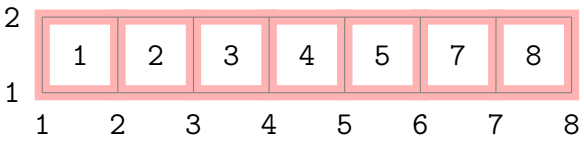
TODO: Array variable name to left of array? Variables in general? Align variables and values?

File: rectcontainer.tex

17 RectContainer

Horizontal array:

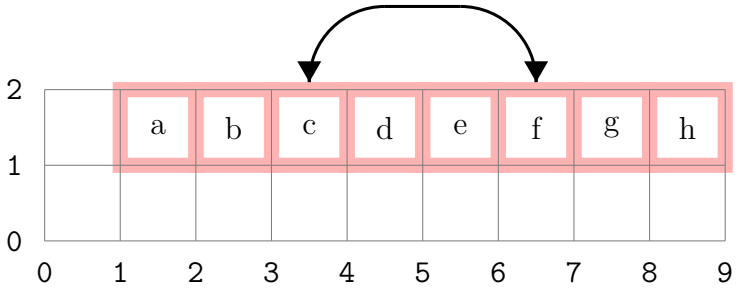
```
from latextool_basic import *
p = Plot()

c = RectContainer(x=1, y=1)
for x in '1234578':
    c += Rect2(x0=0, y0=0, x1=1, y1=1,
               linewidth=0.2, linecolor='red!30!white',
               label=r'{\texttt{%s}}' % x)
p += c
p += Grid()
print p
```



tmp/77a0d9a5a5d050f135d6f4f2176f06c1.pdf

Using []:

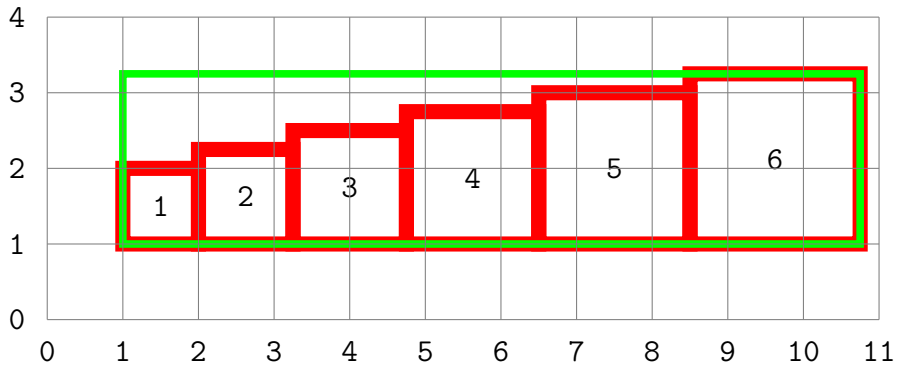
```
from latextool_basic import *
p = Plot()

c = RectContainer(x=1, y=1)
for x in 'abcdefgh':
    c += Rect2(x0=0, y0=0, x1=1, y1=1,
               linewidth=0.2, linecolor='red!30!white',
               label=x)
p += c
p += bend(c[2].top(), c[5].top())
p += Grid()
print p
```



tmp/7f0b152c5a963eb3959a597ed9e1a08d.pdf

Left-to-right, align bottom:

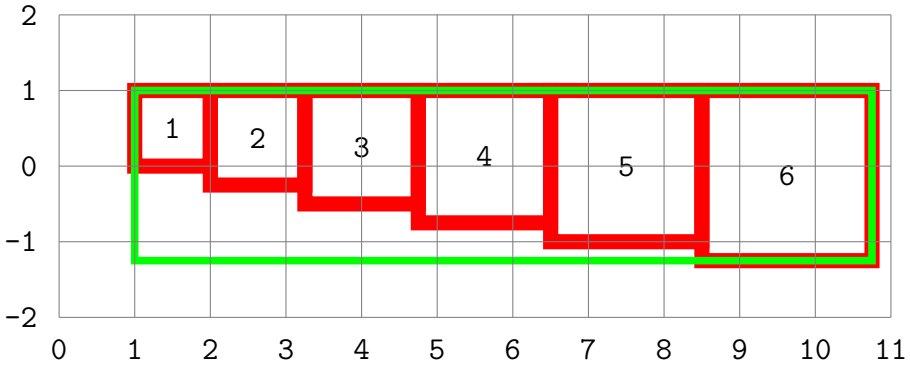
```
from latextool_basic import *
p = Plot()

c = RectContainer(x=1, y=1)
for i, x in enumerate([1,2,3,4,5,6]):
    c += Rect2(x0=0, y0=0, x1=1+i/4.0, y1=1+i/4.0, linecolor='red', linewid
th=0.2,
               label=r'{\texttt{%s}}' % x)
c.layout()
p += c

# boundary of container
p += Rect2(x0=c.x0, y0=c.y0, x1=c.x1, y1=c.y1, linewidth=0.1, linecolor='gr
een')

p += Grid()
print p
```



tmp/8793e56eebd064b868888575186aa662.pdf

Align top, left-to-right:

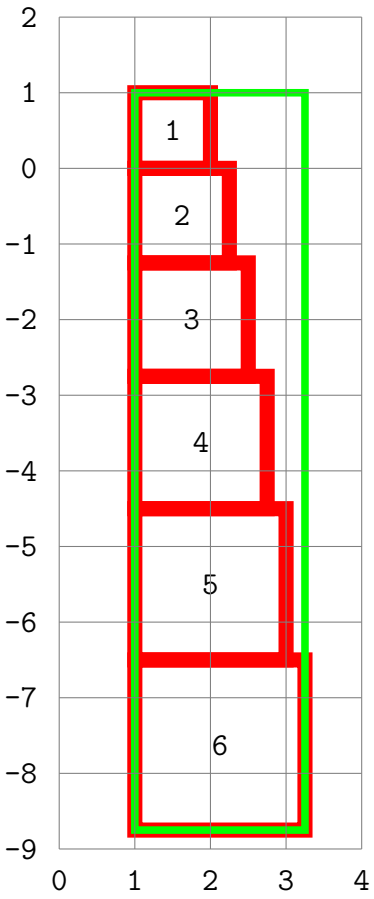
```
from latextool_basic import *
p = Plot()

c = RectContainer(x=1, y=1, align='top')
for i, x in enumerate([1,2,3,4,5,6]):
    c += Rect2(x0=0, y0=0, x1=1+i/4.0, y1=1+i/4.0, linecolor='red', linewid
th=0.2,
               label=r'{\texttt{%s}}' % x)
p += c

# boundary of container
p += Rect2(x0=c.x0, y0=c.y0, x1=c.x1, y1=c.y1, linewidth=0.1, linecolor='gr
een')


p += Grid()
print p
```



tmp/67d057807db123b288c9852577cc28c2.pdf

top-to-bottom, align left:

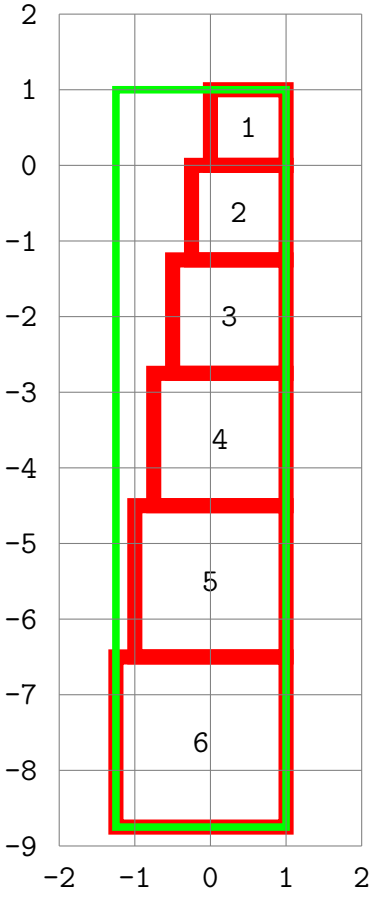
```
from latextool_basic import *
p = Plot()

c = RectContainer(x=1, y=1, align='left', direction='top-to-bottom')
for i, x in enumerate([1,2,3,4,5,6]):
    c += Rect2(x0=0, y0=0, x1=1+i/4.0, y1=1+i/4.0, linecolor='red', linewid
th=0.2,
               label=r'{\texttt{%s}}' % x)
p += c

# boundary of container
p += Rect2(x0=c.x0, y0=c.y0, x1=c.x1, y1=c.y1, linewidth=0.1, linecolor='gr
een')


p += Grid()
print p
```



tmp/44a4ecc0897f0917e1f83b96812413fb.pdf

top-to-bottom, align right:

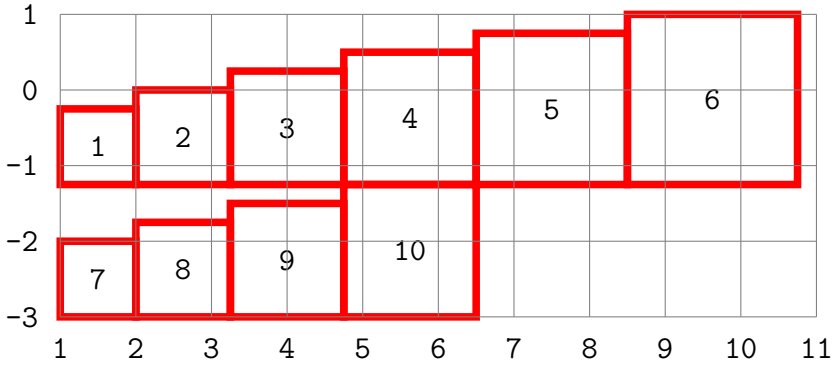
```
from latextool_basic import *
p = Plot()

c = RectContainer(x=1, y=1, align='right', direction='top-to-bottom')
for i, x in enumerate([1,2,3,4,5,6]):
    c += Rect2(x0=0, y0=0, x1=1+i/4.0, y1=1+i/4.0, linecolor='red', linewid
th=0.2,
               label=r'{\texttt{%s}}' % x)
p += c

# boundary of container
p += Rect2(x0=c.x0, y0=c.y0, x1=c.x1, y1=c.y1, linewidth=0.1, linecolor='gr
een')


p += Grid()
print p
```



tmp/07731e32c58982260d799c1ca7f7a6a4.pdf

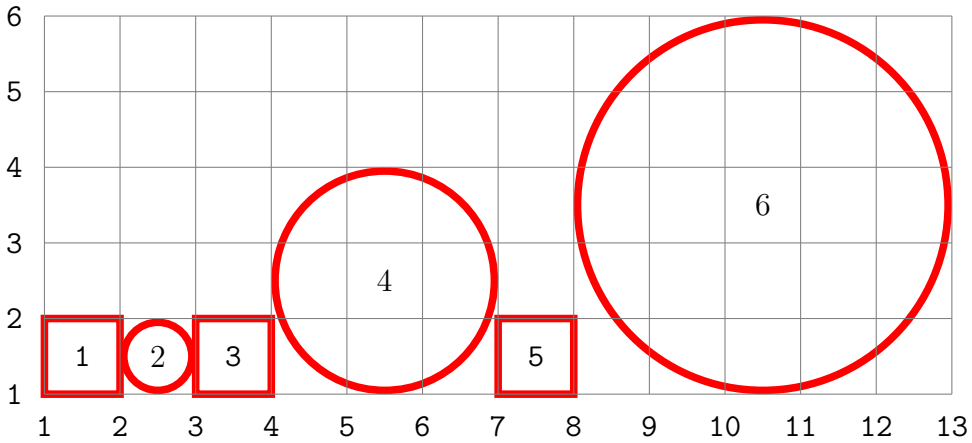
2-d stack

```
from latextool_basic import *
p = Plot()

c0 = RectContainer(x=1, y=1, align='bottom', direction='left-to-right')
for i, x in enumerate([1,2,3,4,5,6]):
    c0 += Rect2(x0=0, y0=0, x1=1+i/4.0, y1=1+i/4.0, linecolor='red', linewi
dth=0.1,
                label=r'{\texttt{%s}}' % x)

c1 = RectContainer(x=1, y=1, align='bottom', direction='left-to-right')
for i, x in enumerate([7,8,9,10]):
    c1 += Rect2(x0=0, y0=0, x1=1+i/4.0, y1=1+i/4.0, linecolor='red', linewi
dth=0.1,
                label=r'{\texttt{%s}}' % x)

C = RectContainer(x=1, y=1, align='left', direction='top-to-bottom')
C += c0; c0.x = c0.x0; c0.y = c0.y0; c0.layout()
C += c1; c1.x = c1.x0; c1.y = c1.y0; c1.layout()

p += C;
p += Grid()
print p
```



tmp/d218b6cb67fb658c6f1974576cb997f9.pdf

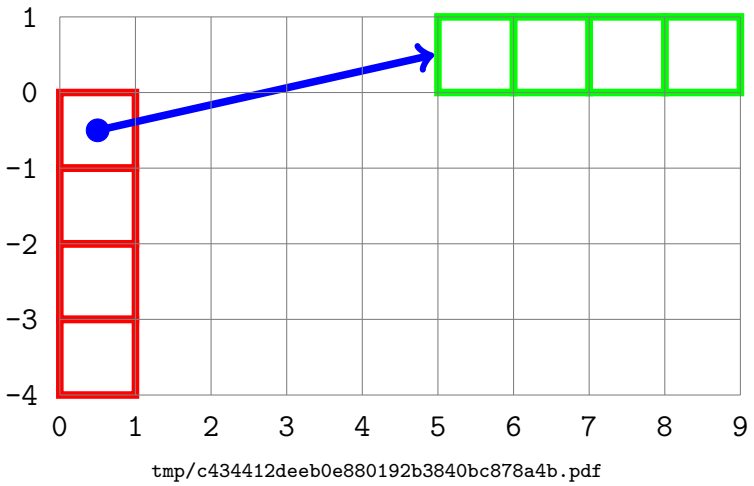
```
from latextool_basic import *
p = Plot()

c = RectContainer(x=1, y=1)
for i, x in enumerate([1,2,3,4,5,6]):
    if i % 2 == 0:
        c += Rect2(x0=0, y0=0, x1=1, y1=1, linecolor='red', linewidth=0.1,
                   label=r'{\texttt{%s}}' % x)
    else:
        c += Circle(x=0.5, y=0.5, r=0.5 + i/2, label=x, linecolor='red', li
newidth=0.1)

p += c
p += Grid()
print p
```



tmp/9c4c738edc6581f50cce08952710f631.pdf

Vertical array and pointers

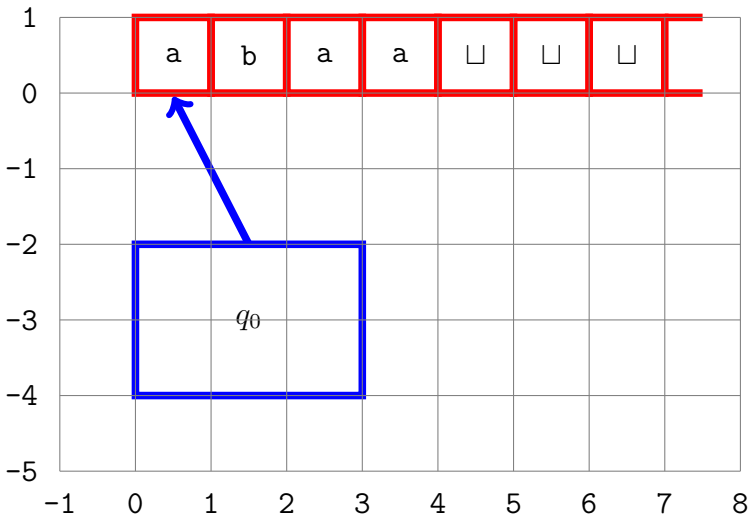
```
L = 0.1 # line width
from latextool_basic import *
p = Plot()


v = RectContainer(x=0, y=0, align='left', direction='top-to-bottom')
for i in ['','','','']:
    v += Rect2(0,0,1,1,s=i, linewidth=0.1, linecolor='red')

p += v

h = RectContainer(x=5, y=0, align='bottom', direction='left-to-right')
for i in ['','','','']:
    h += Rect2(0,0,1,1,s=i, linewidth=0.1, linecolor='green')

p += h

p += Line(x0=v[0].centerx(), y0=v[0].centery(),
          x1=h[0].leftx(), y1=h[0].centery(),
          linewidth=0.1, linecolor='blue',
          endstyle='->', startstyle='dot', r=0.01)

p += Grid()
print p
```



tmp/c434412deeb0e880192b3840bc878a4b.pdf

DFA/NFA:

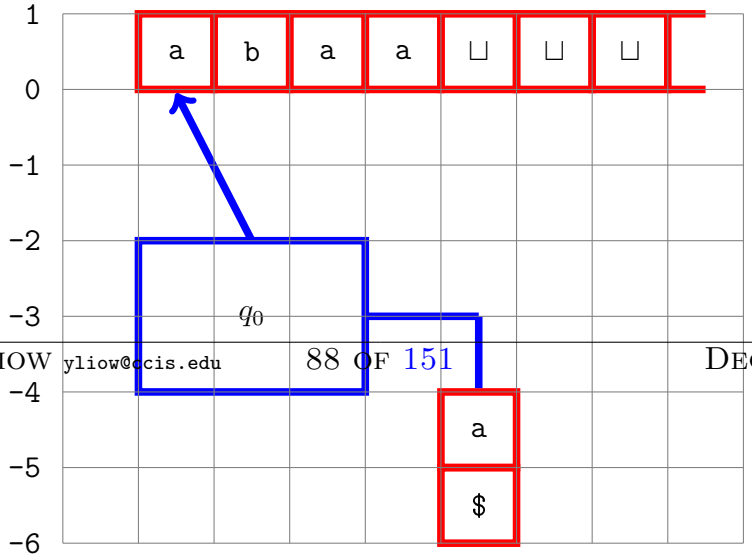
```
from latextool_basic import *
p = Plot()

h = RectContainer(x=0, y=0, align='bottom', direction='left-to-right')
for i in ['a','b','a','a','$\sqcup$','$\sqcup$','$\sqcup$',]:
    h += Rect2(0,0,1,1,
               label= r'\texttt{%s}' % i,
               linewidth=0.1, linecolor='red')
p += h

p += Line(x0=h[-1].x1, y0=h[-1].y1, x1=h[-1].x1+0.5, y1=h[-1].y1,
          linewidth=0.1, linecolor='red')

p += Line(x0=h[-1].x1, y0=h[-1].y0, x1=h[-1].x1+0.5, y1=h[-1].y0,
          linewidth=0.1, linecolor='red')

dfa = Rect2(0,-4,3,-2, linewidth=0.1, linecolor='blue', label='$q_0$')
p += dfa

p += Line(x0=dfa.centerx(), y0=dfa.y1,
          x1=h[0].centerx(), y1=h[0].bottomy(),
          linewidth=0.1, linecolor='blue', endstyle='->')

p += Grid()
print p
```



tmp/fbd3d6ff6250e5c9fa698154bc0f48b4.pdf

PDA:

```
from latextool_basic import *
p = Plot()
h = RectContainer(x=0, y=0, align='bottom', direction='left-to-right')
for i in ['a','b','a','a','$\sqcup$','$\sqcup$','$\sqcup$',]:
    h += Rect2(0,0,1,1,
               label= r'\texttt{%s}' % i,
               linewidth=0.1, linecolor='red')
p += h

p += Line(x0=h[-1].x1, y0=h[-1].y1, x1=h[-1].x1+0.5, y1=h[-1].y1,
          linewidth=0.1, linecolor='red')
p += Line(x0=h[-1].x1, y0=h[-1].y0, x1=h[-1].x1+0.5, y1=h[-1].y0,
          linewidth=0.1, linecolor='red')

pda = Rect2(0,-4,3,-2, linewidth=0.1, linecolor='blue', label='$q_0$')
p += pda

p += Line(x0=pda.centerx(), y0=pda.y1,
          x1=h[0].centerx(), y1=h[0].bottomy(),
          linewidth=0.1, linecolor='blue', endstyle='->')

v = RectContainer(x=4, y=-4, align='left', direction='top-to-bottom')
for i in ['a', '\$',]:
    v += Rect2(0,0,1,1,
           label= r'\texttt{%s}' % i, linewidth=0.1, linecolor='red')
p += v

p += Line(x0=pda.x1,y0=pda.centery(), x1=v[0].centerx(), y1=pda.centery(),
          linewidth=0.1, linecolor='blue')
p += Line(x0=v[0].centerx(),y0=pda.centery(),x1=v[0].centerx(),y1=v[0].topy
(),
          linewidth=0.1, linecolor='blue')

p += Grid()
print p
```

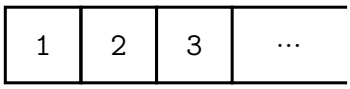


File: snipped-array.tex

18 Snipped Array

Snipped array (snip in the end):

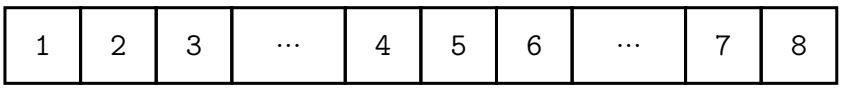
```
from latextool_basic import *
p = Plot()

c = SnippedArray(x=1, y=1, xs=[1, 2, 3, '...'])
p += c
print p
```



tmp/f894ecc88eae39feb6ec9081c2a31fca.pdf

Snipped array (snip in the end):

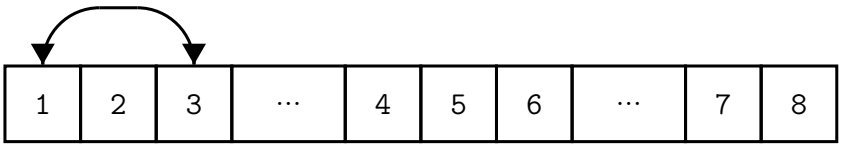
```
from latextool_basic import *
p = Plot()

c = SnippedArray(x=1, y=1, xs=[1, 2, 3, '...', 4, 5, 6, '...', 7, 8])
p += c
print p
```



tmp/49d25ef8eac1a059032482bef8c02e9d.pdf

Snipped array (multiple snips):

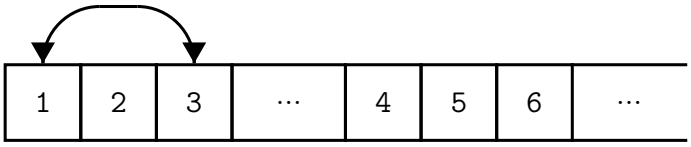
```
from latextool_basic import *
p = Plot()

c = SnippedArray(x=1, y=1, xs=[1, 2, 3, '...', 4, 5, 6, '...', 7, 8])
p += c
p += bend(c[0].top(), c[2].top(), dy=0.75)
print p
```



tmp/c8263ab8f063d09f6be8a0a1304a9f9f.pdf

Snipped array (snip at the end):

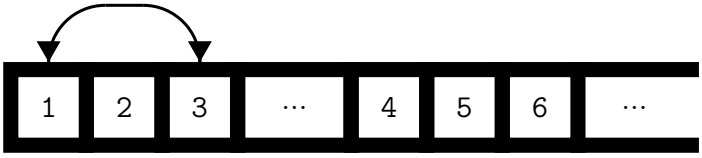
```
from latextool_basic import *
p = Plot()

c = SnippedArray(x=1, y=1, xs=[1, 2, 3, '...', 4, 5, 6, '...'])
p += c
p += bend(c[0].top(), c[2].top(), dy=0.75)
print p
```



tmp/93925e6ca4fa223ee053aa3ac96a2da9.pdf

Snipped array (snip at the end, with linewidth):

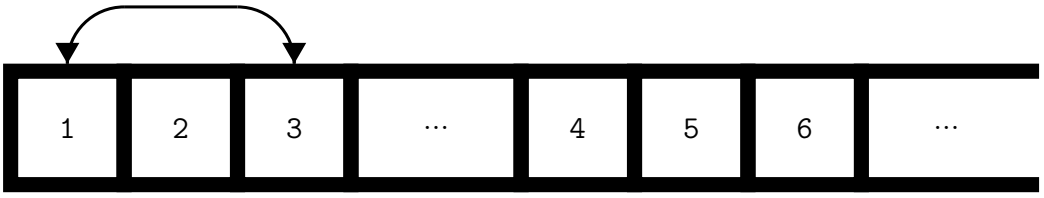
```
from latextool_basic import *
p = Plot()

c = SnippedArray(x=1, y=1, xs=[1, 2, 3, '...', 4, 5, 6, '...'], linewidth=0
.2)
p += c
p += bend(c[0].top(), c[2].top(), dy=0.75)
print p
```



tmp/39845a191b4675ba053f476824e03f1c.pdf

Snipped array (width and height):

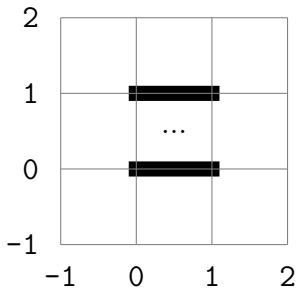
```
from latextool_basic import *
p = Plot()

c = SnippedArray(x=1, y=1, xs=[1, 2, 3, '...', 4, 5, 6, '...'],
    width=1.5, height=1.5, linewidth=0.2)
p += c
p += bend(c[0].top(), c[2].top(), dy=0.75)
print p
```



tmp/9d1f87ef92b28017c5fe584f27e9c087.pdf

Snipped array (snip at the end, with linewidth):

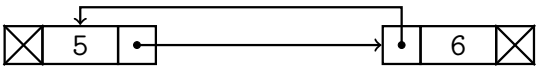
```
from latextool_basic import *
p = Plot()

c = Rect2NoLeftRight(x0=0, y0=0, x1=1, y1=1, linewidth=0.2, label='...')
p += c
p += Grid(-1, -1, 2, 2)
print p
```



tmp/9d8487de695462bccc689cc1dbc31e2d.pdf

File: singlylinkedlist.tex

19 Singly Linked List



File: doublylinkedlist.tex

20 Doubly linked list

PYTHON ERROR. See source, stderr, stdout below

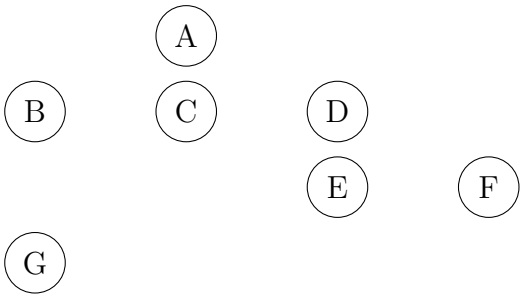
```
from latextool_basic import *
class DLNodeRect:
    L = 0.05 # linewidth
    def __init__(self, x0=0, y0=0, w=0, h=0, label='',
                 prev=None, next=None):
        L = DLNodeRect.L
        self.x0, self.y0 = x0, y0
        self.w, self.h = w, h
        self.label = label
        self.prev, self.next = prev, next
        c = RectContainer(x0=x0, y0=y0)
        c += Rect2(x0=0, y0=0, x1=w, y1=h, linewidth=L, label='')
        c += Rect2(x0=0, y0=0, x1=w, y1=h, linewidth=L, label=label)
        c += Rect2(x0=0, y0=0, x1=w, y1=h, linewidth=L, label='')
        self.c = c
    def next_rect(self): return self.c[2]
    def key_rect(self): return self.c[1]
    def prev_rect(self): return self.c[0]
    def __str__(self):
        L = DLNode.L
        s = str(self.c)
        if self.next != None:
            a = self.next_rect().center()
            b = self.next.prev_rect().left()
            s += line(points=[a, b], linewidth=L,
                      endstyle='->', startstyle='dot', arrowstyle='triangle
')
        else: # self.next is None
            r = self.next_rect()
            s += line(points=[r.topleft(), r.bottomright()], linewidth=L)
            s += line(points=[r.topright(), r.bottomleft()], linewidth=L)
        if self.prev != None:
            a = self.prev_rect().center()
            b = self.prev.key_rect().bottom()
            c = a[0], a[1] - 1
            d = b[0], c[1]
            s += line(points=[a, c, d, b], linewidth=L,
                      endstyle='->', startstyle='dot', arrowstyle='triangle
')
        else: # self.prev is None
            r = self.prev_rect()
            s += line(points=[r.topleft(), r.bottomright()], linewidth=L)
            s += line(points=[r.topright(), r.bottomleft()], linewidth=L)
        return s

class DLNode:
```

File: position.tex

21 positions

The positions function computes positions.

```
from latextool_basic import positions
d = positions(r'''
  A
B C D
    E F
G
''')

from latextool_basic import Plot, Circle
p = Plot()
for label, pos in d.items():
    x, y = pos
    p += Circle(x=x, y=y, r=0.4, label=label)
print p
```



tmp/f5442629d66cfbd227df35856c093582.pdf

You can scale the x and y axes:

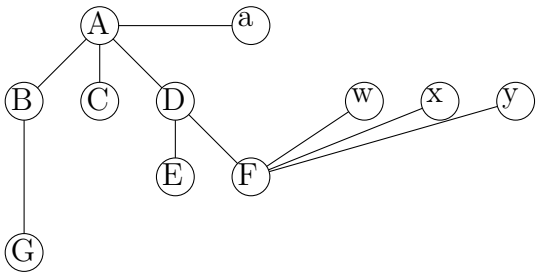
```
from latextool_basic import positions
d = positions(r'''
  A
B C D
    E F
G
''', xscale=2.0, yscale=0.5)

from latextool_basic import Plot, circle
p = Plot()
for label, pos in d.items():
    x, y = pos
    p.add(circle, x=x, y=y, r=0.25, label=label)
print p
```

tmp/9a22e760080015821205d97b2bb3ddae.pdf

File: tree.tex

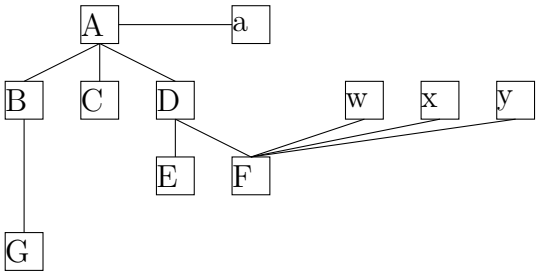
22 tree

```
from latextool_basic import positions
d = positions(r"""
  A   a
B C D    w x y
    E F
G
""", xscale=0.5)

edges = {'A':['B','C','D', 'a'],
         'B':['G'],
         'D':['E','F'],
         'F':['w', 'x', 'y'],
}

from latextool_basic import Plot, tree
p = Plot()
p.add(tree(d, edges=edges))
print p
```



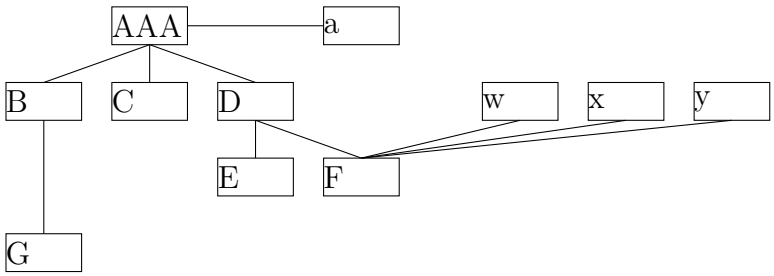
tmp/4728a320501beeace354f62e6ff7620e.pdf

```
from latextool_basic import positions
d = positions(r"""
  A   a
B C D    w x y
    E F
G
""", xscale=0.5)

edges = {'A':['B','C','D', 'a'],
         'B':['G'],
         'D':['E','F'],
         'F':['w', 'x', 'y'],
}

from latextool_basic import Plot, tree
p = Plot()
p.add(tree(d, edges=edges, node_shape='rect'))
print p
```



tmp/b74cfb72d43bef4c72655e49da14d3fd.pdf

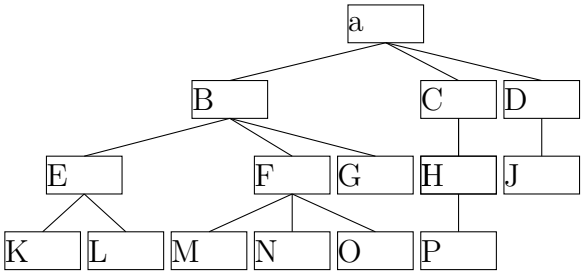
```
from latextool_basic import positions
d = positions(r"""
  A   a
B C D    w x y
    E F
G
""", xscale=0.7)

edges = {'A':['B','C','D', 'a'],
         'B':['G'],
         'D':['E','F'],
         'F':['w', 'x', 'y'],
}

from latextool_basic import Plot, tree
p = Plot()
p.add(tree(d,
           width=1, height=0.5,
           node_label={'A':'AAA'},
           node_shape='rect',
           edges=edges))
print p
```



tmp/110bed55994ceb027689b0a8b1f0fd75.pdf

Auto adjust node position

```
from latextool_basic import positions
d = positions(r"""
      A
  B   C   D
E F G H   I J
K L M N O P
""", xscale=0.7)

edges = {'A':['B','C','D'], 'B':['E', 'F', 'G'],
         'C':['H','I'],     'D':['J'],
         'E':['K', 'L'],    'F':['M', 'N', 'O'],
         'I':['P'],
}

from latextool_basic import Plot, tree
p = Plot()
p.add(tree(d,
           hor_sep=0.1,
           width=1, height=0.5,
           node_label={'A':'a'},
           node_shape='rect',
           edges=edges,
           autoadjust=True))
print p
```



tmp/52113effd1e1320f52be67de39a73d61.pdf

File: tree2.tex

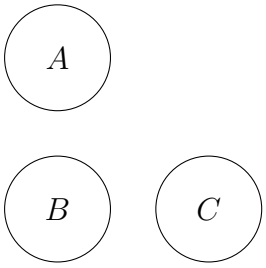
23 tree2

vertices: ['A', 'B', 'C', 'D']

File: graph.tex

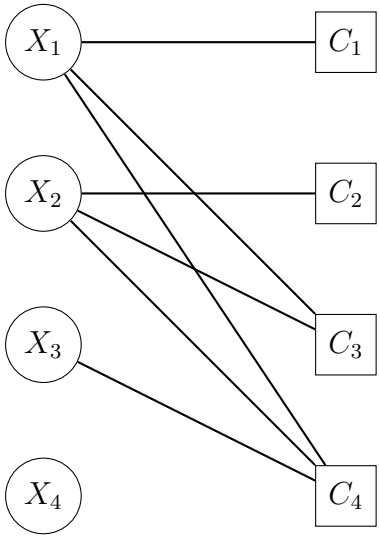
24 graph

```
\begin{python}
from latextool_basic import graph
print graph(layout="""
A
B C
""")
\end{python}
```



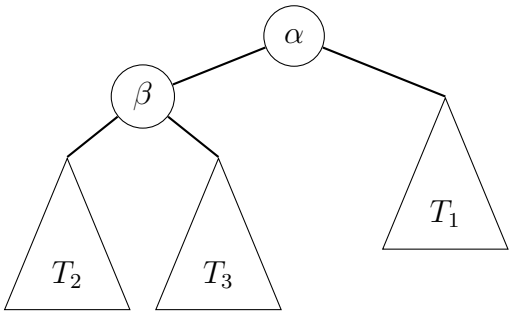
nodes and labels:

```
\begin{python}
from latextool_basic import graph
print graph(layout='''
     X1  C1
     X2  C2
     X3  C3
     X4  C4
''',
minimum_size='8mm',
edges='X1-C1,X2-C2,X1-C3,X2-C3,X1-C4,X2-C4,X3dashedC4',
X1='label=$X_1$',
X2='label=$X_2$',
X3='label=$X_3$',
X4='label=$X_4$',
C1='shape=rectangle, label=$C_1$',
C2='shape=rectangle, label=$C_2$',
C3='shape=rectangle, label=$C_3$',
C4='shape=rectangle, label=$C_4$',
)
\end{python}
```



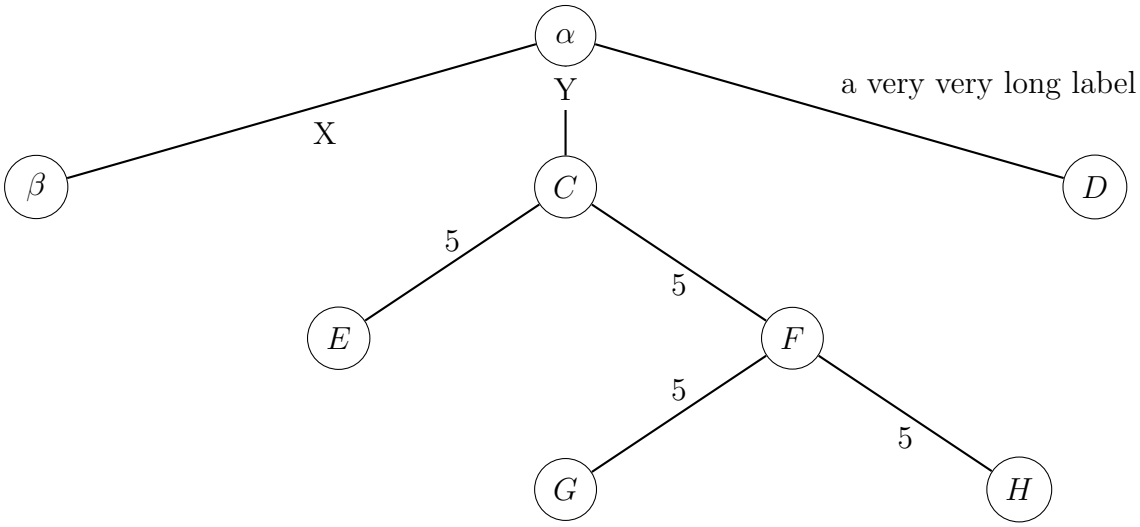
Isoceles triangle as subtree:

```
graph(layout='''
     A
   B   C
  D E
''',
minimum_size='8mm',
edges='A-B,A-C',
A=r'label=$\alpha$',
B=r'label=$\beta$',
C=r'shape=tree, minimum height=2cm, label=$T_1$',
D=r'shape=tree, minimum height=2cm, label=$T_2$',
E=r'shape=tree, minimum height=2cm, label=$T_3$',
)
```



Edge labels:

```
from latextool_basic import graph
print graph(layout='''
          A
   B      C      D
       E     F
          G     H
       I
''',
minimum_size='8mm',
edges='A-B,A-C,A-D,C-E,C-F,F-G,F-H,G-I',
A=r'label=$\alpha$',
B=r'label=$\beta$',
edge_label={('A','B'):{'label':'X'},
            ('A','C'):{'label':'Y', 'style':'pos=0.25,fill=white'},
            ('A','D'):{'label':'a very very long label'},
            ('C','E'):{'label':'5', 'style':'pos=0.5,above'},
            ('C','F'):{'label':'5', 'style':'pos=0.5,below'},
            ('F','G'):{'label':'5', 'style':'pos=0.5,above,inner sep=1mm,circle'},
            ('F','H'):{'label':'5', 'style':'pos=0.5,below,inner sep=1mm,circle'},
            ('G','I'):{'label':'abcdef', 'style':'sloped'},
           },
)
```



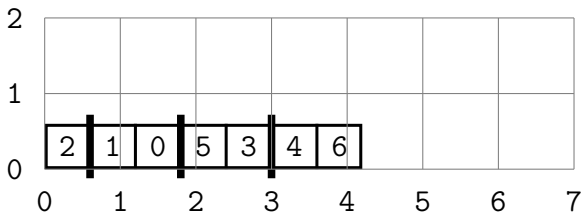
http://tex.stackexchange.com/questions/86386/edge-nodes-auto-and-node-distance

File: chunkedarray.tex

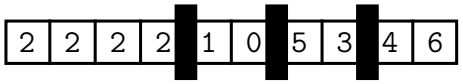
25 chunkedarray

This is for list of lists.

```
from latextool_basic import Plot, grid, chunkedarray
p = Plot()
s = chunkedarray(cellwidth=0.6,
                 cellheight=0.6,
                 arr=[[2],[1,0],[5,3],[4,6]])
p.add(s)
p.add(grid, x0=0, y0=0, x1=7, y1=2)
print p
```

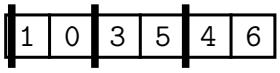



```
from latextool_basic import Plot, chunkedarray
p = Plot()
s = chunkedarray(cellwidth=0.6,
                 cellheight=0.6,
                 pipewidth=0.3,
                 pipeheight=1,
                 arr=[[2,2,2,2],[1,0],[5,3],[4,6]])
p.add(s)
print p
```



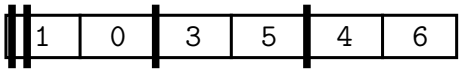
One empty list in front:

```
from latextool_basic import Plot, chunkedarray
p = Plot()
s = chunkedarray(cellwidth=0.6,
                 cellheight=0.6,
                   arr=[[],[1,0],[3,5],[4,6]])
p.add(s)
print p
```



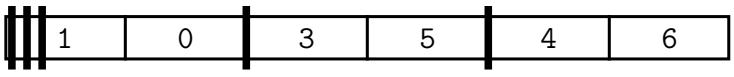
2 empty list in front:

```
from latextool_basic import Plot, chunkedarray
p = Plot()
s = chunkedarray(cellwidth=1,
                 cellheight=0.6,
                   arr=[[],[],[1,0],[3,5],[4,6]])
p.add(s)
print p
```



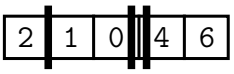
3 empty list in front:

```
from latextool_basic import Plot, chunkedarray
p = Plot()
s = chunkedarray(cellwidth=1.6,
                 cellheight=0.6,
                 arr=[[],[],[],[1,0],[3,5],[4,6]])
p.add(s)
print p
```



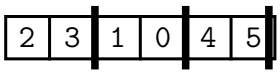
One empty list in the middle:

```
from latextool_basic import Plot, chunkedarray
p = Plot()
s = chunkedarray(cellwidth=0.6,
                 cellheight=0.6,
                 arr=[[2],[1,0],[],[4,6]])
p.add(s)
print p
```



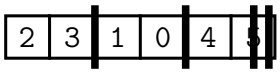
1 empty list at the end:

```
from latextool_basic import Plot, grid, chunkedarray
p = Plot()
s = chunkedarray(cellwidth=0.6,
                 cellheight=0.6,
                 arr=[[2,3],[1,0],[4,5],[]])
p.add(s)
print p
```



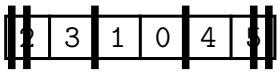
2 empty lists at the end:

```
from latextool_basic import Plot, grid, chunkedarray
p = Plot()
s = chunkedarray(cellwidth=0.6,
                 cellheight=0.6,
                 arr=[[2,3],[1,0],[4,5],[], []])
p.add(s)
print p
```



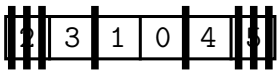
2 empty lists at the end and in front:

```
from latextool_basic import Plot, grid, chunkedarray
p = Plot()
s = chunkedarray(cellwidth=0.6,
                 cellheight=0.6,
                 arr=[[],[],[2,3],[1,0],[4,5],[],[]])
p.add(s)
print p
```



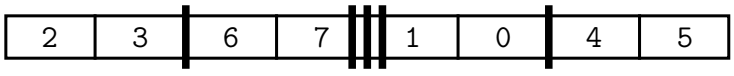
3 empty lists in front:

```
from latextool_basic import Plot, grid, chunkedarray
p = Plot()
s = chunkedarray(cellwidth=0.6,
                 cellheight=0.6,
                 arr=[[],[],[],[2,3],[1,0],[4,5],[], [],[]])
p.add(s)
print p
```



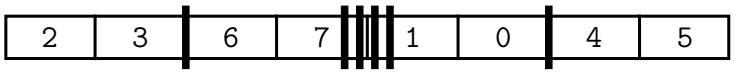
Two empty lists in the middle:

```
from latextool_basic import Plot, grid, chunkedarray
p = Plot()
s = chunkedarray(cellwidth=1.2,
                 cellheight=0.6,
                 arr=[[2,3],[6,7],[],[],[1,0],[4,5]])
p.add(s)
print p
```



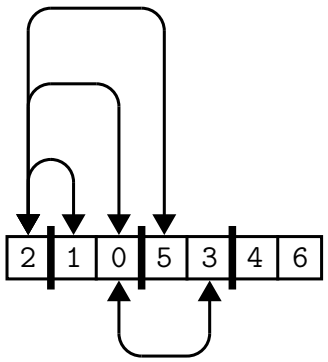
3 empty lists in the middle:

```
from latextool_basic import Plot, grid, chunkedarray
p = Plot()
s = chunkedarray(cellwidth=1.2,
                 cellheight=0.6,
                 arr=[[2,3],[6,7],[],[],[],[1,0],[4,5]])
p.add(s)
print p
```



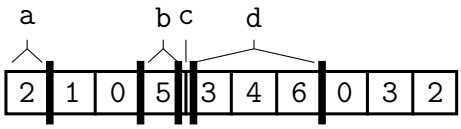
Swaps:

```
from latextool_basic import Plot, grid, chunkedarray
p = Plot()
s = chunkedarray(cellwidth=0.6,
                 cellheight=0.6,
                 arr=[[2],[1,0],[5,3],[4,6]],
                 swaps=[(0,1,1),(0,2,2), (0,3,3),(2,4,-1)])
p.add(s)
print p
```



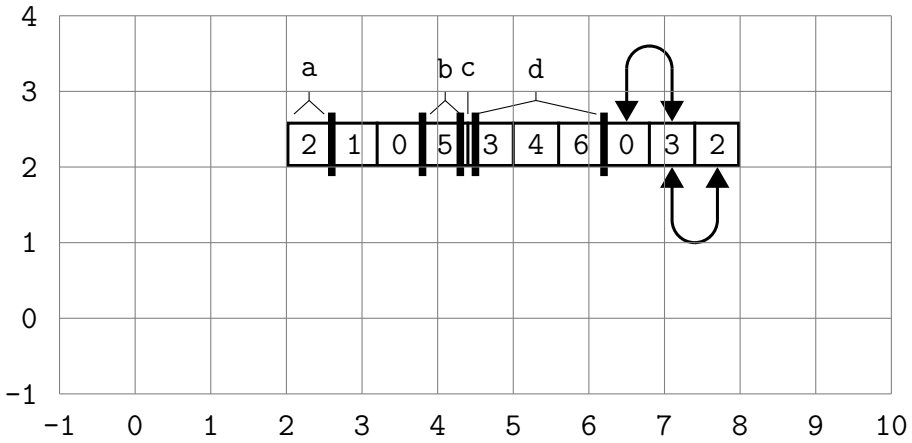
Labels for chunks

```
from latextool_basic import Plot, grid, chunkedarray
p = Plot()
s = chunkedarray(cellwidth=0.6,
                 cellheight=0.6,
                 arr=[[2],[1,0],[5],[],[3,4,6],[0,3,2]],
                 chunklabels=['a', '', 'b', 'c','d'])
p.add(s)
print p
```



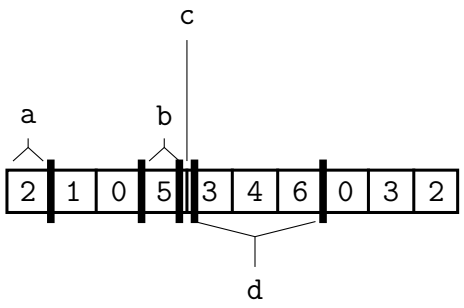
Labels for chunks with x,y:

```
from latextool_basic import Plot, chunkedarray, Grid
p = Plot()
s = chunkedarray(x=2, y=2,
                 cellwidth=0.6,
                 cellheight=0.6,
                 arr=[[2],[1,0],[5],[],[3,4,6],[0,3,2]],
                 swaps=[(7,8,1),(8,9,-1)],
                 chunklabels=['a', '', 'b', 'c','d'])
p.add(s)
p += Grid(x0=-1,y0=-1,x1=10,y1=4)
print p
```



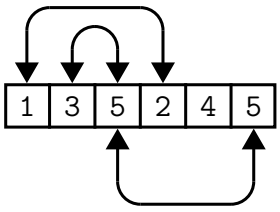
Labels with heights:

```
from latextool_basic import Plot, grid, chunkedarray
p = Plot()
s = chunkedarray(cellwidth=0.6,
                 cellheight=0.6,
                 arr=[[2],[1,0],[5],[],[3,4,6],[0,3,2]],
                 chunklabels=['a', '', 'b', ('c',2),('d',-1)])
p.add(s)
print p
```



Using chunkedarray as array with swaps:

```
from latextool_basic import Plot, grid, chunkedarray
p = Plot()
s = chunkedarray(cellwidth=0.6,
                 cellheight=0.6,
                 arr=[[1,3,5,2,4,5]],
                 swaps=[(0,3,1), (1,2,0.75), (2,5,-1)]
)
p.add(s)
print p
```



TODO: unify API for chunked and regulars.

TODO: avoid collision of arrow tips and edge crossing.

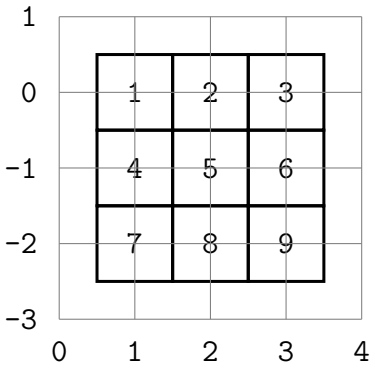
TODO: label arrow

TODO: label array

File: array2d.tex

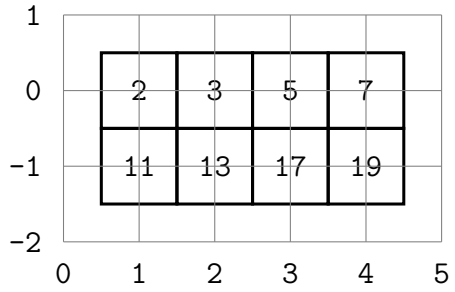
26 2D Array

```
from latextool_basic import *
p = Plot()

c = Array2d(x=0.5, y=0.5, xs=[[1,2,3],[4,5,6],[7,8,9]])
p += c
p += Grid()
print p
```

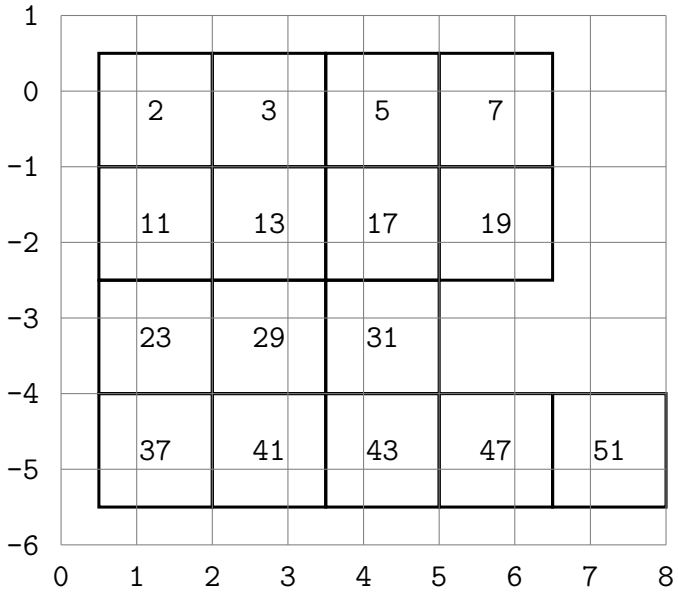


tmp/c95c9bb48ff8cf0b8ff53bce6253be8b.pdf

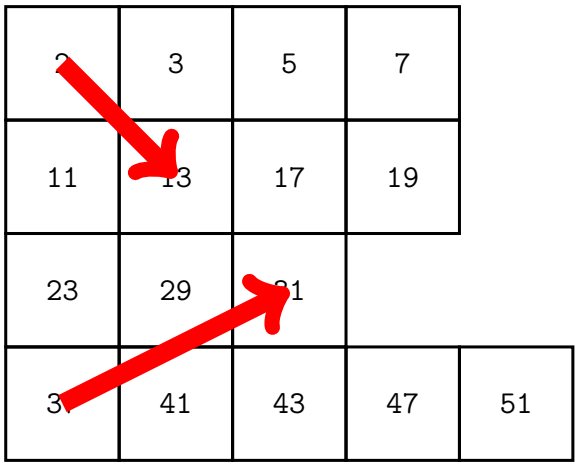
```
from latextool_basic import *
p = Plot()
a = Array2d(0.5, 0.5, [[2, 3, 5, 7], [11,13,17,19]])

p += a
p += Grid()
print p
```



```
from latextool_basic import *
p = Plot()
a = Array2d(0.5, 0.5, width=1.5, height=1.5, xs=[[2, 3, 5, 7], [11,13,17,19
], [23, 29, 31], [37,41,43,47,51]])

p += a
p += Grid()
print p
```

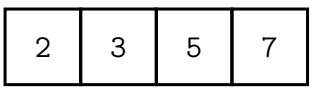


```
from latextool_basic import *
p = Plot()
a = Array2d(0, 0, width=1.5, height=1.5, xs=[[2, 3, 5, 7], [11,13,17,19], [
23, 29, 31], [37,41,43,47,51]])

def l((r0,c0), (r1,c1)):
    return Line(a[r0][c0].centerx(), a[r0][c0].centery(),
           a[r1][c1].centerx(), a[r1][c1].centery(),
           linecolor='red', linewidth=0.25, endstyle='->')

p += a
p += l((0,0),(1,1))
p += l((3,0),(2,2))

print p
```



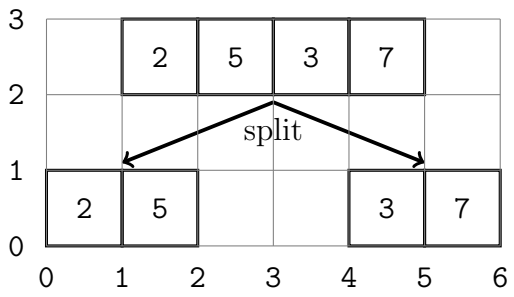
Test Array2d drawing 1d array:

```
from latextool_basic import *
p = Plot()
p += Array2d(0, 0, width=1, height=1, xs=[[2, 3, 5, 7]])
print p
```



The split operation in mergesort:

```
from latextool_basic import *
p = Plot()

def arr(x, y, xs):
    return Array2d(x, y, width=1, height=1, xs=xs)

def string(x, y, s):
    return Rect2(x0=x, y0=y, x1=x, y1=y, linewidth=0, label = s)

def _line(x0, y0, x1, y1):
    gap = 0.1
    y0 -= gap
    y1 += gap
    return Line(x0, y0, x1, y1, endstyle='->', linewidth=0.05)

xs = [2, 5, 3, 7]; left = xs[:len(xs)/2]; right = xs[len(xs)/2:]
common_len = max(len(left), len(right))

x = 1; y = 3
a = arr(x, y, xs=[xs])
midx = a.bottom()[0]

b = arr(midx - 1 - common_len, y - 2, xs=[left])
c = arr(midx + 1, y - 2, xs=[right])
d = string(midx, 1.5, "split")
p += a; p += b; p += c; p += d

x0, y0 = a.bottom()
x1, y1 = midx - 1 - common_len/2.0, y0 - 1
p += _line(x0, y0, x1, y1)
x1, y1 = midx + 1 + common_len/2.0, y0 - 1
p += _line(x0, y0, x1, y1)

p += Grid()
print p
```

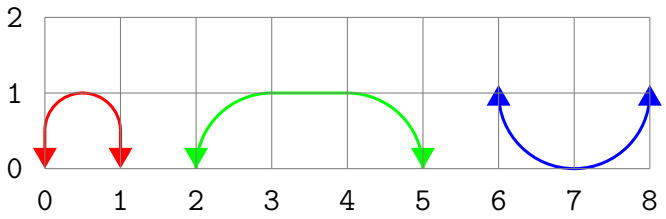


File: bend.tex

27 bend

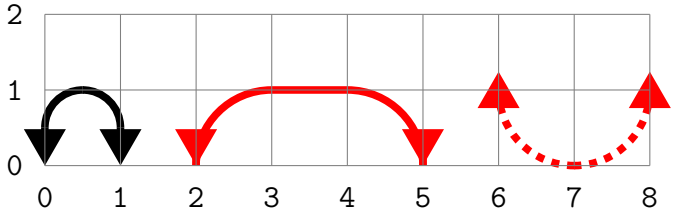
Basically used for drawing swaps in array sorting.

```
from latextool_basic import Plot, Grid, bend
p = Plot()
p += bend([0,0], [1, 0], dy=1, linecolor='red')
p += bend([2,0], [5, 0], dy=1, linecolor='green')
p += bend([6,1], [8, 1], dy=-1, linecolor='blue')
p += Grid(x0=0, y0=0, x1=8, y1=2)
print p
```



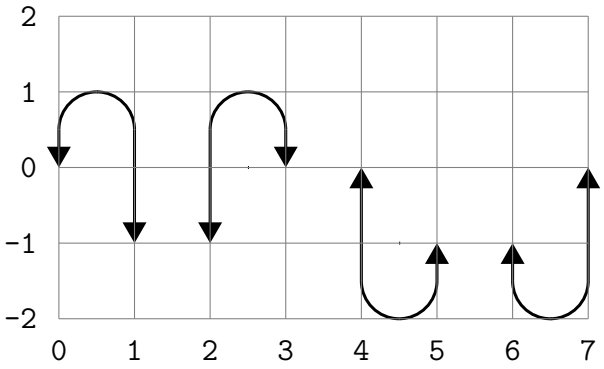
You can specify linewdith, linecolor, linestyle:

```
from latextool_basic import Plot, Grid, bend
p = Plot()
p += bend([0,0], [1, 0], dy=1, linewidth=0.1)
p += bend([2,0], [5, 0], dy=1, linewidth=0.1, linecolor='red')
p += bend([6,1], [8, 1], dy=-1, linewidth=0.1, linecolor='red',
          linestyle='dashed')
p += Grid(x0=0, y0=0, x1=8, y1=2)
print p
```



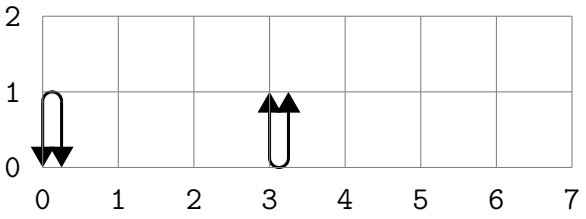
The y values can be different:

```
from latextool_basic import Plot, Grid, bend
p = Plot()
p += bend([0,0], [1, -1], dy=1)
p += bend([2,-1], [3, 0], dy=1)
p += bend([4,0], [5, -1], dy=-1)
p += bend([6,-1], [7, 0], dy=-1)
p += Grid(x0=0, y0=-2, x1=7, y1=2)
print p
```



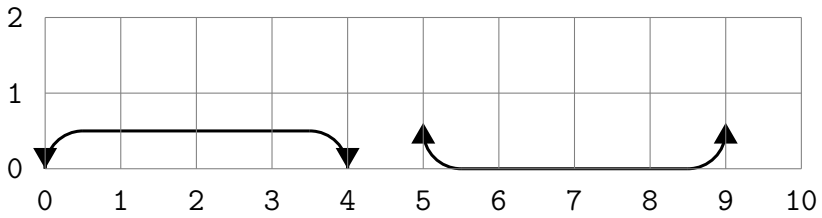
default radius (dy too large):

```
from latextool_basic import Plot, Grid, bend
p = Plot()
s0 = bend([0,0], [0.25,0], dy=1)
s1 = bend([3,1], [3.25,1], dy=-1)
p.add(s0)
p.add(s1)
p += Grid(x0=0, y0=0, x1=7, y1=2)
print p
```



default radius (dx too large):

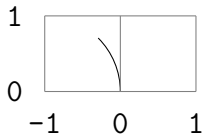
```
from latextool_basic import Plot, Grid, bend
p = Plot()
s0 = bend([0,0], [4,0], dy=0.5)
s1 = bend([5,0.5], [9,0.5], dy=-0.5)
p.add(s0)
p.add(s1)
p += Grid(x0=0, y0=0, x1=10, y1=2)
print p
```



File: arc.tex

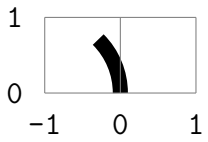
28 arc

```
from latextool_basic import Plot, Grid, arc
p = Plot()
p += arc(x=0, y=0, r=1, angle0=0, angle1=45)
p += Grid(x0=-1, y0=0, x1=1, y1=1)
print p
```



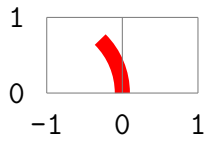
Set linewidth:

```
from latextool_basic import Plot, Grid, arc
p = Plot()
p += arc(x=0, y=0, r=1, angle0=0, angle1=45, linewidth=0.2)
p += Grid(x0=-1, y0=0, x1=1, y1=1)
print p
```



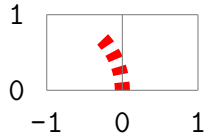
Set color:

```
from latextool_basic import Plot, Grid, arc
p = Plot()
p += arc(x=0, y=0, r=1, angle0=0, angle1=45,
         linewidth=0.2, linecolor='red')
p += Grid(x0=-1, y0=0, x1=1, y1=1)
print p
```



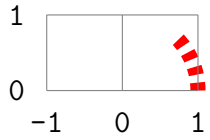
Set linestyle:

```
from latextool_basic import Plot, Grid, arc
p = Plot()
p += arc(x=0, y=0, r=1, angle0=0, angle1=45,
        linewidth=0.2, linecolor='red', linestyle='dashed')
p += Grid(x0=-1, y0=0, x1=1, y1=1)
print p
```



Change starting point of arc:

```
from latextool_basic import Plot, Grid, arc
p = Plot()
p += arc(x=1, y=0, r=1, angle0=0, angle1=45,
        linewidth=0.2, linecolor='red', linestyle='dashed')
p += Grid(x0=-1, y0=0, x1=1, y1=1)
print p
```



File: shell.tex

29 shell

The following are 3 ways to draw a framed verbatim environment.

METHOD 1. The following is a console latex environment:

```
[student@localhost latextool] pwd
home/student
```

Line after the console environment. Here are two such:

```
[student@localhost latextool] pwd
home/student
```

```
[student@localhost latextool] pwd
home/student
```

METHOD 2. The following is a python environment that prints a shell function call:

```
[student@localhost doc] pwd
/home/student/host/work/projects/latextool/doc
```

Line after python environment with shell function call. Here are two such:

```
[student@localhost doc] pwd
/home/student/host/work/projects/latextool/doc
```

```
[student@localhost doc] pwd
/home/student/host/work/projects/latextool/doc
```

METHOD 3. The following is a python environment that prints an execute function call:

```
[student@localhost doc] pwd
/home/student/host/work/projects/latextool/doc
```

Line after python environment with execute function call. Here are two such:

```
[student@localhost doc] pwd
/home/student/host/work/projects/latextool/doc
```

```
[student@localhost doc] pwd
/home/student/host/work/projects/latextool/doc
```

Notice the vertical spacing before and after the framed window is smaller for 1. The verbatim spacing before and after the framed window for 2 and 3 are the same.

METHOD 4. The following is a python environment that prints an execute function call:

```
from latextool_basic import shell
print shell('pwd')
```

```
[student@localhost doc] pwd
/home/student/host/work/projects/latextool/doc
```

Line after python environment with execute function call.

Another example:

```
from latextool_basic import shell
print shell('ls -la c*.py')
```

```
[student@localhost doc] ls -la c*.py
ls: cannot access c*.py: No such file or directory
```

Line after python environment with execute function call.

Execute command in another directory

```
from latextool_basic import shell
print shell('pwd; ls -la .b*', dir='/home/student')
```

```
[student@localhost ~] pwd; ls -la .b*
/home/student
-rw-------. 1 student student 9915 Dec 17 14:42 .bash_history
-rw-r--r--. 1 student student   18 Jun 22  2010 .bash_logout
-rw-r--r--. 1 student student  176 Jan 25  2012 .bash_profile
-rw-r--r--. 1 student student  176 Jun 22  2010 .bash_profile~
-rw-r--r--  1 student student 1047 Mar 19  2013 .bashrc
-rw-r--r--  1 student student 1032 Feb 19  2013 .bashrc~
```

no execution

```
from latextool_basic import shell
print shell('ls -la', execute=False)
```

```
[student@localhost doc] ls -la
```

Executing with error:
PYTHON ERROR. See source, stderr, stdout below

```
print x
```

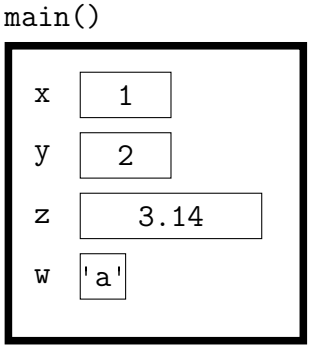
```

```

```
Traceback (most recent call last):
  File "dgcmhzwq.tmp.py", line 1, in <module>
    print x
NameError: name 'x' is not defined
```

File: frame.tex

30 Frame

```
from latextool_basic import *
p = Plot()
env = [('x', 1), ('y', 2), ('z', 3.14), ('w', 'a')]
p.add(frame(env, top="main()"))
print p
```



tmp/de9ccc511094d770e786a5aea648bcb4.pdf

```
File:  test-verbatim-spacing.tex
```

31 Test Verbatim Spacing

First here's the vertical spacing between paragraphs. Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

TEST 1. Text, console environment, text:

```
hello world
```

Line after.

TEST 2. Text, console environment, console environment, text:

```
hello world
```

```
hello world
```

Line after. Probably won't be used. Probably too much spacing between the two environments.

TEST 3. Text, python environment with console function, text:

```
hello world
```

Line after.

File: automata.tex

32 Automata

The `automata` function (in the `latextool_basic` module) spits out latex code for state diagrams which can then be modified by hand.

Here are some examples.

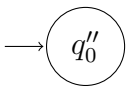
If you execute the following python code:

```
print automata(layout="""
    A
    """,
    A="initial|label=$q''_0$",
    )
```

you will get this latex code as output:

```
\begin{center}
\begin{tikzpicture}[shorten >=1pt,node distance=2cm,auto,initial text=]
\node[state,initial] (A) at (  4,  0) {$q''_0$};

\path[->]

;
\end{tikzpicture}
\end{center}
```

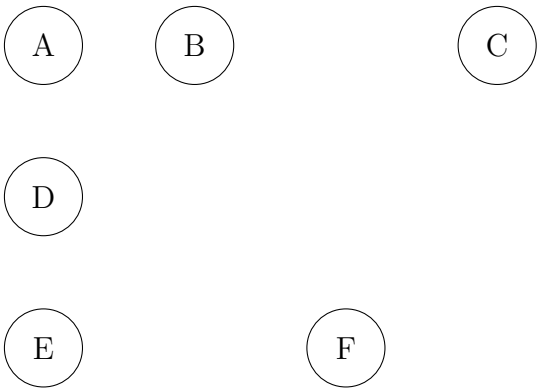
When you paste the above output into a latex document, you will get this picture:



The `layout` parameter is a string for placing the nodes. When you execute this:

```
from latextool_basic import *
automata(layout="""
A B   C
D
E   F
"""
)
```

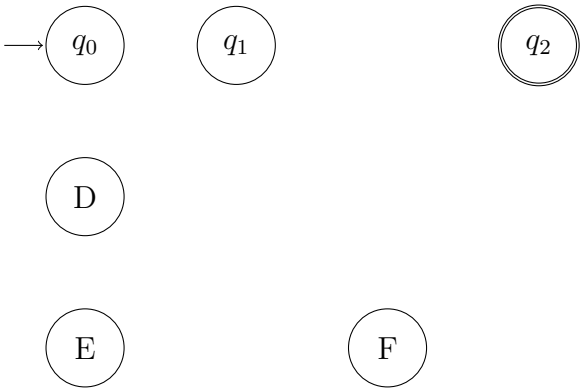
you get this output:



You can then put decorate each node.

```
from latextool_basic import *
print automata(layout="""
A B   C
D
E   F
""",
A = "initial|label=$q_0$",
B = "label=$q_1$",
C = "accept|label=$q_2$"
)
```

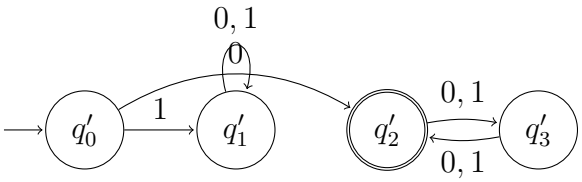
gives this picture



For the rest of the examples, I will just give you the python code and the corresponding picture.

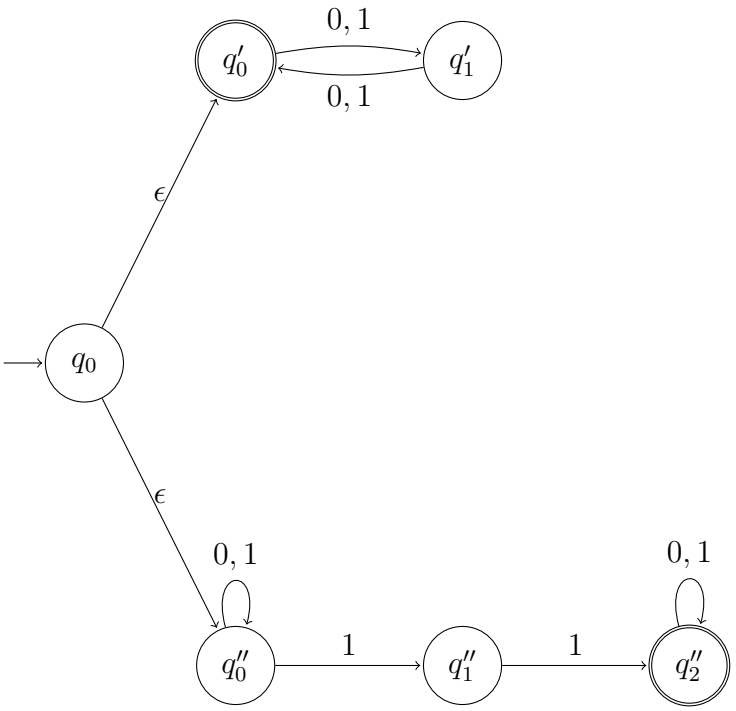
DFA for "starts with 0 and has odd length":

```
from latextool_basic import *
print automata(layout="""
A D B C
""",
edges="A,$0$,B|B,$0,1$,C|C,$0,1$,B|A,$1$,D|D,$0,1$,D",
A="initial|label=$q'_0$",
B="accept|label=$q'_2$",
C="label=$q'_3$",
D="label=$q'_1$",
)
```



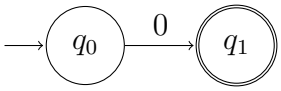
Sipser 1.7c

```
from latextool_basic import *
print automata(layout="""
  B  D

A

  C  E  F
""",
edges="A,$\ep$,B|B,$0,1$,D|D,$0,1$,B|A,$\ep$,C|C,$1$,E|E,$1$,F|C,$0,1$,C|F,
$0,1$,F",
A="initial|label=$q_0$",
B="accept|label=$q'_0$",
C="label=$q''_0$",
D="label=$q'_1$",
E="label=$q''_1$",
F="label=$q''_2$|accept",
)
```



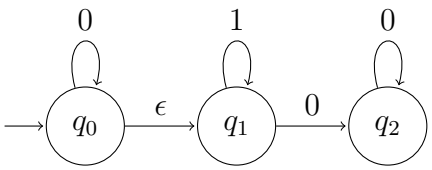
Sipser 1.7d

```
from latextool_basic import *

print automata(layout="""
A B
""",
edges="A,$0$,B",
A="initial|label=$q_0$",
B="accept|label=$q_1$",
)
```



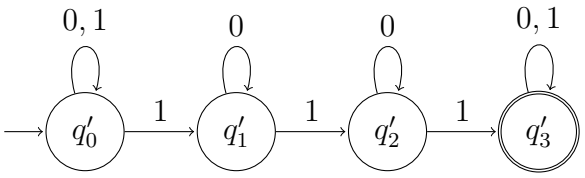
Sipser 1.7e

```
from latextool_basic import *
print automata(layout="""
A B C
""",
edges="A,$\ep$,B|A,$0$,A|B,$1$,B|B,$0$,C|C,$0$,C",
A="initial|label=$q_0$",
B="label=$q_1$",
C="label=$q_2$",
)
```



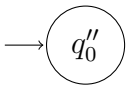
NFA for at least three 1s:

```
from latextool_basic import *
print automata(layout="""
A B C D
""",
edges="A,1,B|B,1,C|C,1,D|A,$0,1$,A|D,$0,1$,D|B,0,B|C,0,C",
A="initial|label=$q'_0$",
B="label=$q'_1$",
C="label=$q'_2$",
D="accept|label=$q'_3$",
)
```



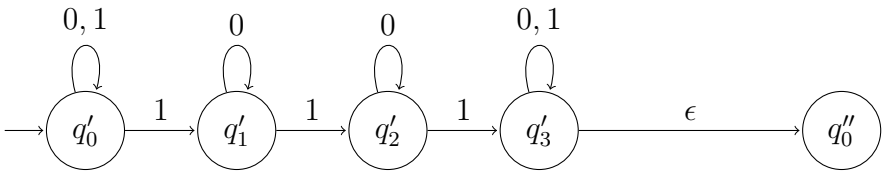
NFA for $\emptyset$:

```
from latextool_basic import *
print automata(layout="""
A
""",
A="initial|label=$q''_0$",
)
```



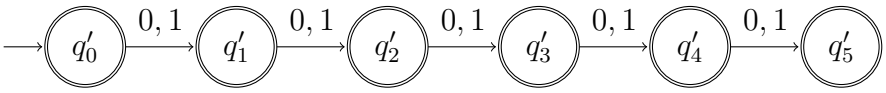
NFA for concat of "contains at least 3 1s" and $\emptyset$:

```
from latextool_basic import *
print automata(layout="""
A B C D   E
""",
edges="A,1,B|B,1,C|C,1,D|A,$0,1$,A|D,$0,1$,D|B,0,B|C,0,C|D,$\ep$,E",
A="initial|label=$q'_0$",
B="label=$q'_1$",
C="label=$q'_2$",
D="label=$q'_3$",
E="label=$q''_0$"
)
```



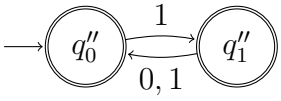
NFA for concat of "length <= 5" and "every odd position is a 1":

```
from latextool_basic import *
print automata(layout="""
A B C D E F
""",
edges="A,$0,1$,B|B,$0,1$,C|C,$0,1$,D|D,$0,1$,E|E,$0,1$,F",
A="accept|initial|label=$q'_0$",
B="accept|label=$q'_1$",
C="accept|label=$q'_2$",
D="accept|label=$q'_3$",
E="accept|label=$q'_4$",
F="accept|label=$q'_5$",
)
```



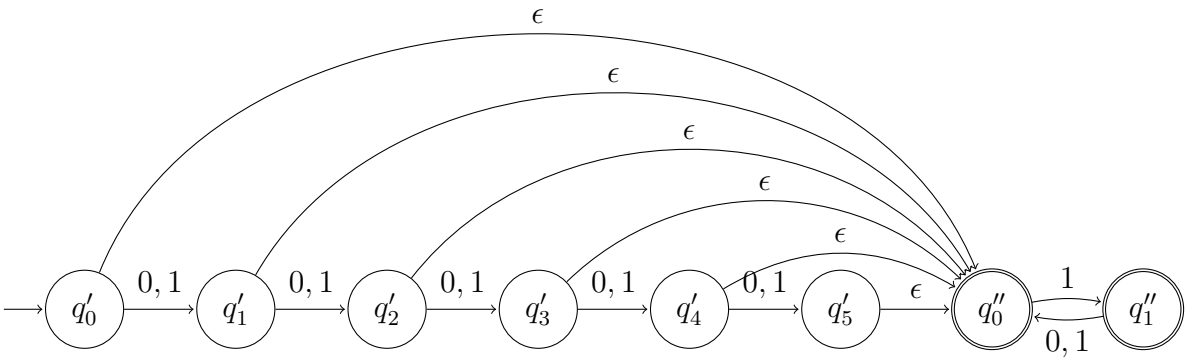
NFA for "every odd position is a 1":

```
from latextool_basic import *
print automata(layout="""
A B
""",
edges="A,$1$,B|B,$0,1$,A",
A="accept|initial|label=$q''_0$",
B="accept|label=$q''_1$",
)
```



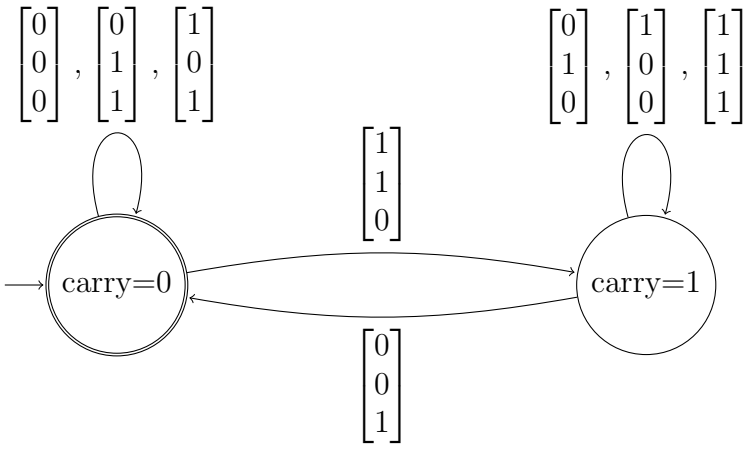
NFA for concat of “length <=5” and “every odd position is a 1”:

```
from latextool_basic import *
print automata(layout="""
A B C D E F G H
""",
edges="A,$0,1$,B|B,$0,1$,C|C,$0,1$,D|D,$0,1$,E|E,$0,1$,F"+\
 "|F,$\epsilon$,G"+\
 "|A,$\epsilon$,G"+\
 "|B,$\epsilon$,G"+\
 "|C,$\epsilon$,G"+\
 "|D,$\epsilon$,G"+\
 "|E,$\epsilon$,G"+\
 "|G,$1$,H|H,$0,1$,G",
A="initial|label=$q'_0$",
B="label=$q'_1$",
C="label=$q'_2$",
D="label=$q'_3$",
E="label=$q'_4$",
F="label=$q'_5$",
G="accept|label=$q''_0$",
H="accept|label=$q''_1$",
)
```



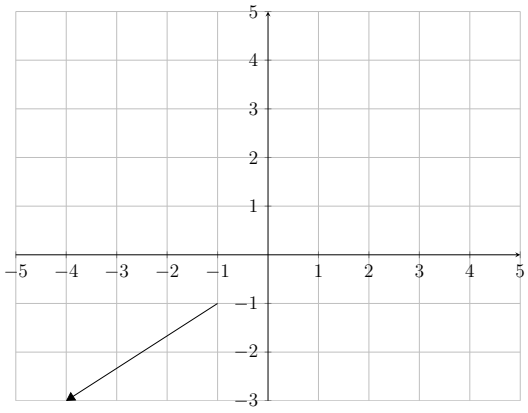
NFA with vectors as Σ:

```
from latextool_basic import *
print automata(layout="""
A      B
""",
edges=r"A,$\begin{bmatrix}0\\0\\0 \end{bmatrix},\begin{bmatrix}0\\1\\1 \end
{bmatrix},\begin{bmatrix}1\\0\\1 \end{bmatrix}$,A"+\
r"|A,$\begin{bmatrix}1\\1\\0\end{bmatrix}$,B"+\
r"|B,$\begin{bmatrix}0\\1\\0\end{bmatrix},\begin{bmatrix}1\\0\\0\end{bmatri
x},\begin{bmatrix}1\\1\\1\end{bmatrix}$,B"+\
r"|B,$\begin{bmatrix}0\\0\\1\end{bmatrix}$,A"+\
r"",
A="initial|accept|label=carry=0",
B="label=carry=1",
)
```



File: vec2d.tex

33 2d vector diagram

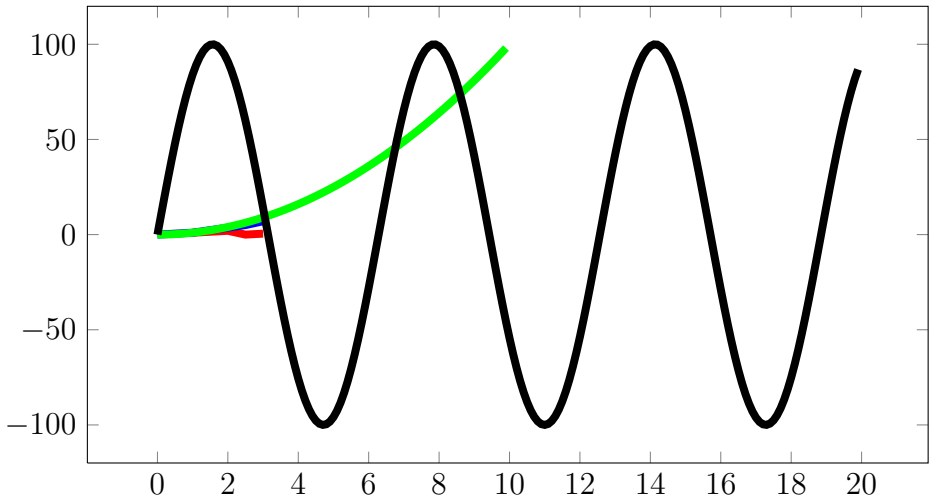


ANSWER:

File: line-graph.tex

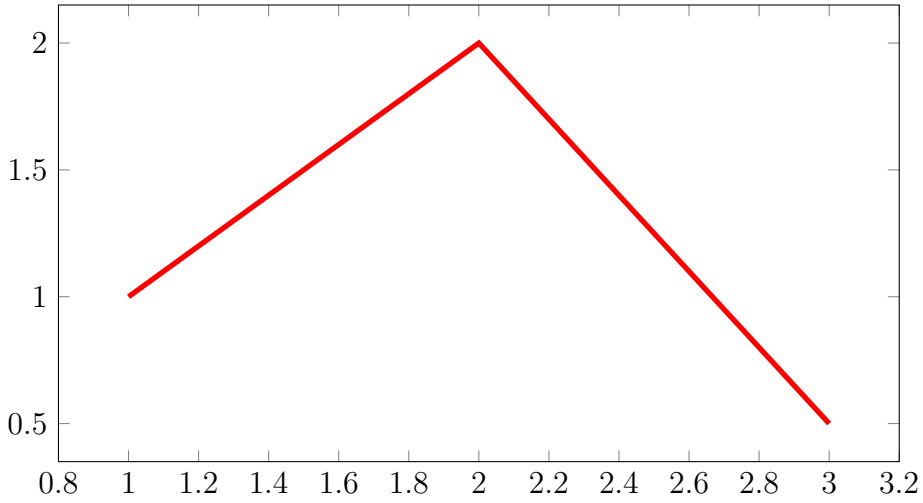
34 Line Graph

```
from math import sin
from latextool_basic import *
plot = FunctionPlot()

data = ((1, 1), (2, 2), (2.5, 0), (3, 0.5))
data2 = ((0, 0), (1, 1), (2.5, 5), (3, 7))
data3 = [(x/10.0, (x/10.0)**2) for x in range(0, 100)]
data4 = [(x/10.0, 100 * sin(x/10.0)) for x in range(0, 200)]
plot.add(data, line_width='3', color='red')
plot.add(data2, line_width='3', color='blue')
plot.add(data3, line_width='3', color='green')
plot.add(data4, line_width='3', color='black')
print plot
```



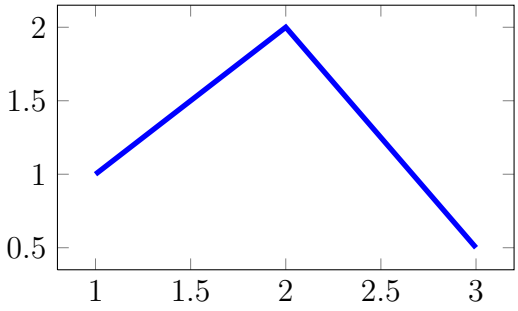
Line width and color:

```
from latextool_basic import *
plot = FunctionPlot()
plot.add(((1, 1), (2, 2), (3, 0.5)), line_width='2', color='red')
print plot
```



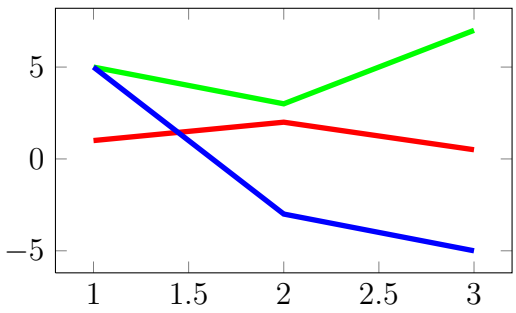
Width and height:

```
from latextool_basic import *
plot = FunctionPlot(width="3in", height="2in")
plot.add(((1, 1), (2, 2), (3, 0.5)), line_width='2', color='blue')
print plot
```



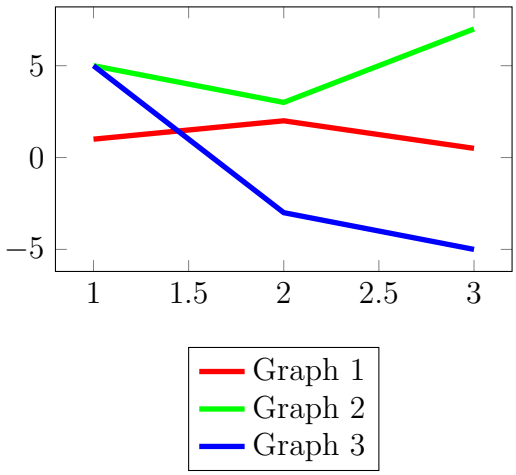
Multiple lines:

```
from latextool_basic import *
plot = FunctionPlot(width="3in", height="2in")
plot.add(((1, 1), (2, 2), (3, 0.5)), line_width='2', color='red')
plot.add(((1, 5), (2, 3), (3, 7)), line_width='2', color='green')
plot.add(((1, 5), (2, -3), (3, -5)), line_width='2', color='blue')
print plot
```



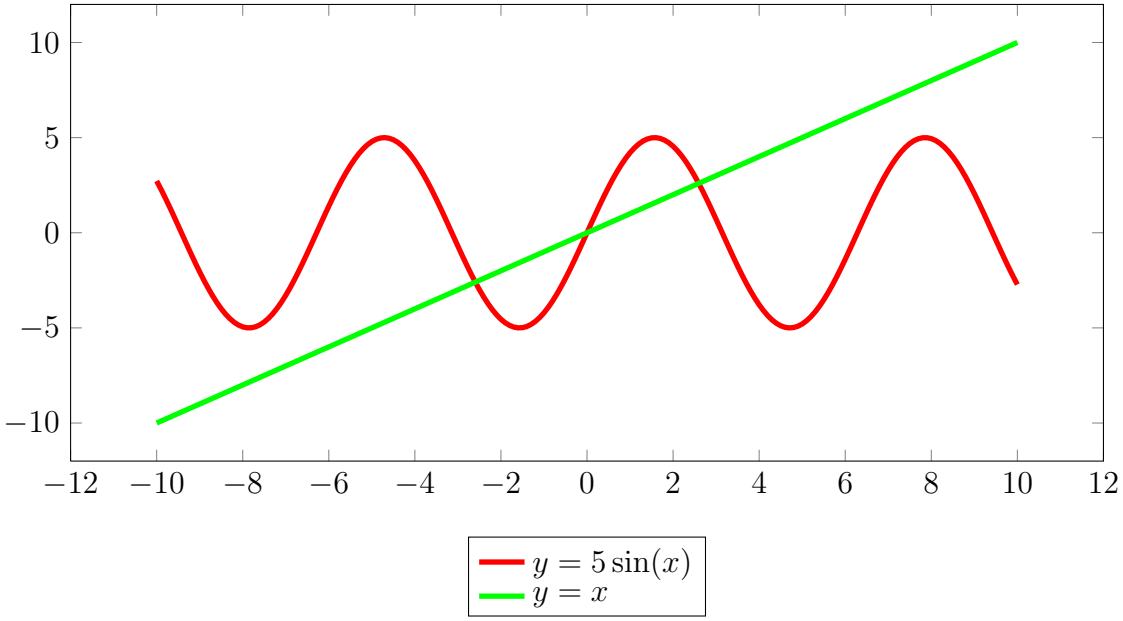
Legend:

```
from latextool_basic import *
plot = FunctionPlot(width="3in", height="2in")
plot.add(((1, 1), (2, 2), (3, 0.5)), line_width='2', color='red', legend='G
raph 1')
plot.add(((1, 5), (2, 3), (3, 7)), line_width='2', color='green', legend='G
raph 2')
plot.add(((1, 5), (2, -3), (3, -5)), line_width='2', color='blue', legend='
Graph 3')
print plot
```

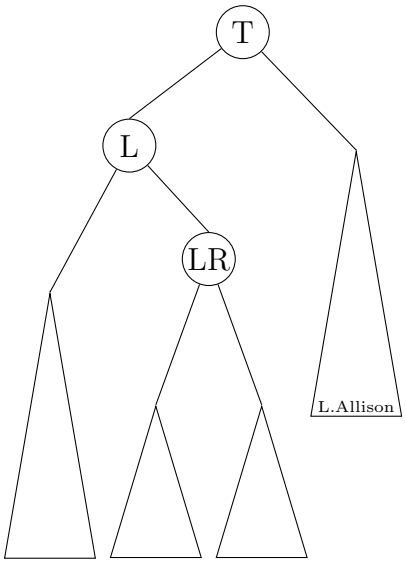


Legend:

```
from math import sin
domain = [x / 10.0 for x in range(-100, 101)]
y_sinx = [(x, 5 * sin(x)) for x in domain]
y_x = [(x, x) for x in domain]

from latextool_basic import *
plot = FunctionPlot(width="6in", height="3in")
plot.add(y_sinx, line_width='2', color='red', legend=r'$y = 5 \sin(x)$')
plot.add(y_x, line_width='2', color='green', legend='$y = x$')
print plot
```



35 TEST ISOCELES TRIANGLE



http://tex.stackexchange.com/questions/7862/triangle-node-with-adjustable-height

http://tex.stackexchange.com/questions/37462/placing-a-triangle-around-nodes-in-a-tre