# sphinxcontrib-jupyter Documentation

***Release 20.1.1***

**QuantEcon Development Team**

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# Contents:

This sphinx extension can be used to build a collection of Jupyter notebooks for Sphinx Projects.

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**Note:** It has mainly been written to support the use case of scientific publishing and hasn't been well tested outside of this domain. Please provide feedback as an issue to this repository.

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**Requires:** Sphinx >= 1.7.2 (for running tests).

One of the main benefits of writing Jupyter notebooks as `RST` files is to simplify the task of version control for large projects.

CHAPTER 1

# Installation

To install the extension:

```
pip install sphinxcontrib-jupyter
```

to upgrade your current installation to the latest version:

```
pip install --upgrade sphinxcontrib-jupyter
```

**Todo:** Add installation to distribute via conda-forge. See Issue #160.

You can refer to the release notes for information on each release.

## 1.1 Alternative

Another way to get the **latest** version it is to install directly by getting a copy of the repository:

```
git clone https://github.com/QuantEcon/sphinxcontrib-jupyter
```

and then use

```
python setup.py install
```

## 1.2 Developers

For developers it can be useful to install using the *develop* option:

```
python setup.py develop
```

this will install the package into the *site-wide* package directory which is linked to the code in your local copy of the repository. It is **not** recommended to install this way for common use.

# CHAPTER 2

## Sphinx Setup

To initially setup a Sphinx project, please refer here.

**Note:** QuantEcon has developed a `jupinx-quickstart` that can assist with setting up a repository to get you up and running quickly. Please refer to the Jupinx Project for more details.

You can use the sphinx quickstart and update the project `conf.py` file to include the jupyter extension and add the desired configuration settings (see *Extension Configuration* section for details):

```
extensions = ["sphinxcontrib.jupyter"]
```

once the extension is installed you can then run:

```
make jupyter
```

The *Extension Configuration* section includes details on how to configure the extension in your `conf.py`.

CHAPTER 3

# Extension Configuration and Options

The options are split into the different parts of the compilation pipeline that are available in this extension:

## 3.1 Constructing Jupyter Notebooks

**Options**

- *jupyter_conversion_mode*
- *jupyter_static_file_path*
- *jupyter_header_block*
- *jupyter_default_lang*
- *jupyter_lang_synonyms*
- *jupyter_kernels*
- *jupyter_write_metadata*
- *jupyter_options*
- *jupyter_drop_solutions*
- *jupyter_drop_tests*
- *jupyter_ignore_no_execute:*
- *jupyter_ignore_skip_test*
- *jupyter_allow_html_only*
- *jupyter_target_html*
- *jupyter_images_markdown*

- *jupyter_dependencies*

### 3.1.1 jupyter_conversion_mode

Specifies which writer to use when constructing notebooks.

| Option | Description |
|---|---|
| "all" (**default**) | compile complete notebooks which include `markdown cells` and `code blocks` |
| "code" | compile notebooks that only contain the `code blocks`. |

`conf.py` usage:

```
jupyter_conversion_mode = "all"
```

### 3.1.2 jupyter_static_file_path

Specify path to *_static* folder.

`conf.py` usage:

```
jupyter_static_file_path = ["source/_static"]
```

### 3.1.3 jupyter_header_block

Add a header block to every generated notebook by specifying an RST file

`conf.py` usage:

```
jupyter_header_block = ["source/welcome.rst"]
```

### 3.1.4 jupyter_default_lang

Specify default language for collection of RST files

`conf.py` usage:

```
jupyter_default_lang = "python3"
```

### 3.1.5 jupyter_lang_synonyms

Specify any language synonyms.

This will be used when parsing code blocks. For example, python and ipython have slightly different highlighting directives but contain code that can both be executed on the same kernel

`conf.py` usage:

```
jupyter_lang_synonyms = ["pycon", "ipython"]
```

### 3.1.6 jupyter_kernels

Specify kernel information for the jupyter notebook metadata.

This is used by jupyter to connect the correct language kernel and is **required** in `conf.py`.

`conf.py` usage:

```
jupyter_kernels = {
    "python3": {
        "kernelspec": {
            "display_name": "Python",
            "language": "python3",
            "name": "python3"
            },
        "file_extension": ".py",
    },
}
```

**Todo:** See Issue 196

### 3.1.7 jupyter_write_metadata

write time and date information at the top of each notebook as notebook metadata

**Note:** This option is slated to be deprecated

### 3.1.8 jupyter_options

An dict-type object that is used by dask to control execution

**Todo:** This option needs to be reviewed

### 3.1.9 jupyter_drop_solutions

Drop `code-blocks` that include `:class: solution`

| Values |
|---|
| False (**default**) |
| True |

**Todo:** This option needs to be reviewed

### 3.1.10 jupyter_drop_tests

Drop `code-blocks` that include ``:class: test`

| Values |
|---|
| False (**default**) |
| True |

**Todo:** This option needs to be reviewed

### 3.1.11 jupyter_ignore_no_execute:

| Values |
|---|
| False (**default**) |
| True |

When constructing notebooks this option can be enabled to ignore *:class: no-execute* for *code-blocks*. This is useful for *html* writer for pages that are meant to fail but shouldn't be included in *coverage* tests.

`conf.py` usage:

```
jupyter_ignore_no_execute = True
```

### 3.1.12 jupyter_ignore_skip_test

When constructing notebooks this option can be enabled to ignore *:class: skip-test* for *code-blocks*.

| Values |
|---|
| False (**default**) |
| True |

`conf.py` usage:

```
jupyter_ignore_skip_test = True
```

### 3.1.13 jupyter_allow_html_only

Enable this option to allow `.. only:: html` pass through to the notebooks.

| Values |
|---|
| False (**default**) |
| True |

`conf.py` usage:

```
jupyter_allow_html_only = True
```

### 3.1.14 jupyter_target_html

Enable this option to generate notebooks that favour the inclusion of `html` in notebooks to support more advanced features.

| Values |
|---|
| False (**default**) |
| True |

Supported Features:

1. html based table support
2. image inclusion as `html` figures

`conf.py` usage:

```
jupyter_target_html = True
```

### 3.1.15 jupyter_images_markdown

Force the inclusion of images as native markdown

| Values |
|---|
| False (**default**) |
| True |

**Note:** when this option is enabled the *:scale:* option is not supported in RST.

`conf.py` usage:

```
jupyter_images_markdown = True
```

### 3.1.16 jupyter_dependencies

Specify file or directory level dependencies

`conf.py` usage:

```
jupyter_dependencies = {
    <dir> : ['file1', 'file2'],
    {<dir>}/<file.rst> : ['file1']
}
```

this allows you to specify a companion data file for a given `RST` document and it will get copied through sphinx to the `_build` folder.

## 3.2 Executing Notebooks

### 3.2.1 jupyter_execute_nb

Enables the execution of generated notebooks

| Values |
|---|
| False (**default**) |
| True |

**Todo:** deprecate this option in favour of jupyter_execute_notebooks

### 3.2.2 jupyter_execute_notebooks

Enables the execution of generated notebooks

| Values |
|---|
| False (**default**) |
| True |

`conf.py` usage:

```
jupyter_execute_notebooks = True
```

### 3.2.3 jupyter_dependency_lists

Dependency of notebooks on other notebooks for execution can also be added to the configuration file above in the form of a dictionary. The key/value pairs will contain the names of the notebook files.

`conf.py` usage:

```
# add your dependency lists here
jupyter_dependency_lists = {
   'python_advanced_features' : ['python_essentials','python_oop'],
   'discrete_dp' : ['dp_essentials'],
}
```

### 3.2.4 jupyter_dependencies

Specify support (dependencies) for notebook collection at the *file* or the *directory* level.

`conf.py` usage:

```
jupyter_dependencies = {
    <dir> : ['file1', 'file2'],
    {<dir>}/<file.rst> : ['file1']
}
```

**Note:** to specify a support file at the root level of the source directory the key should be “”

### 3.2.5 jupyter_number_workers

Specify the number cores to use with dask

| Values |
| --- |
| Integer (**default** = 1) |

`conf.py` usage:

jupyter_number_workers = 4

### 3.2.6 jupyter_threads_per_worker

Specify the number of threads per worker for dask

| Values |
| --- |
| Integer (**default** = 1) |

`conf.py` usage:

jupyter_threads_per_worker = 1

## 3.3 Converting Notebooks to HTML

**Options**

- *jupyter_generate_html*
- *jupyter_html_template*
- *jupyter_make_site*
- *jupyter_download_nb*
- *jupyter_download_nb_images_urlpath*
- *jupyter_theme*
- *jupyter_theme_path*
- *jupyter_template_path*
- *jupyter_template_html*

### 3.3.1 jupyter_generate_html

Enable sphinx to generate HTML versions of notebooks

| Values |
| --- |
| False (**default**) |
| True |

`conf.py` usage:

```
jupyter_generate_html = True
```

### 3.3.2 jupyter_html_template

Specify path to nbconvert html template file

**Note:** Documentation on nbconvert templates can be found here

`conf.py` usage:

```
jupyter_html_template = "theme/template/<file>.tpl"
```

### 3.3.3 jupyter_make_site

Enable sphinx to construct a complete website

**Todo:** Document all the extra elements this option does over jupyter_generate_html

This option:

1. fetches coverage statistics if coverage is enabled.

`conf.py` usage:

```
jupyter_make_site = True
```

### 3.3.4 jupyter_download_nb

Request Sphinx to generate a collection of download notebooks to support a website

`conf.py` usage:

```
jupyter_download_nb = True
```

### 3.3.5 jupyter_download_nb_images_urlpath

Apply a url prefix when writing images in Jupyter notebooks for *download* notebook set.

`conf.py` usage:

```
jupyter_images_urlpath = "s3://<path>/_static/img/"
```

### 3.3.6 jupyter_theme

Specify theme name

`conf.py` usage:

```
jupyter_theme = <theme-name>
```

The theme should be located in the path of *jupyter_theme_path*. The default path would be: `theme/<theme-name>/`

### 3.3.7 jupyter_theme_path

Specify location for theme files

| Value |
| --- |
| "theme" (**default**) |

`conf.py` usage:

```
jupyter_theme_path = "theme"
```

### 3.3.8 jupyter_template_path

Specify path for templates

| Value |
| --- |
| "templates" (**default**) |

`conf.py` usage:

```
jupyter_template_path = "templates"
```

### 3.3.9 jupyter_template_html

Specify `html` template to be used by `nbconvert`

`conf.py` usage:

```
jupyter_template_html = <path to tpl file>
```

The template file should be located in the path of `jupyter_template_path`. The default path would be: `templates/<tpl file>`

## 3.4 Computing Coverage Statistics

**Warning:** `make coverage` will currently produce a `json` report that can be used to support an execution status page. But adding badges and a status page needs to be made into an option and specified via the default theme. See #237

### 3.4.1 jupyter_make_coverage

Enable coverage statistics to be computed

| Values |
|---|
| False (**default**) |
| True |

### 3.4.2 jupyter_template_coverage_file_path

Provide path to template coverage file

**Todo:** Document format for template

`conf.py` usage:

```
jupyter_template_coverage_file_path = "theme/templates/<file>.json"
```

## 3.5 Configuration for Exercise Directives

**Options**

- *exercise_include_exercise*
- *exercise_inline_exercises*

### 3.5.1 exercise_include_exercise

Enable inclusion / exclusion of exercises directives contained in the rst

| Values |
|---|
| True (**default**) |
| False |

`conf.py` usage:

```
exercise_include_exercise = False
```

### 3.5.2 exercise_inline_exercises

Add inline exercises as a formatting choice

| Values |
|---|
| False (**default**) |
| True |

If the config variable *exercise_inline_exercises* is set to false (the default), then where ever the exercise initially appeared in the body of the document, you will instead see a link that says `See exercise #` which refers to an ExerciseList.

## 3.6 Converting Notebooks to PDF

**Options**

- *jupyter_latex_template*
- *jupyter_pdf_logo*
- *jupyter_bib_file*
- *jupyter_pdf_author*
- *jupyter_pdf_showcontentdepth*
- *jupyter_pdf_urlpath*
- *jupyter_pdf_excludepatterns*

### 3.6.1 jupyter_latex_template

Provide path to *latex* nbconvert template file

`conf.py` usage:

```
jupyter_latex_template = "theme/templates/latex.tpl"
```

### 3.6.2 jupyter_pdf_logo

Add project logo to pdf document

`conf.py` usage:

```
jupyter_pdf_logo = "theme/img/logo.png"
```

### 3.6.3 jupyter_bib_file

Provide path to bibtex file for reference support

`conf.py` usage:

```
jupyter_bib_file = "_static/references.bib"
```

### 3.6.4 jupyter_pdf_author

Specify Author Field for PDF document

`conf.py` usage:

```
jupyter_pdf_author = "QuantEcon Developers"
```

### 3.6.5 jupyter_pdf_showcontentdepth

Specify which depth of the local contents directives to add to generated pdf files

| Values |
| --- |
| 2 (**Default**) |

**Note:** this shows second level contents by default as the pdf document adds the page or document title to the top of the article format.

### 3.6.6 jupyter_pdf_urlpath

Enable local links within the project to link a hosted located via a urlprefix and link modification.

`conf.py` usage:

```
jupyter_pdf_urlpath  = "https://lectures.quantecon.org/"
```

### 3.6.7 jupyter_pdf_excludepatterns

Exclude certainly documents from getting compiled as pdf files.

`conf.py` usage:

```
jupyter_pdf_excludepatterns = ["index", "404", "search"]
```

This can be useful for *make site* when *pdf* construction is part of a broader project that supports *html* targets.

This extension also offers additional directives that can be used while writing your documents

## 3.7 Directives

The following directives are provided by this extension:



### 3.7.1 Directive: exercise

Exercise directives can be added to your text such as:

```
.. exercise::

    Contains the Exercise
```

If you would like to `exclude` them from your documents you can set:

```
exercise_include_exercises = False``
```

in your `conf.py` file.

### 3.7.2 Directive: exerciselist

Collect exercises from the document and compile an exercise list where the directive is placed in the RST

```
.. exerciselist::
```

Beneath each exercise in the list there is another link "(back to text)" that points back to the location where you originally authored/placed the exercise.

#### Provided Options

```
.. exerciselist::
    :scope: SCOPE
    :from: FILE
    :force:
```

| Option | Description | Values |
|---|---|---|
| `:from:` | import exercise defined in a file | |
| `:scope:` | provide scope of exercises | `file`, `section`, or `all` |
| `:force:` | force exercises to render where they are defined | True/False |
| `:title:` | Specify title used for exercise block | |

**`:scope:`**

`file` then only exercises defined in the same file as the *exerciselist* directive will be included `section` then all exercises defined in the same section will be included `all` then all exercises anywhere in the project will be included

**`:force:`**

By default, when the conf.py config setting *exercise_inline_exercises* is true, all exercises will render where they are defined and the exerciselist node will be removed from the doctree.

> **Warning:** However, if the *:force:* option is given the exerciselist will always be rendered and when *exercise_inline_exercises* is True, each problem will be rendered twice.

### Additional Info

If an exercise is included in an exercise list, it is only removed from its original location if the exercise list is in the same file.

For example, if I define an exercise in *A.rst* and in *B.rst* I both define an exercise and an exerciselist with *:scope: section* then the following will happen:

- both exercises will render at the point of the exerciselist in *B.rst*
- The exercise in *B.rst* will not be rendered where it was defined, but instead a link to the exercise list and number will be given
- The exercise in *A.rst* will still be rendered in file A. This means its contents are rendered two times.

It can also be useful to have multiple configurations when working on a large project, such as generating notebooks for working on locally while compiling the project for HTML in a deployment setting.

Further details on how to manage large projects can be found here.

An example *conf.py* is available here

CHAPTER 4

# RST Conversion Gallery

**Note:** A minimum configured sphinx repo is available here which generates a sample notebook

**Examples**



The test suite, located here provides examples of conversions between RST and the Jupyter notebook which form the test cases for this extension. It can be a useful resource to check how elements are converted if they are not contained in this gallery.

## 4.1 code-blocks

The following code in the **.rst** file

```
Code blocks
-----------

This is a collection to test various code-blocks

This is a **.. code::** directive

.. code:: python

    this = 'is a code block'
    x = 1
    no = 'really!'
    p = argwhere(x == 2)

This is another **.. code::** directive

.. code:: python

    from pylab import linspace
    t = linspace(0, 1)
    x = t**2

This is a **::** directive

::

    from pylab import *
    x = logspace(0, 1)
    y = x**2
    figure()
    plot(x, y)
    show()
```

will look as follows in the jupyter notebook

## Code blocks

This is a collection to test various code-blocks

This is a **.. code::** directive

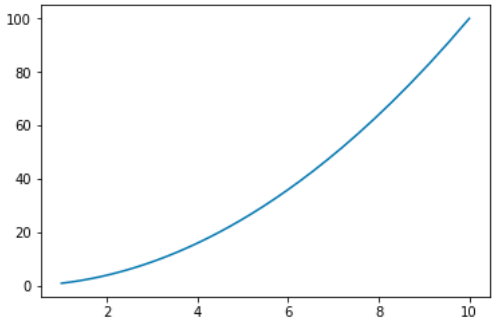
In [5]:
```
this = 'is a code block'
x = 1
no = 'really!'
p = argwhere(x == 2)
```

This is another **.. code::** directive

In [3]:
```
from pylab import linspace
t = linspace(0, 1)
x = t**2
```

This is a **::** directive

In [4]:
```
from pylab import *
x = logspace(0, 1)
y = x**2
figure()
plot(x, y)
show()
```




## 4.2 images and figures

The following code in the .rst file

```
Images
======

Collection of tests for **.. image::** and **.. figure::** directives

Image
-----

`Docutils Reference <http://docutils.sourceforge.net/docs/ref/rst/directives.html
↪#images>`__

Most basic image directive

.. image:: _static/hood.jpg

A scaled down version with 25 % width
```

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```
.. image:: _static/hood.jpg
:width: 25 %

A height of 50px

.. image:: _static/hood.jpg
:height: 50px

Figure
------

`Docutils Reference <http://docutils.sourceforge.net/docs/ref/rst/directives.html
↪#figure>`__

Testing the **.. figure::** directive

.. figure:: _static/hood.jpg
:scale: 50 %
```

will look as follows in the jupyter notebook

## Image

Docutils Reference

Most basic image directive

A scaled down version with 25 % width

A height of 50px

## Figure

Docutils Reference

Testing the .. **figure::** directive

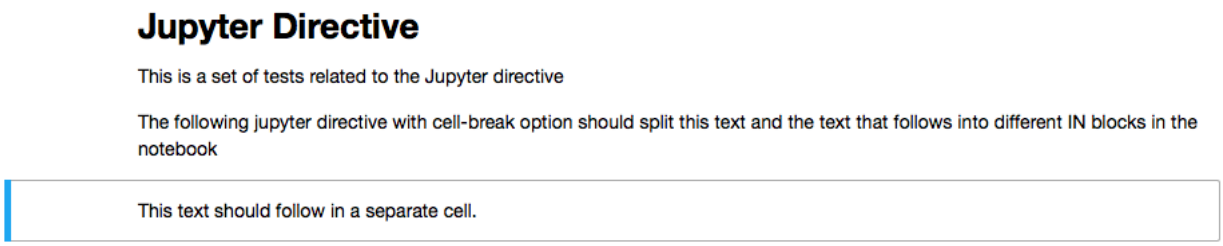
**Warning:** if `jupyter_images_markdown = True` then the `:scale:`, `:height:` and `:width:` attributes will be ignored.

## 4.3 jupyter-directive

The following code in the .rst file

```
Jupyter Directive
=================

This is a set of tests related to the Jupyter directive


The following jupyter directive with cell-break option should
split this text and the text that follows into different IN
blocks in the notebook

.. jupyter::
    :cell-break:

This text should follow in a separate cell.
```

will look as follows in the jupyter notebook



## Jupyter Directive

This is a set of tests related to the Jupyter directive

The following jupyter directive with cell-break option should split this text and the text that follows into different IN blocks in the notebook

This text should follow in a separate cell.

## 4.4 links

The following code in the .rst file

```
.. _links:

Links
-----

Links are generated as markdown references to jump between notebooks and
the sphinx link machinery is employed to track links across documents.

An external link to another `notebook (as full file) <links_target.ipynb>`_

This is a paragraph that contains `a google hyperlink`_.

.. _a google hyperlink: https://google.com.au

- An inline reference to :ref:`another document <links_target>`

Special Cases
-------------

The following link has ( and ) contained within them that doesn't render nicely in␣
↪markdown. In this case the extension will substitute ( with `%28` and ) with `%29`

Thinking back to the mathematical motivation, a `Field <https://en.wikipedia.org/wiki/
↪Field_\(mathematics\)>`_ is an `Ring` with a few additional properties
```

will look as follows in the jupyter notebook

## Links

Links are generated as markdown references to jump between notebooks and the sphinx link machinery is employed to track links across documents.

An external link to another notebook (as full file)

This is a paragraph that contains a google hyperlink.

- An inline reference to another document

## Special Cases

The following link has ( and ) contained within them that doesn't render nicely in markdown. In this case the extension will substitute ( with %28 and ) with %29

Thinking back to the mathematical motivation, a Field is an Ring with a few additional properties

## 4.5 math

The following code in the .rst file

```
Math
----

Inline maths with inline role: :math:`x^3+\frac{1+\sqrt{2}}{\pi}`

Inline maths using dollar signs (not supported yet): $x^3+\frac{1+\sqrt{2}}{\pi}$ as␣
↪the
backslashes are removed.

.. math::

x^3+\frac{1+\sqrt{2}}{\pi}

check math with some more advanced LaTeX, previously reported as an issue.

.. math::

    \mathbb P\{z = v \mid x \}
    = \begin{cases}
        f_0(v) & \mbox{if } x = x_0, \\
        f_1(v) & \mbox{if } x = x_1
    \end{cases}

and labeled test cases

.. math::
   :label: firsteq

    \mathbb P\{z = v \mid x \}
    = \begin{cases}
        f_0(v) & \mbox{if } x = x_0, \\
        f_1(v) & \mbox{if } x = x_1
    \end{cases}
```

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```
Further Inline
--------------

A continuation Ramsey planner at :math:`t \geq 1` takes
:math:`(x_{t-1}, s_{t-1}) = (x_-, s_-)` as given and before
:math:`s` is realized chooses
:math:`(n_t(s_t), x_t(s_t)) = (n(s), x(s))` for :math:`s \in  {\cal S}`

Referenced Math
---------------

Simple test case with reference in text

.. math::
   :label: test

    v = p + \beta v

this is a reference to :eq:`test` which is the above equation
```

will look as follows in the jupyter notebook

## Math

Inline maths with inline role: $x^3 + \frac{1+\sqrt{2}}{\pi}$

Inline maths using dollar signs (not supported yet): $x^3 + frac1 + sqrt2pi$ as the backslashes are removed.

$$x^3 + \frac{1 + \sqrt{2}}{\pi}$$

check math with some more advanced LaTeX, previously reported as an issue.

$$\mathbb{P}\{z = v \mid x\} = \begin{cases} f_0(v) & \text{if } x = x_0, \\ f_1(v) & \text{if } x = x_1 \end{cases}$$

and labeled test cases

$$\mathbb{P}\{z = v \mid x\} = \begin{cases} f_0(v) & \text{if } x = x_0, \\ f_1(v) & \text{if } x = x_1 \end{cases} \tag{1}$$

## Further Inline

A continuation Ramsey planner at $t \geq 1$ takes $(x_{t-1}, s_{t-1}) = (x_-, s_-)$ as given and before $s$ is realized chooses $(n_t(s_t), x_t(s_t)) = (n(s), x(s))$ for $s \in \mathcal{S}$

## Referenced Math

Simple test case with reference in text

$$v = p + \beta v \tag{2}$$

this is a reference to (2) which is the above equation

## 4.6 block-quote

The following code in the .rst file

```
Quote
-----

This is some text

    This is a quote!

and this is not

Epigraph
--------

An epigraph is a special block-quote node

.. epigraph::

    "Debugging is twice as hard as writing the code in the first place.
    Therefore, if you write the code as cleverly as possible, you are, by definition,
    not smart enough to debug it."

-- Brian Kernighan

and one that is technically malformed

.. epigraph::

    "Debugging is twice as hard as writing the code in the first place.
    Therefore, if you write the code as cleverly as possible, you are, by definition,
    not smart enough to debug it." -- Brian Kernighan

with some final text
```

will look as follows in the jupyter notebook

## Quote

This is some text

> This is a quote!

and this is not

## Epigraph

An epigraph is a special block-quote node

> "Debugging is twice as hard as writing the code in the first place. Therefore, if you write the code as cleverly as possible, you are, by definition, not smart enough to debug it."
>
> Brian Kernighan

and one that is technically malformed

> "Debugging is twice as hard as writing the code in the first place. Therefore, if you write the code as cleverly as possible, you are, by definition, not smart enough to debug it." – Brian Kernighan

with some final text

## 4.7 slides

The following code in the .rst file

```
Slide option activated
----------------------

.. jupyter::
    :slide: enable

This is a collection of different types of cells where the toolbar: Slideshow has␣
↪been activated

.. jupyter::
    :cell-break:
    :slide-type: subslide

The idea is that eventually we will assign a type (*slide*, *subslide*, *skip*,␣
↪*note*) for each one. We used our **jupyter** directive  to break the markdown cell␣
↪into two different cells.


.. code:: python3

    import numpy as np

    x = np.linspace(0, 1, 5)
    y = np.sin(4 * np.pi * x) * np.exp(-5 * x)
```

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(continued from previous page)

```
    print(y)

.. code:: python3

    import numpy as np

    z = np.cos(3 * np.pi * x) * np.exp(-2 * x)
    w = z*y

    print(w)

Math
++++

The previous function was

.. math:: f(x)=\sin(4\pi x)\cos(4\pi x)e^{-7x}


.. jupyter::
    :cell-break:
    :slide-type: fragment

We can also include the figures from some folder


.. figure:: _static/hood.jpg
```

will look as follows in the jupyter notebook

Slide Type: Slide

## Slide option activated

This is a collection of different types of cells where the toolbar: Slideshow has been activated

Slide Type: Sub-Slide

The idea is that eventually we will assign a type (*slide*, *subslide*, *skip*, *note*) for each one. We used our **jupyter** directive to break the markdown cell into two different cells.

In [ ]:

Slide Type: Slide

```
import numpy as np

x = np.linspace(0, 1, 5)
y = np.sin(4 * np.pi * x) * np.exp(-5 * x)

print(y)
```

In [ ]:

Slide Type: Slide

```
import numpy as np

z = np.cos(3 * np.pi * x) * np.exp(-2 * x)
w = z*y

print(w)
```

Slide Type: Slide

## Math

The previous function was

$$f(x) = \sin(4\pi x)\cos(4\pi x)e^{-7x}$$

Slide Type: Fragment

We can also include the figures from some folder

## 4.8 footnotes

The following code in the .rst file

```
Rubric
======

Define the government's one-period loss function [#f1]_

.. math::
    :label: target

    r(y, u)  =  y' R y  + u' Q u


History dependence has two sources: (a) the government's ability to commit [#f2]_ to␣
↪a sequence of rules at time :math:`0`


.. rubric:: Footnotes

.. [#f1] The problem assumes that there are no cross products between states and␣
↪controls in the return function.  A simple transformation  converts a problem whose␣
↪return function has cross products into an equivalent problem that has no cross␣
↪products.

.. [#f2] The government would make different choices were it to choose sequentially,␣
↪that is,  were it to select its time :math:`t` action at time :math:`t`.
```

will look as follows in the jupyter notebook

# Rubric

Define the government's one-period loss function [1]

$$r(y,u) = y' Ry + u' Qu \tag{1}$$

History dependence has two sources: (a) the government's ability to commit [2] to a sequence of rules at time 0

**Footnotes**

**[1]** The problem assumes that there are no cross products between states and controls in the return function. A simple transformation converts a problem whose return function has cross products into an equivalent problem that has no cross products.

**[2]** The government would make different choices were it to choose sequentially, that is, were it to select its time $t$ action at time $t$.

## 4.9 solutions

The following code in the .rst file

```
Notebook without solutions
==========================

```

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```
The idea is with the use of classes, we can  decide whether to show or not the␣
↪solutions
of a particular lecture, creating two different types of jupyter notebooks. For now␣
↪it only
works with *code blocks*, you have to include **:class: solution**, and set in  the␣
↪conf.py file
*jupyter_drop_solutions=True*.


Here is a small example

Question 1
----------

Plot the area under the curve

.. math::

    f(x)=\sin(4\pi x) exp(-5x)

when :math:`x \in [0,1]`

.. code-block:: python3
    :class: solution

    import numpy as np
    import matplotlib.pyplot as plt

    x = np.linspace(0, 1, 500)
    y = np.sin(4 * np.pi * x) * np.exp(-5 * x)

    fig, ax = plt.subplots()

    ax.fill(x, y, zorder=10)
    ax.grid(True, zorder=5)
    plt.show()
```

will look as follows in the jupyter notebook

## Notebook without solutions

The idea is with the use of classes, we can decide whether to show or not the solutions of a particular lecture, creating two different types of jupyter notebooks. For now it only works with *code blocks*, you have to include **:class: solution**, and set in the conf.py file *jupyter_drop_solutions=True*.

Here is a small example

### Question 1

Plot the area under the curve

$$f(x) = \sin(4\pi x)exp(-5x)$$

when $x \in [0, 1]$

**Todo:** Currently generating the two sets of notebooks requires two separate runs of sphinx which is incovenient. It

would be better to develop a set of notebooks without solutions (as Default) and a set of notebooks with solutions in a subdir.

## 4.10 tables

Basic table support is provided by this extension.

**Note:** Complex tables are **not** currently supported. See Issue [#54](https://github.com/QuantEcon/sphinxcontrib-jupyter/issues/54)

The following code in the .rst file

```
Table
=====

These tables are from the `RST specification <http://docutils.sourceforge.net/docs/
↪ref/rst/restructuredtext.html#grid-tables>`__:

Grid Tables
-----------

A simple rst table with header

+------+------+
| C1   | C2   |
+======+======+
| a    | b    |
+------+------+
| c    | d    |
+------+------+

**Note:** Tables without a header are currently not supported as markdown does
not support tables without headers.


Simple Tables
-------------

=====  =====  =======
A      B    A and B
=====  =====  =======
False  False  False
True   False  False
False  True   False
True   True   True
=====  =====  =======

Directive Table Types
---------------------

These table types are provided by `sphinx docs <http://www.sphinx-doc.org/en/master/
↪rest.html#directives>`__
```

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```
List Table directive
~~~~~~~~~~~~~~~~~~~~

.. list-table:: Frozen Delights!
:widths: 15 10 30
:header-rows: 1

* - Treat
    - Quantity
    - Description
* - Albatross
    - 2.99
    - On a stick!
* - Crunchy Frog
    - 1.49
    - If we took the bones out, it wouldn't be crunchy, now would it?
* - Gannet Ripple
    - 1.99
    - On a stick!
```

will look as follows in the jupyter notebook

# Table

These tables are from the RST specification:

## Grid Tables

A simple rst table with header

| C1 | C2 |
|---|---|
| a | b |
| c | d |

**Note:** Tables without a header are currently not supported as markdown does not support tables without headers.

## Simple Tables

| A | B | A and B |
|---|---|---|
| False | False | False |
| True | False | False |
| False | True | False |
| True | True | True |

## Directive Table Types

These table types are provided by sphinx docs

### List Table directive

### Frozen Delights!

| Treat | Quantity | Description |
|---|---|---|
| Albatross | 2.99 | On a stick! |
| Crunchy Frog | 1.49 | If we took the bones out, it wouldn't be crunchy, now would it? |
| Gannet Ripple | 1.99 | On a stick! |

## 4.11 tests

The following code in the .rst file

```
Notebook without Tests
======================

This is an almost exact analogue to the solutions class. The idea is that we can␣
↪include test blocks using **:class: test** that we can toggle on or off with␣
↪*jupyter_drop_tests = True*. A primary use case is for regression testing for the 0.
↪6 => 1.0 port, which we will not want to show to the end user.

Here is a small example:
```

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```
Question 1
------------

.. code-block:: julia

    x = 3
    foo = n -> (x -> x + n)

.. code-block:: julia
    :class: test

    import Test
    @test x == 3
    @test foo(3) isa Function
    @test foo(3)(4) == 7
```

will look as follows in the jupyter notebook

## Notebook without Tests

This is an almost exact analogue to the solutions class. The idea is that we can include test blocks using **:class: test** that we can toggle on or off with *jupyter_drop_tests* = *True*. A primary use case is for regression testing for the 0.6 => 1.0 port, which we will not want to show to the end user.

Here is a small example:

### Question 1

```
x = 3
foo = n -> (x -> x + n)
```

**Note:** inclusion of tests in the generated notebook can be controlled in the `conf.py` file using `jupyter_drop_tests = False`. This is useful when using the `coverage` build pathway.

# CHAPTER 5

## Example *conf.py* file

After running a sphinx-quickstart you can add the *jupyter* options needed for your project in a similar fashion to what is shown belows.

The below configuration settings are the default ones provided by the jupinx quickstart tool

```
# Configuration file for the Jupinx documentation builder.
#
# This file only contains a selection of the most common options. For a full
# list see the documentation:
# http://www.sphinx-doc.org/en/master/config

# -- Path setup --------------------------------------------------------------

# If extensions (or modules to document with autodoc) are in another directory,
# add these directories to sys.path here. If the directory is relative to the
# documentation root, use os.path.abspath to make it absolute, like shown here.
#
# import os
# import sys
# sys.path.insert(0, os.path.abspath('.'))


# -- Project information -----------------------------------------------------

project = 'DEMO'
copyright = '2019, AUTHOR'
author = 'AUTHOR'

# The short X.Y version
version = '0.1'

# The full version, including alpha/beta/rc tags
release = '0.1'
```

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```
# -- General configuration ------------------------------------------------

# Add any Sphinx extension module names here, as strings. They can be
# extensions coming with Sphinx (named 'sphinx.ext.*') or your custom
# ones.
extensions = [
    'sphinxcontrib.jupyter',
    'sphinxcontrib.bibtex',
]

# Add any paths that contain templates here, relative to this directory.
templates_path = ['templates']

# The suffix(es) of source filenames.
# You can specify multiple suffix as a list of string:
#
# source_suffix = ['.rst', '.md']
source_suffix = '.rst'

# The master toctree document.
master_doc = 'index'

# List of patterns, relative to source directory, that match files and
# directories to ignore when looking for source files.
# This pattern also affects html_static_path and html_extra_path.
exclude_patterns = []


# -- Options for HTML output ----------------------------------------------

# The theme to use for HTML and HTML Help pages.  See the documentation for
# a list of builtin themes.
#
html_theme = 'alabaster'

# Add any paths that contain custom static files (such as style sheets) here,
# relative to this directory. They are copied after the builtin static files,
# so a file named "default.css" will overwrite the builtin "default.css".
html_static_path = ['static']


# -- Extension configuration ----------------------------------------------

# -- jupyter build configuration ------------------------------------------------
jupyter_kernels = {
    'python3': {
        'kernelspec': {
            'display_name': 'Python',
            'language': 'python3',
            'name': 'python3'
        },
        'file_extension': '.py'
    },
    'python2': {
        'kernelspec': {
            'display_name': 'Python',
            'language': 'python2',
```

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```
            'name': 'python2'
        },
        'file_extension': '.py'
    },
    'julia-1.1': {
        'kernelspec': {
            'display_name': 'Julia 1.1',
            'language': 'julia',
            'name': 'julia-1.1'
        },
        'file_extension': '.jl'
    }
}

# ----------------------------------------------
# jupyter Sphinx Extension conversion settings
# ----------------------------------------------

# Conversion Mode Settings
# If "all", convert codes and texts into notebook
# If "code", convert codes only
jupyter_conversion_mode = "all"

jupyter_write_metadata = False

# Location for _static folder
jupyter_static_file_path = ["source/_static"]

# Configure jupyter headers
jupyter_headers = {
    "python3": [
        # nbformat.v4.new_code_cell("%autosave 0")      #@mmcky please make this an␣
↪option
        ],
    "julia": [
        ],
}

# Filename for the file containing the welcome block
jupyter_welcome_block = ""

#Adjust links to target html (rather than ipynb)
jupyter_target_html = False

#path to download notebooks from
jupyter_download_nb_urlpath = None

#allow downloading of notebooks
jupyter_download_nb = False

#Use urlprefix images
jupyter_download_nb_image_urlpath = None

#Allow ipython as a language synonym for blocks to be ipython highlighted
jupyter_lang_synonyms = ["ipython"]

#Execute skip-test code blocks for rendering of website (this will need to be ignored␣
↪in coverage testing)
```

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```
jupyter_ignore_skip_test = True

#allow execution of notebooks
jupyter_execute_notebooks = False

# Location of template folder for coverage reports
jupyter_template_coverage_file_path = False

# generate html from IPYNB files
jupyter_generate_html = False

# html template specific to your website needs
jupyter_html_template = ""

# latex template specific to your website needs
jupyter_latex_template = ""

#make website
jupyter_make_site = False

#force markdown image inclusion
jupyter_images_markdown = True

#This is set true by default to pass html to the notebooks
jupyter_allow_html_only=True
```

# CHAPTER 6

## Managing Large Projects

Large projects may require different build pathways due to the time required for execution of embedded code. This can be done by modifying the `Makefile` to accommodate multiple build pathways.

You may, for example, wish to leave `make jupyter` simply building notebooks while setting up an alternative `make` command to target a full `website` build.

In the `Makefile` you can add an alternative build target such as:

```
BUILDWEBSITE  = _build/website
```

and then you can modify options (set in the `conf.py` file) using the *-D* flag.

```
website:
    @$(SPHINXBUILD) -M jupyter "$(SOURCEDIR)" "$(BUILDWEBSITE)" $(SPHINXOPTS) $(O) -D␣
↪jupyter_make_site=1 -D jupyter_generate_html=1 -D jupyter_download_nb=1 -D jupyter_
↪execute_notebooks=1 -D jupyter_target_html=1 -D jupyter_images_markdown=0 -D␣
↪jupyter_html_template="theme/templates/lectures-nbconvert.tpl" -D jupyter_download_
↪nb_urlpath="https://lectures.quantecon.org/"
```

this will setup a new folder `_build/website` for the new build pathway to store resultant files from the options selected. See *Builders* for further details.

**Note:** This method also preserves the `sphinx` cache mechanism for each build pathway.

**Warning:** Issue #199 will alter this approach to include all *configuration* settings in the `conf.py` file and then the different pipelines can be switched off in the Makefile which will be less error prone.

CHAPTER 7

# Builders

This extension has the following Builders

## 7.1 jupyter

This builder currently handles *jupyter*, *html*, and *coverage* output

```
@$(SPHINXBUILD) -M jupyter "$(SOURCEDIR)" "$(BUILDCOVERAGE)" $(FILES) $(SPHINXOPTS)
↪$(O)
```

**Warning:** If your project needs to build *jupyter* and *html* then configuration for *html* and *coverage* is currently handled through Makefile overrides. The project is working on separate builders for html and coverage

Example Configuration for *HTML* production

```
@$(SPHINXBUILD) -M jupyter "$(SOURCEDIR)" "$(BUILDWEBSITE)" $(FILES) $(SPHINXOPTS)
↪$(O) -D jupyter_make_site=1 -D jupyter_generate_html=1 -D jupyter_download_nb=1 -D␣
↪jupyter_execute_notebooks=1 -D jupyter_target_html=1 -D jupyter_download_nb_image_
↪urlpath="https://s3-ap-southeast-2.amazonaws.com/lectures.quantecon.org/py/_static/
↪" -D jupyter_images_markdown=0 -D jupyter_html_template="python-html.tpl" -D␣
↪jupyter_download_nb_urlpath="https://lectures.quantecon.org/" -D jupyter_coverage_
↪dir=$(BUILDCOVERAGE)
```

## 7.2 jupyterpdf

This builder handles production of *pdf*

```
@$(SPHINXBUILD) -M jupyterpdf "$(SOURCEDIR)" "$(BUILDCOVERAGE)" $(FILES)
↪$(SPHINXOPTS) $(O)
```

CHAPTER 8

# Credits

This project is supported by QuantEcon

Many thanks to the lead developers of this project.

- @AakashGfude
- @mmcky

Contributors

- FelipeMaldonado
- @myuuuuun
- @NickSifniotis

CHAPTER 9

# Projects using Extension

1. QuantEcon Lectures

If you find this extension useful please let us know at contact@quantecon.org

# CHAPTER 10

# LICENSE

CHAPTER 11

# Indices and tables

- genindex
- modindex
- search