550.400: Mathematical Modeling and Consulting

Lecture Notes

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Notes

Outline

Notes

Vim

Vim is a *highly customizable* text editor

1. LaTeX, R, C/C++, Java, Python, Git and etc.
2. Regular expression, syntax coloring, autocompletion
3. <ESC>-mode
   - :-mode, aka., the last line mode
   - i-mode, aka., the insert mode

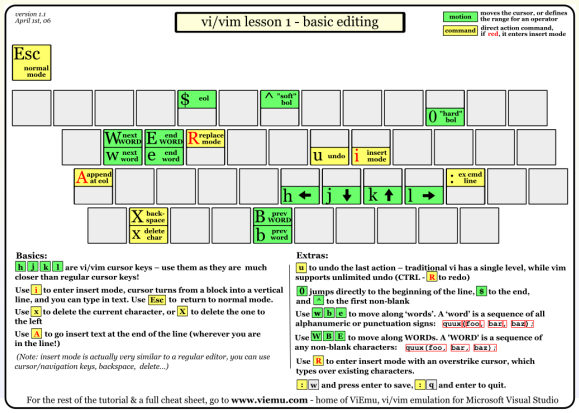
Notes

Vim

- Download & Install GVim or MacVim
- Download & Install tetris.vim
- Download & Install Gundo

Notes

Tutorial: Vim



Notes

Intro. to Using Git for Off-Line Teamwork I

Places to set up a git for your group work:

- Git Hub
- Dropbox

Why does it matter?

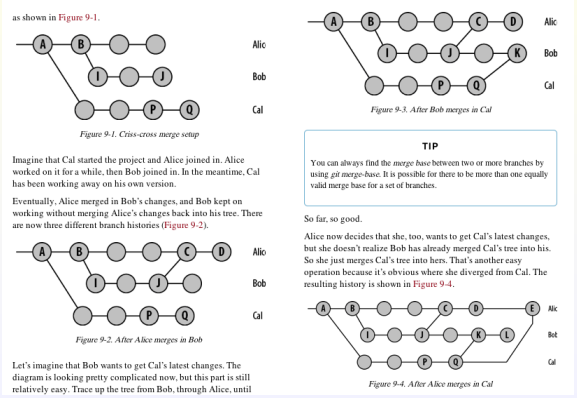
- It allows you to collaborate with others off-line
- You leave a trail of your contributions to the project

In-Class Activities for setting up a github account

- go to github.com
- initiate a git project from github
- set up your local folder
- populate the folder with new contents

Notes

Intro. to Using Git for Off-Line Teamwork II



Notes

```
1 git branch alice
2 git checkout alice
```


Focus Problem

- Objective: your own copy of the poem
- Rule 1: You write one stanza of the poem into the `main.tex` file
- Rule 2: You can collect all the others only by using the following commands:

```
1 git remote
2 git pull
3 git push
4 git fetch
5 git merge
```


Notes

Adv. Git Mehod for Off-Line Teamwork I

```
1  git format-patch master~2..master
```


Notes

Adv. Git Mehod for Off-Line Teamwork II

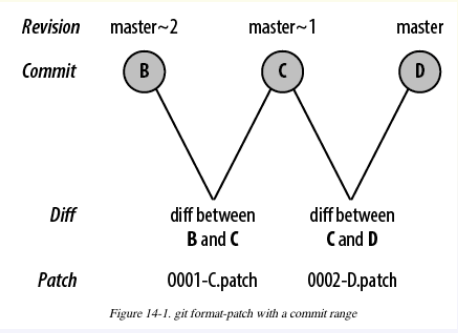


Figure 14-1. git format-patch with a commit range

Notes

Git Exercise I

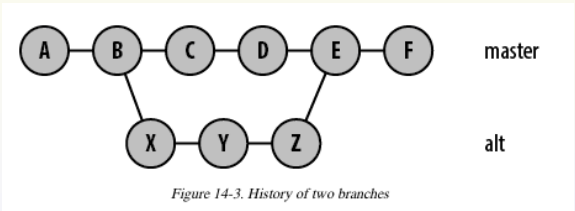


Figure 14-3. History of two branches

Notes

Git Exercise II

Create a git folder with the following history

- Each node's label signifies the commit
- The folder contains only one single file `main.txt` throughout the history
- KISS (See WMA for its meaning)

Class Exercise

Collect all 8 stanzas together with your neighbor.

- You do four of them
- Your teammate do four of them
- Then, you combine yours with your teammate's

Notes

Using R to do System Admin Stuff I

```
1 for(itr in 1:8) {
2     stanzaname = paste("stanza",itr,sep="")
3     gitaddress = paste("git://github.com/nhlee/550400.",
4                        stanzaname,".git",sep="")
5     bashcommand = paste("git remote add ",
6                         stanzaname," ",gitaddress,sep="")
7     system(bashcommand)
8 }
```

- `1:8` creates a vector that ...
- `X = 1` assigns 1 to X
- `X <- 1` also assigns 1 to X
- lots of things are done through function
- `paste` and `system` are functions that ...

Notes

Using R to do System Admin Stuff II

- functions has none or more arguments
- arguments are implicitly ordered but the order can be overriden

```
1 system('ls -ld .*')
2 system('cat .Rprofile')
3 system('cat .bashrc')
4 system('cat .gitignore')
5 system('cat .vimrc')
```

- .xxx files are hidden
- ls -ld .* show the hidden files
- .Rprofile set up your R behavior
- .bashrc set up your bash behavior
- .gitignore set up your git behavior

Notes

Using R to do System Admin Stuff III

- .vimrc set up you vim behavior
- these files are equivalent to Preference part of your GUI software

Notes

Intro. to workstatement template I

```
1  \documentclass[12pt,letterpaper][aritcle]
2  \usepackage{amsmath,amsthm,amssymb,amsfonts} # for popular math add-on
3  \usepackage{graphicx} # for inserting png, jpeg, pdf files as figure
4  \usepackage{bm} # for bold math
5  # some preamble stuff omitted (see the actual template)
6  \begin{document}
7  \section{A}
8      \subsection{a}
9          \paragraph{Hello World}
10         \begin{align*}
11             &f(x) = \int_0^1 \sin(u+x) du, \\
12             &f(\bm x) = \int_0^1 \sin(u+\|\bm x\|) du.
13         \end{align*}
14 \end{document}
```


Notes

Introduction to beamer I

Basic Body Layer

```
\begin{document}
\section{Hello World}
    \subsection{hello world}
        \begin{frame}
            \frametitle{hi world}
            \begin{columns}
                \begin{column}{0.5\textwidth}
                    \begin{itemize}
                        \item Alice!
                    \end{itemize}
                \end{column}
                \begin{column}{0.5\textwidth}
                    \begin{block}{hey world}
                        Bob!
                    \end{block}
                \end{column}
            \end{columns}
        \end{frame}
```


Notes

Introduction to beamer II

```
\end{document}
```

Basic Preambles

```
\documentclass[hyperref={colorlinks=false},handout,10pt]{beamer}
\usetheme{Singapore}
\usecolortheme{lily}
\usefonttheme[onlymath]{serif} % What does this do?
```

OR

```
\documentclass[hyperref={colorlinks=false},handout,10pt]{beamer}
\usetheme{Berlin}
\usecolortheme{wolverine}
\usefonttheme[onlymath]{serif} % What does this do?
```

For a more complete array of themes, go to:

http://www.hartwork.org/beamer-theme-matrix/

Notes

Introduction to beamer III

SO, how to put a code in the slide? and it looks like codes?

```
\begin{lstlisting}
require(tikzDevice)
x = rnorm(100)
plot.ts(x)
dev.off()
\end{lstlisting}
```

```
require(tikzDevice)
x = rnorm(100)
plot.ts(x)
dev.off()
```

But, this requires the following in the preamble portion of your tex file:

Notes

Introduction to beamer IV

```
\usepackage{listings}
\lstset{
basicstyle=\footnotesize\ttfamily,
numbers=left,
frame=bottomline,
framextopmargin=50pt,
}
```

Where to get more help:

http://en.wikibooks.org/wiki/LaTeX/Presentations

Notes

Spurious Causality I

```
CBE <- read.table('http://www.massey.ac.nz/~pscowper/ts/cbe.dat')
Ets <- ts(CBE[,3], start = 1958, freq=12)
Cts <- ts(CBE[,2], start = 1958, freq=12)
plot(as.vector(aggregate(Cts)),as.vector(aggregate(Ets)))
```

```
set.seed(10)
x <- rnorm(100)
y <- rnorm(100)
for(i in 2:100) {
    x[i] <- x[i-1] + rnorm(1)
    y[i] <- y[i-1] + rnorm(1)
}
plot(x,y)
```


Notes

Spurious Causality II

```
xrates <- read.table(
    'http://www.massey.ac.nz/~pscowper/ts/us_rates.dat')
plot(xrates$UK,xrates$EU,pch=4)
require(tseries)
pp.test(xrates$UK)
pp.test(xrates$EU)
```

```
x <- y <- mu <- rep(0,1000)
for(i in 2:1000) mu[i] <- mu[i-1] + rnorm(1)
x <- mu + rnorm(1000)
y <- mu + rnorm(1000)
adf.test(x)$p.value
adf.test(y)$p.value
po.test(cbind(x,y))

po.test(cbind(xrates$UK,xrates$EU))
ukeu.lm <- lm(xrates$UK ~ xrates$EU)
ukeu.res <- resid(ukeu.lm)
ukeu.res.ar <- ar(ukeu.res)
```


Notes

Spurious Causality III

```
ukeu.res.ar$order
```


Notes

How to do software documentation using R

```
myfun <- function(x) {x^2}
package.skeleton(name='MYPAC',
                 list='myfun',
                 path='~/')
#Do the documentation
system('R CMD check ~/MYPAC')
system('R CMD build ~/MYPAC')
system('R CMD install MYPAC')
```


Notes

A brain-teaser

"To encourage Elmer's promising tennis career, his father offers him a prize if he wins (at least) two tennis sets in a row in a three-set series to be played with his father"

- What is that you wish to know?
- unimportant, exogenous, and endogenous?
- if the model fits the situation, will we be able to use it?
- Test the model

Notes

Arguments from Scale I

Cost of Packing

Speed of Racing Shells

Size Effect in Animal

Notes

Notes

Notes