

Easy Data Visualization with Graph

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Background

- I work for DreamBox Learning
- We build adaptive educational software for children
- 500 lessons with manually specified dependencies
- Need to find patterns and bugs in that data

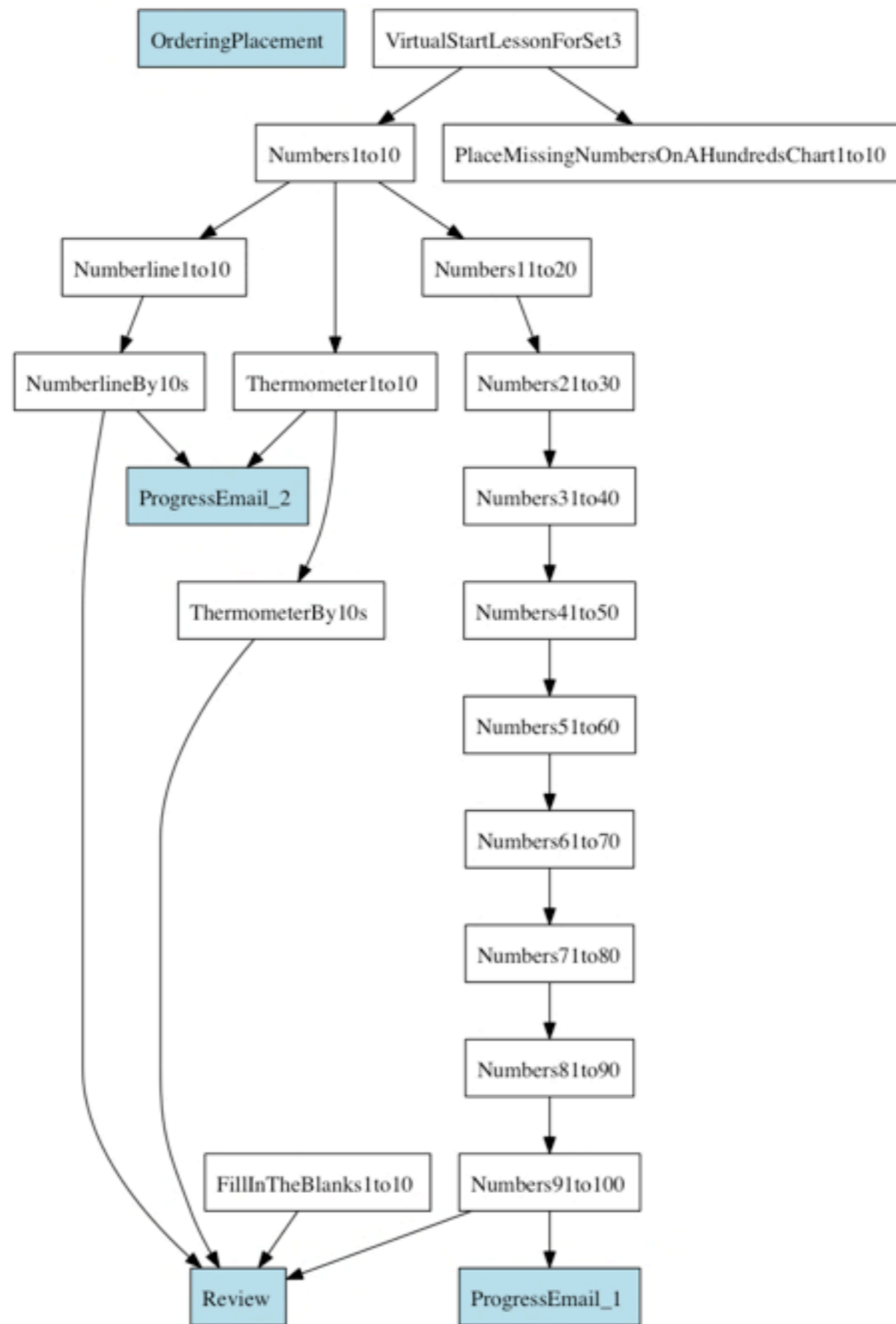
**Which is easier to
comprehend?**

```

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question_type="Decade" req_min="0"/>
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```

Or This?



**Making pictures by
hand is easy**

But it doesn't scale

- Time consuming
- Underlying data changes frequently
- Different people want different views

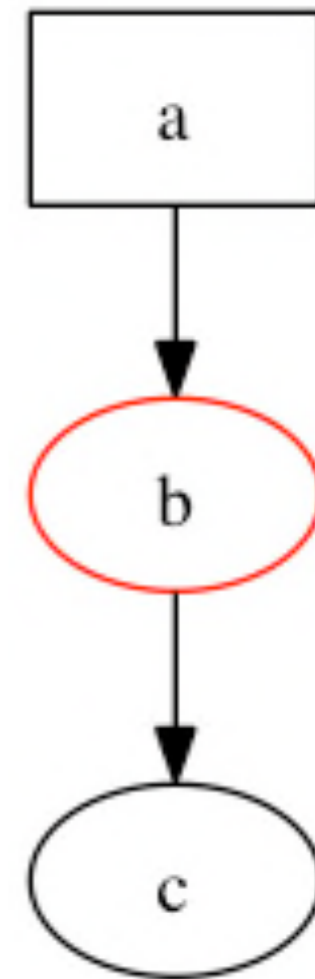
graphviz
to the rescue

DOT

- Simple language to describe graphs
- Graphs are nodes and edges
- Can edit attributes such as color and shape

Example

```
digraph example {  
  a -> b;  
  b -> c;  
  a[shape=box]  
  b[color=red]  
}
```



Viewing DOT files

- GraphViz
- Tulip

But let's use Ruby

```
sudo gem install graph
```

A simple graph

```
digraph do  
  node("B")  
end
```



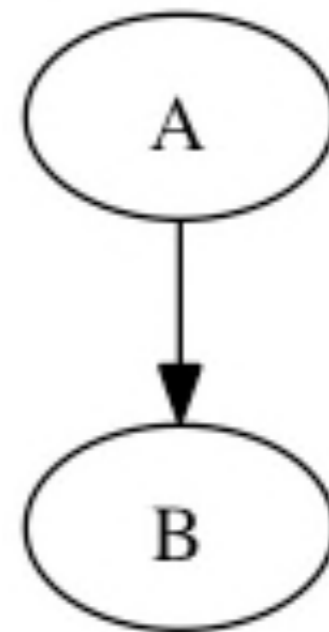
Nodes with Labels

```
digraph do  
  node("B").label "Hello"  
end
```



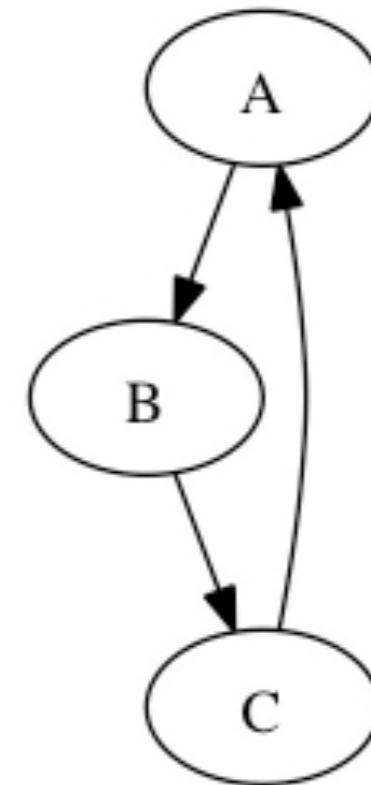
Adding Edges

```
digraph do  
  edge "A", "B"  
end
```



Saving

```
digraph do
  edge "A", "B"
  edge "B", "C"
  edge "C", "A"
  save "cycle"
end
```

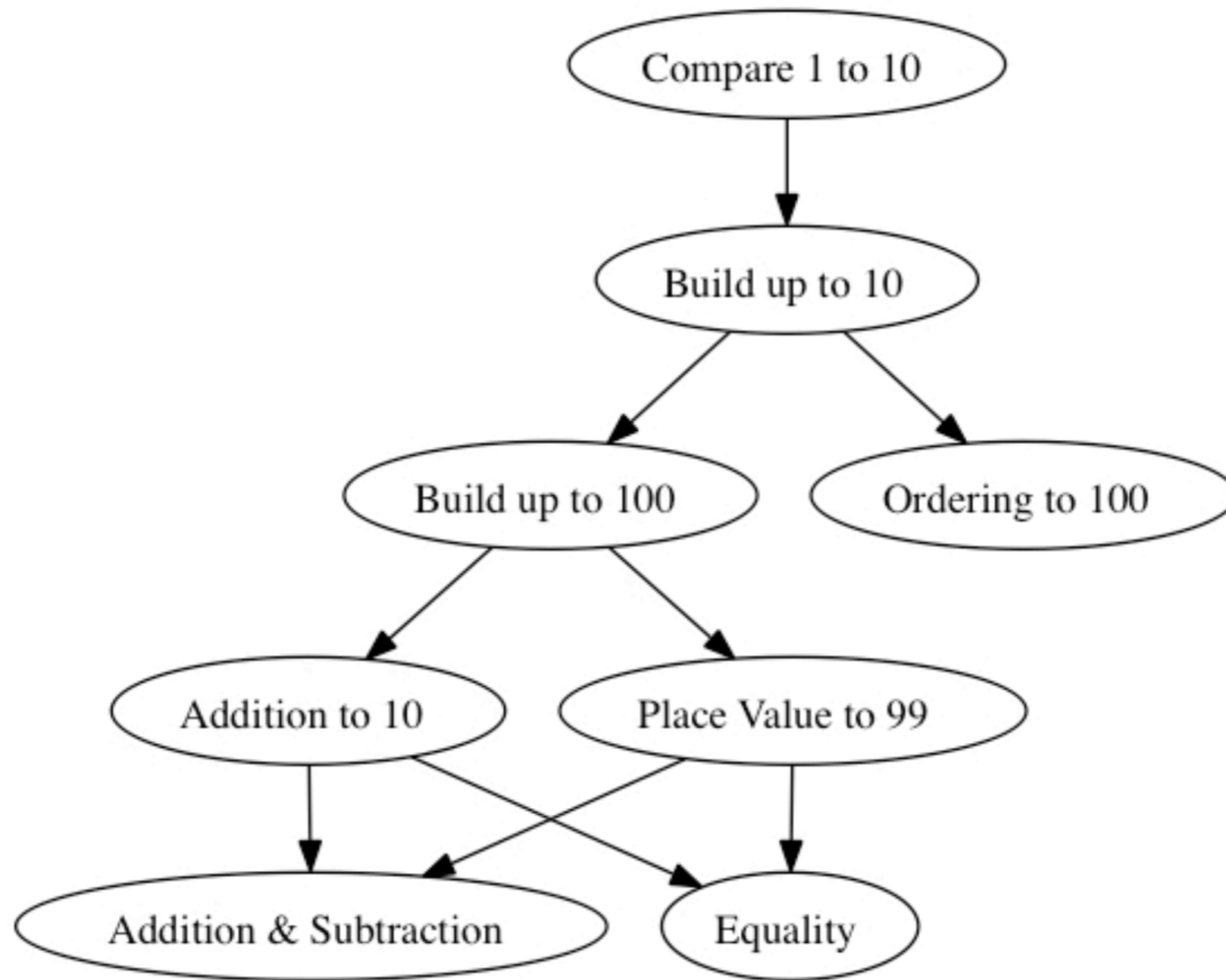


Exporting

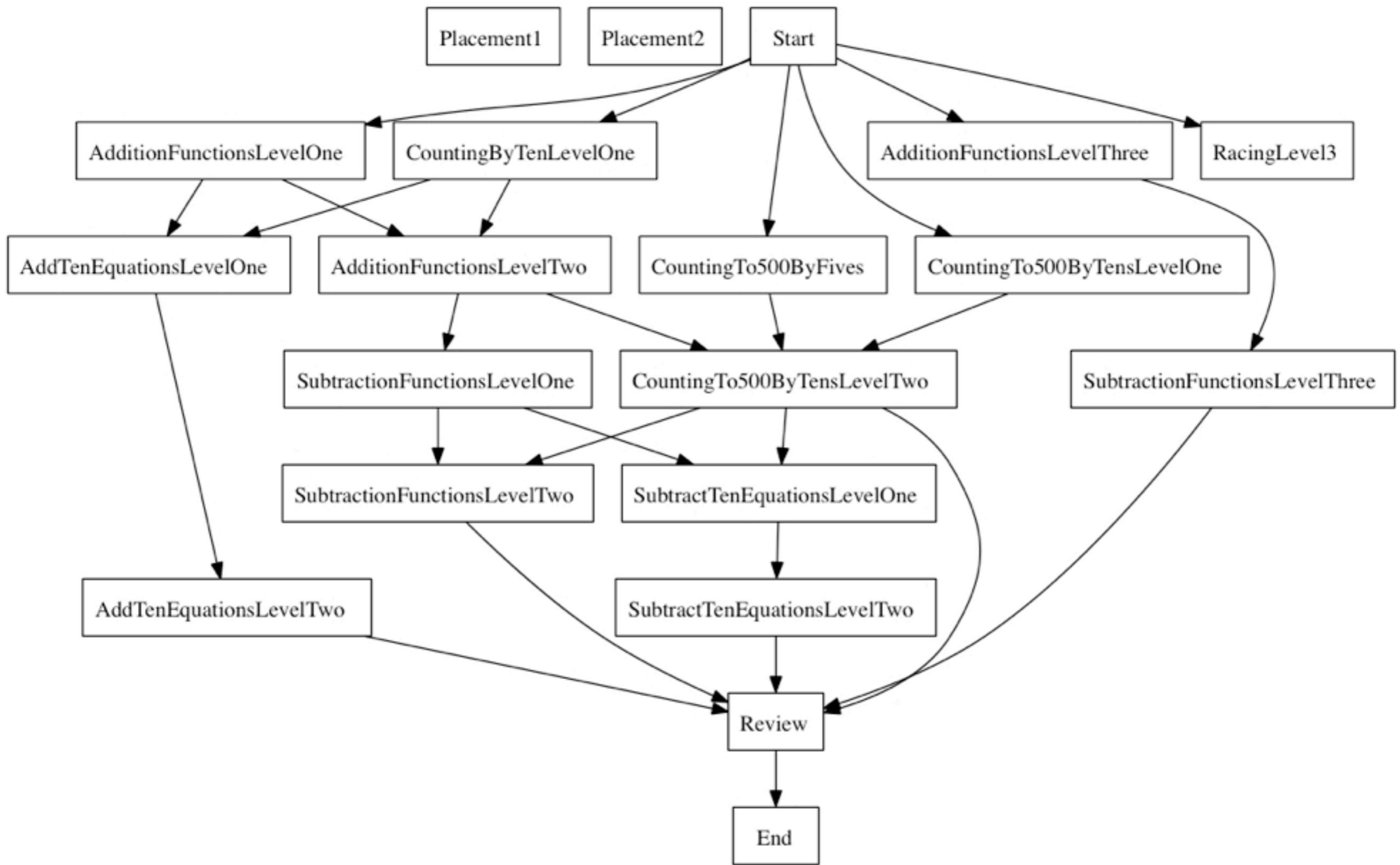
```
digraph do
  edge "a", "b"
  save "example", "png"
  save "example", "jpg"
end
```

Format list: <http://www.graphviz.org/doc/info/output.html>

Now you can build this



Or This

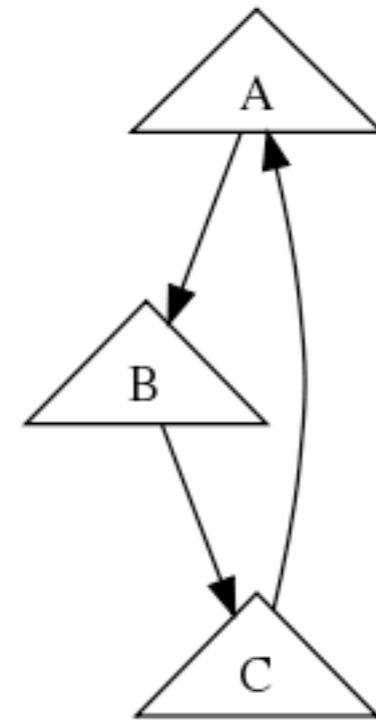


But that's boring

Shapes

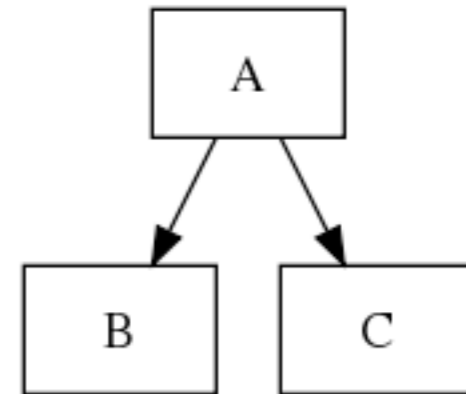
Shapes

```
digraph do
  node_attribs << triangle
  edge "A", "B"
  edge "B", "C"
  edge "C", "A"
end
```



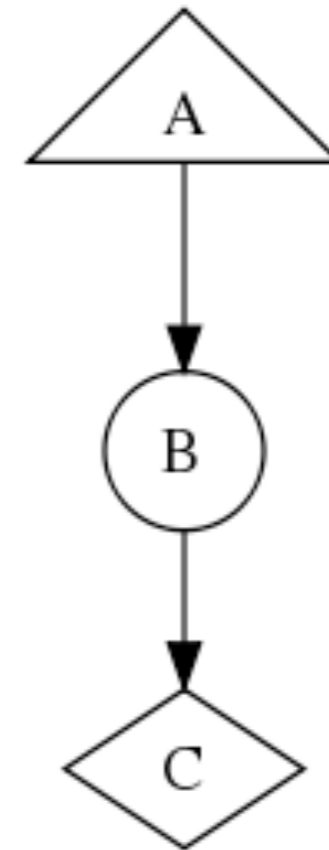
Boxes are Special

```
digraph do
  boxes
  edge "A", "B"
  edge "A", "C"
end
```



Many Shapes

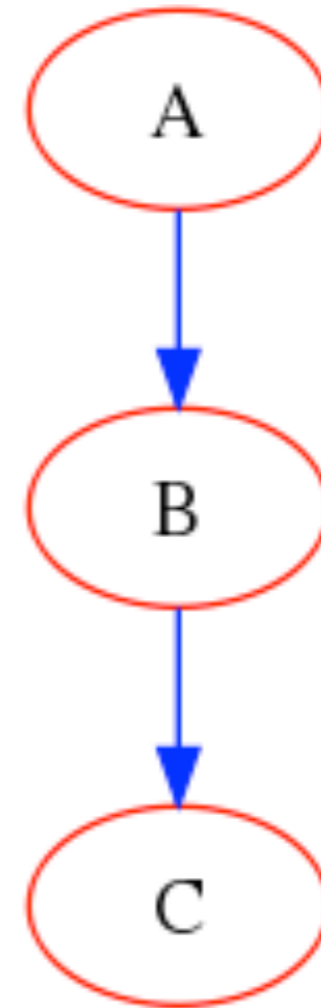
```
digraph do
  edge "A", "B", "C"
  triangle << node("A")
  circle << node("B")
  diamond << node("C")
end
```



Color

One Color for All

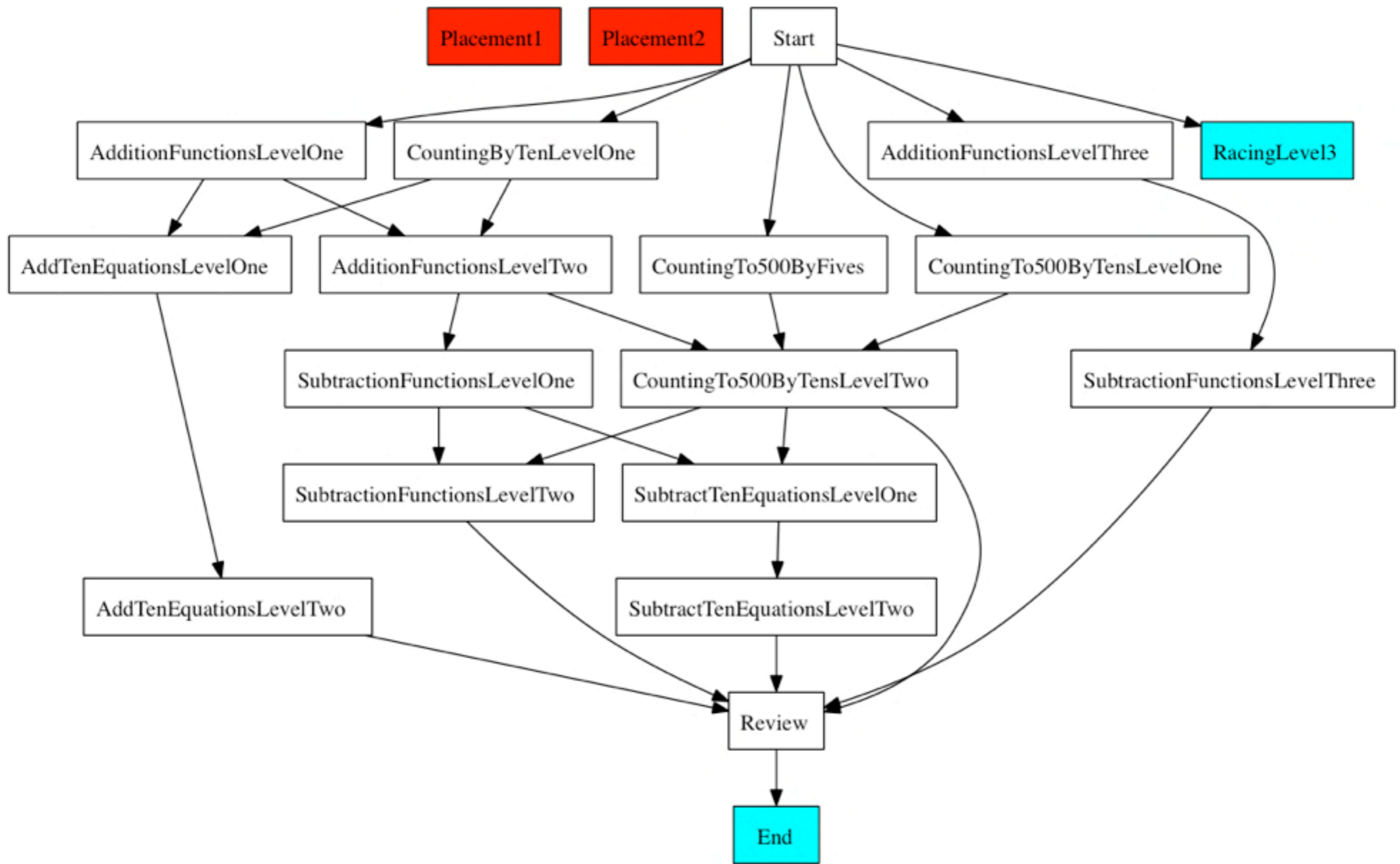
```
digraph do
  node_attribs << red
  edge_attribs << blue
  edge "A", "B", "C"
end
```



Many Colors

```
digraph do
  node_attribs << filled
  edge "G", "O", "R", "P"
  green << node("G")
  orange << node("O")
  red << node("R")
  purple << node("P")
end
```





**Help for the design
impaired**

Color Schemes

- Uses Brewer Color Schemes
 - <http://www.graphviz.org/doc/info/colors.html>
- Preview schemes here
 - <http://colorbrewer2.com>

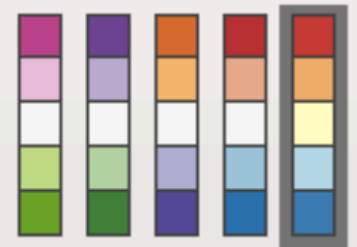
number of data classes on your map

9 learn more >

the nature of your data

diverging learn more >

pick a color scheme: RdYlBu



(optional) only show schemes that are:

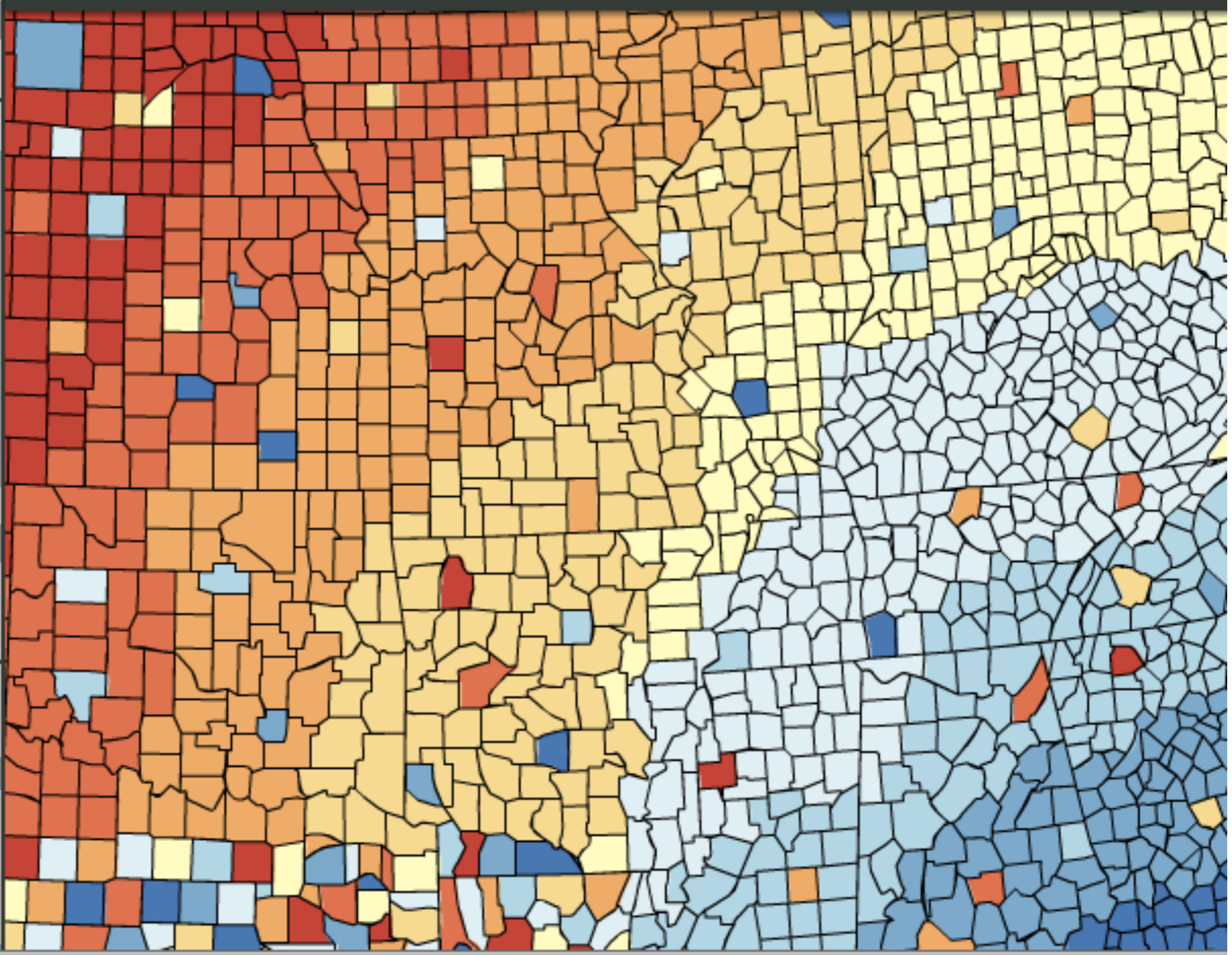
checkboxes for colorblind safe, print friendly, photocopy-able

pick a color system

Color value lists (15, 80, 75, 0) and system selection (RGB, CMYK, HEX)

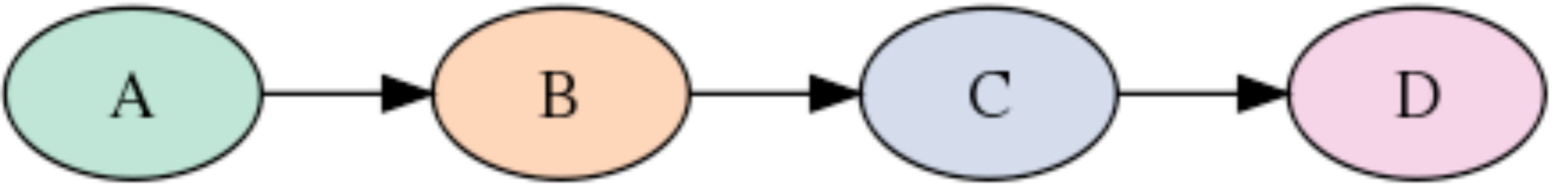
adjust map context checkboxes for roads, cities, borders

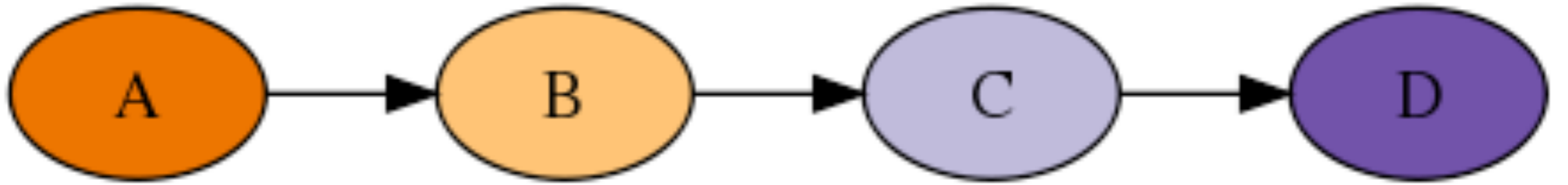
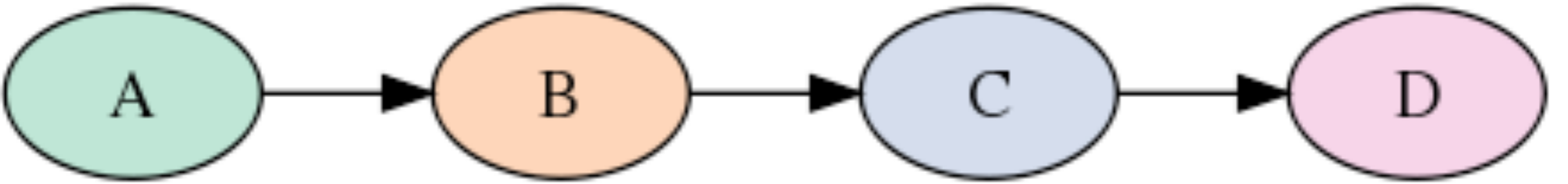
how to use | updates | credits

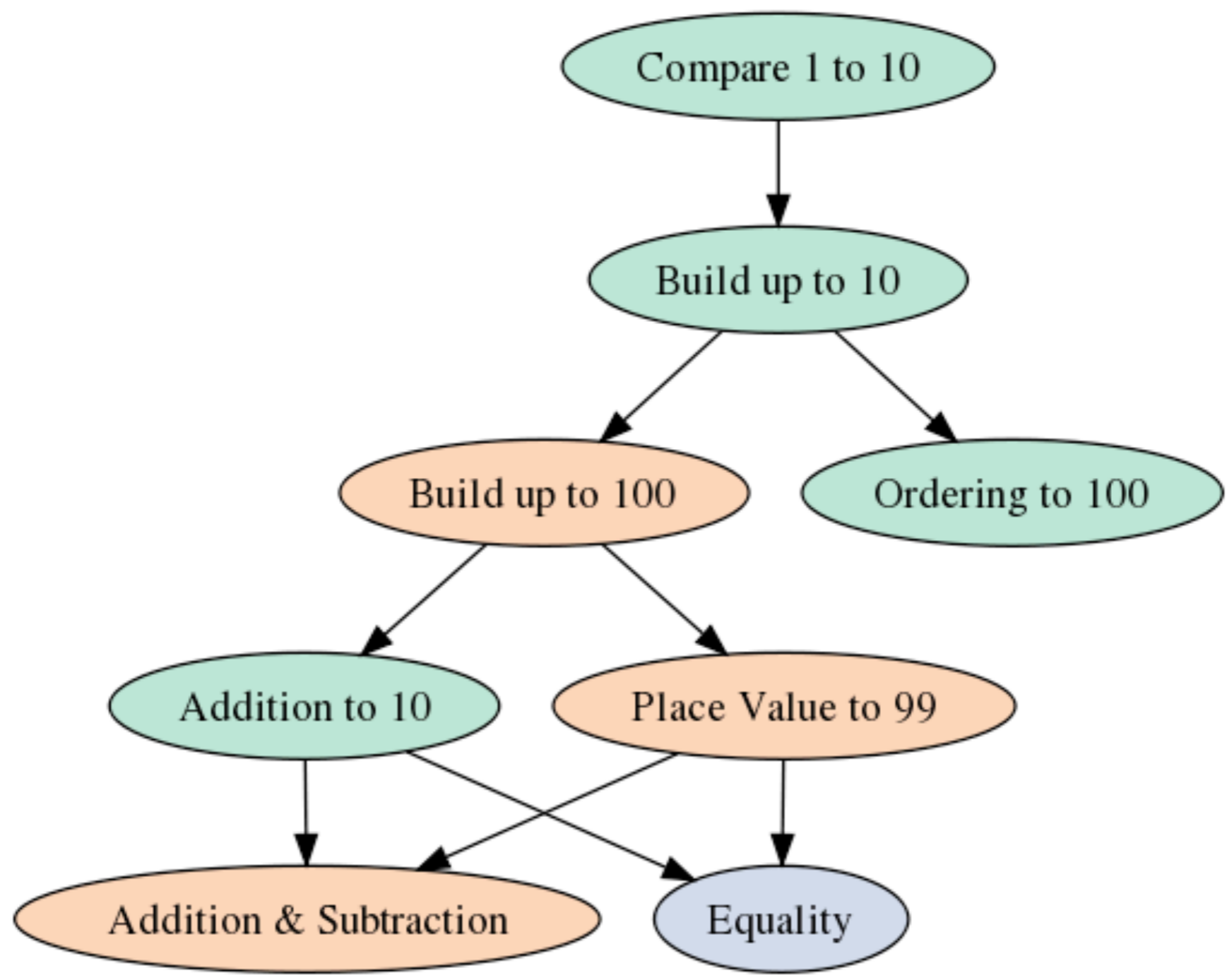


Color Scheme Example

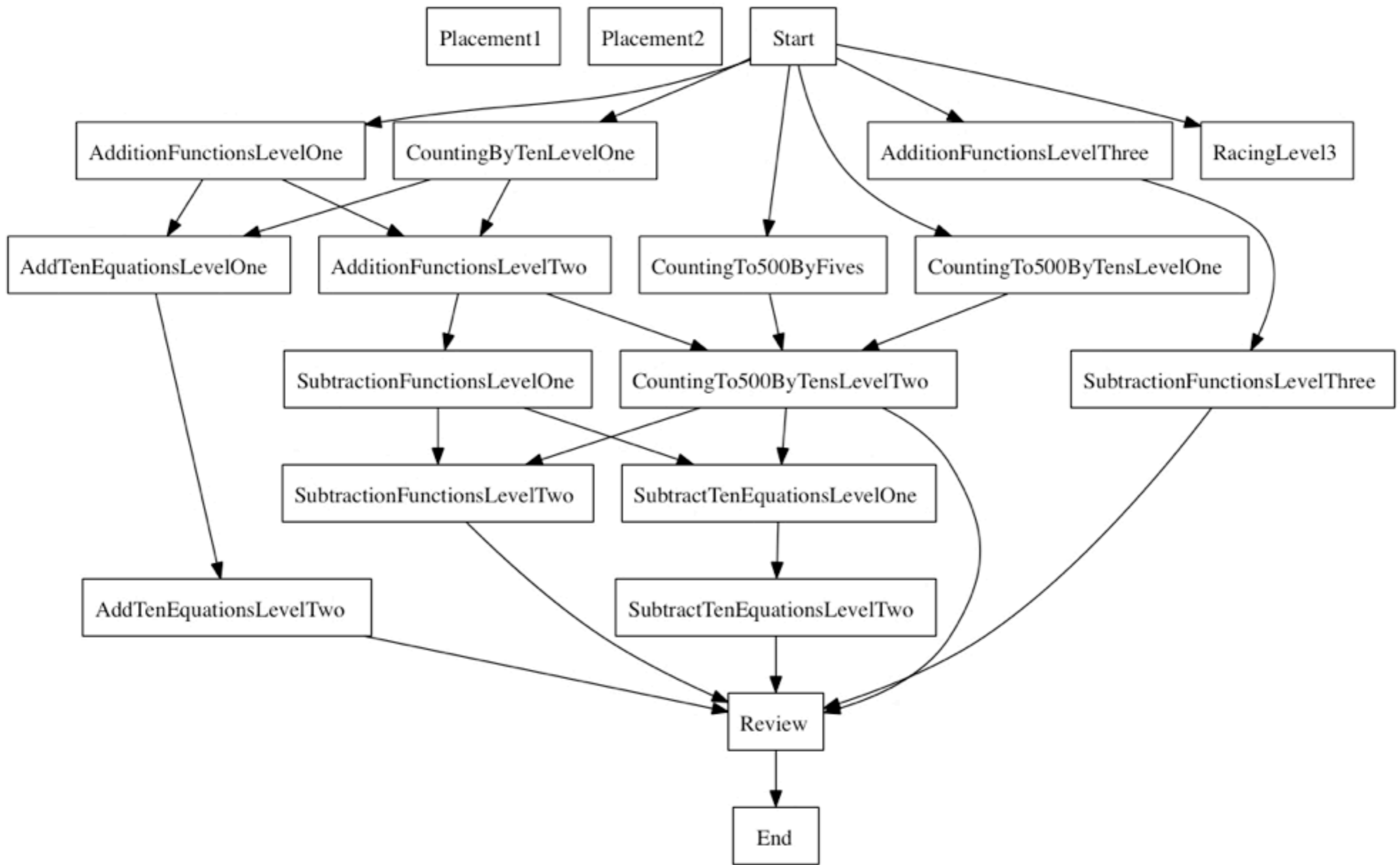
```
digraph do
  node_attribs << filled
  colorscheme(:set1, 4)
  c1 << node("A")
  c2 << node("B")
  c3 << node("C")
  c4 << node("D")
  edge "A", "B", "C", "D"
end
```



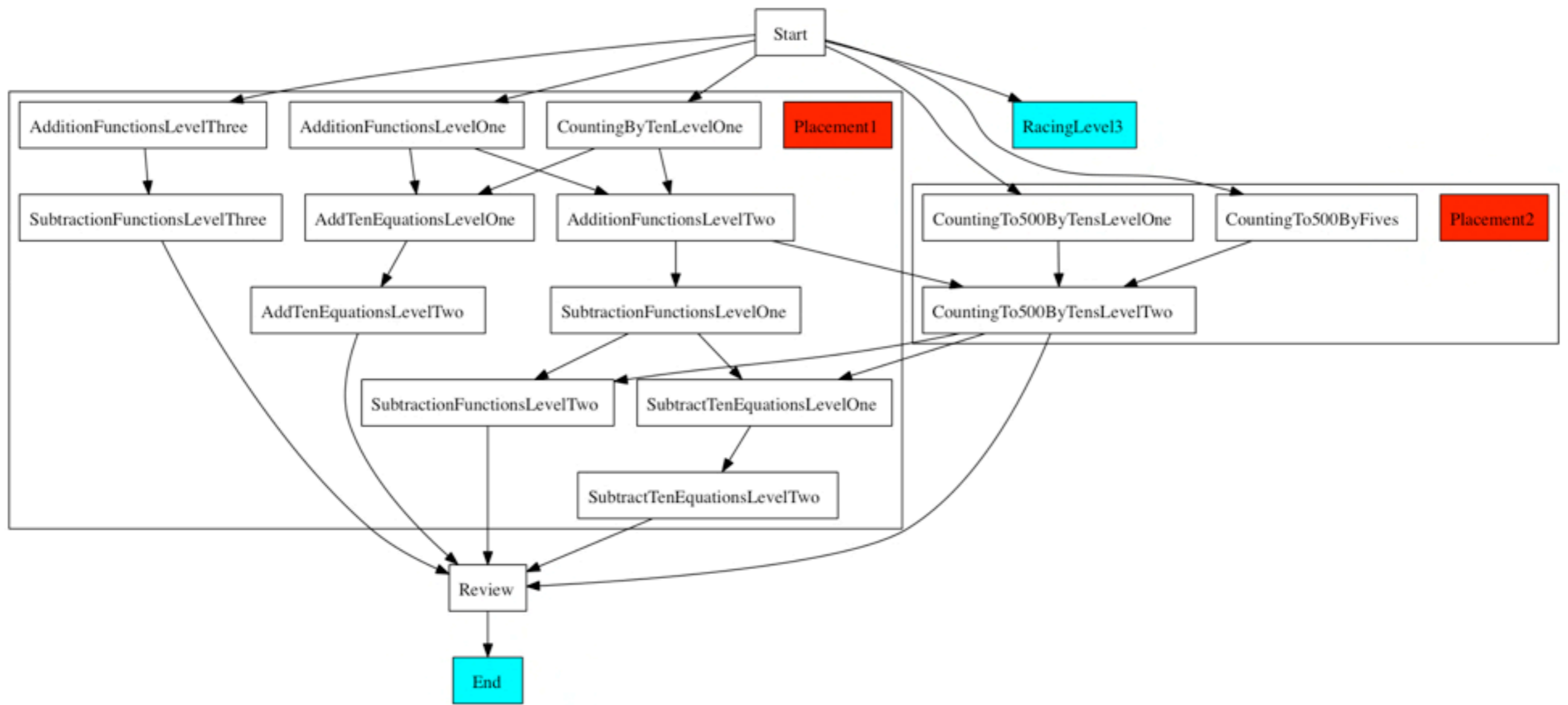




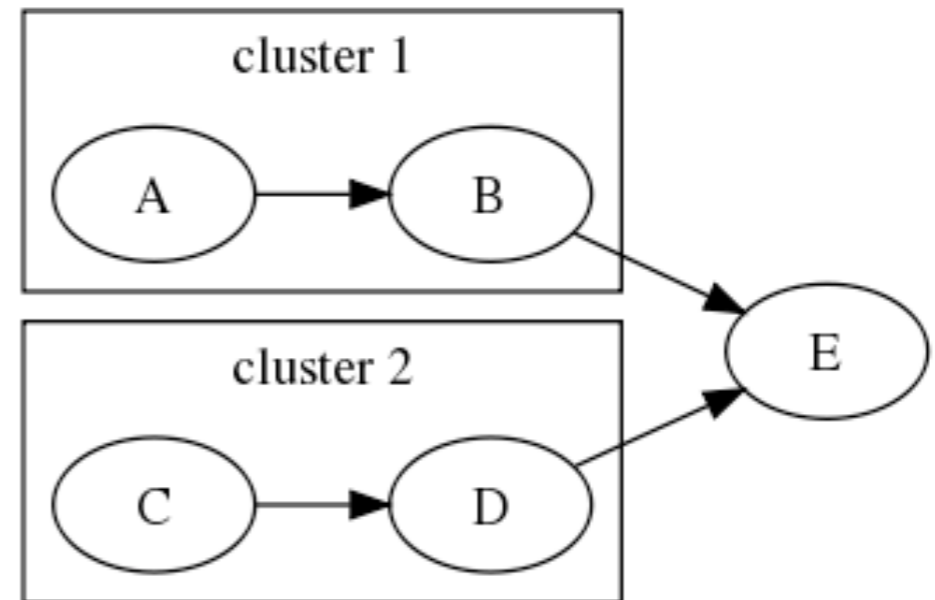
Clustering



Into This



```
digraph do
  cluster "1" do
    label "cluster 1"
    edge "A", "B"
  end
  cluster "2" do
    label "cluster 2"
    edge "C", "D"
  end
  edge "B", "E"
  edge "D", "E"
end
```



Building from data

Data

```
<lessons>
  <lesson id="1" name="MoreLess1to5" />
  <lesson id="2" name="MoreLess1to10" />
  <lesson id="3" name="MoreLessEqual1to5" />
  <lesson id="4" name="MoreLessEqual1to10" />
  <sequence lesson_id="2" pre_req="1" />
  <sequence lesson_id="3" pre_req="1" />
  <sequence lesson_id="4" pre_req="2" />
  <sequence lesson_id="4" pre_req="3" />
</lessons>
```

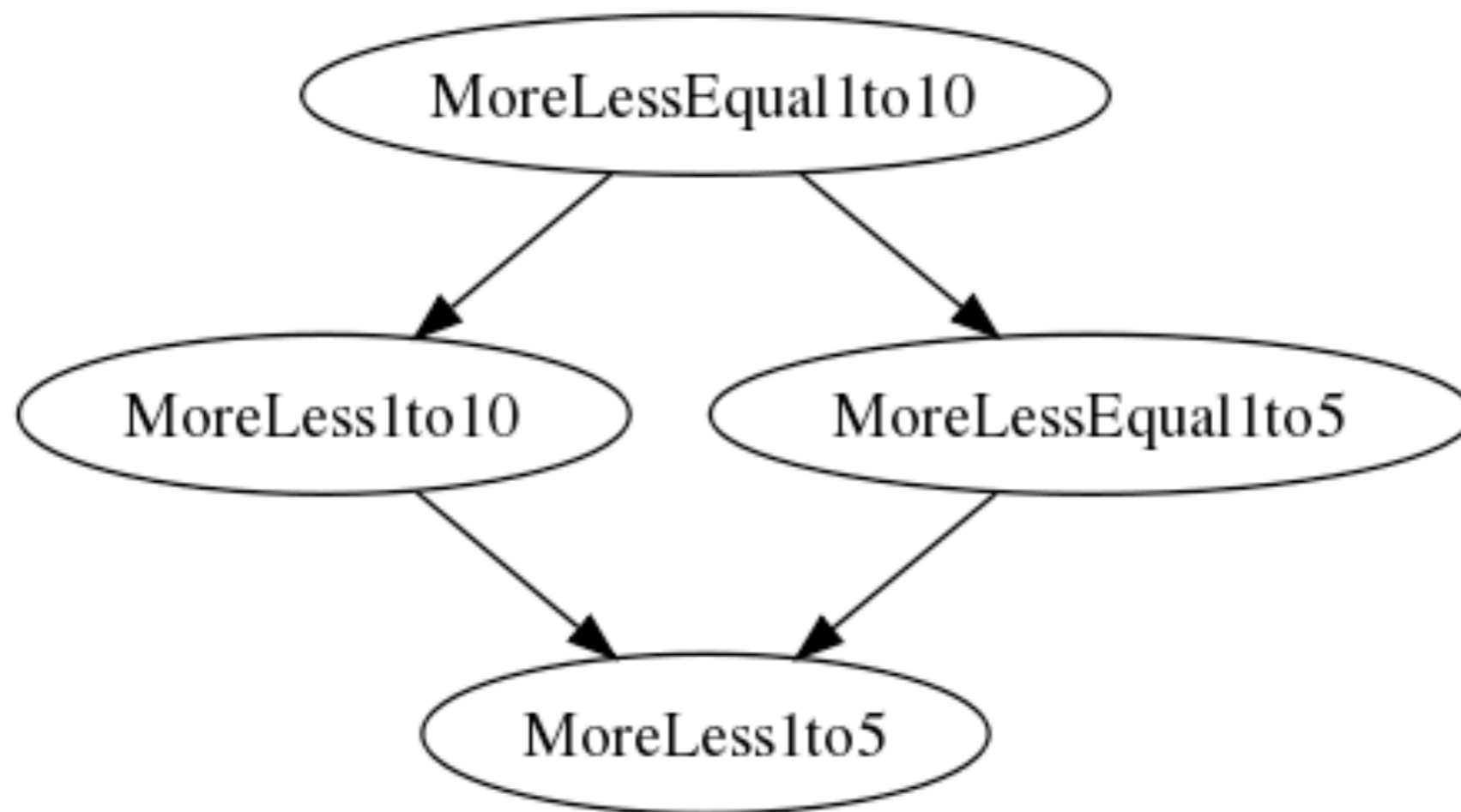
Extract Data

```
File.open("sample.xml") do |f|  
  doc      = Nokogiri::XML(f)  
  lessons  = doc.xpath("//lesson")  
  sequences = doc.xpath("//sequence")  
  
  draw_graph(lessons, sequences)  
end
```

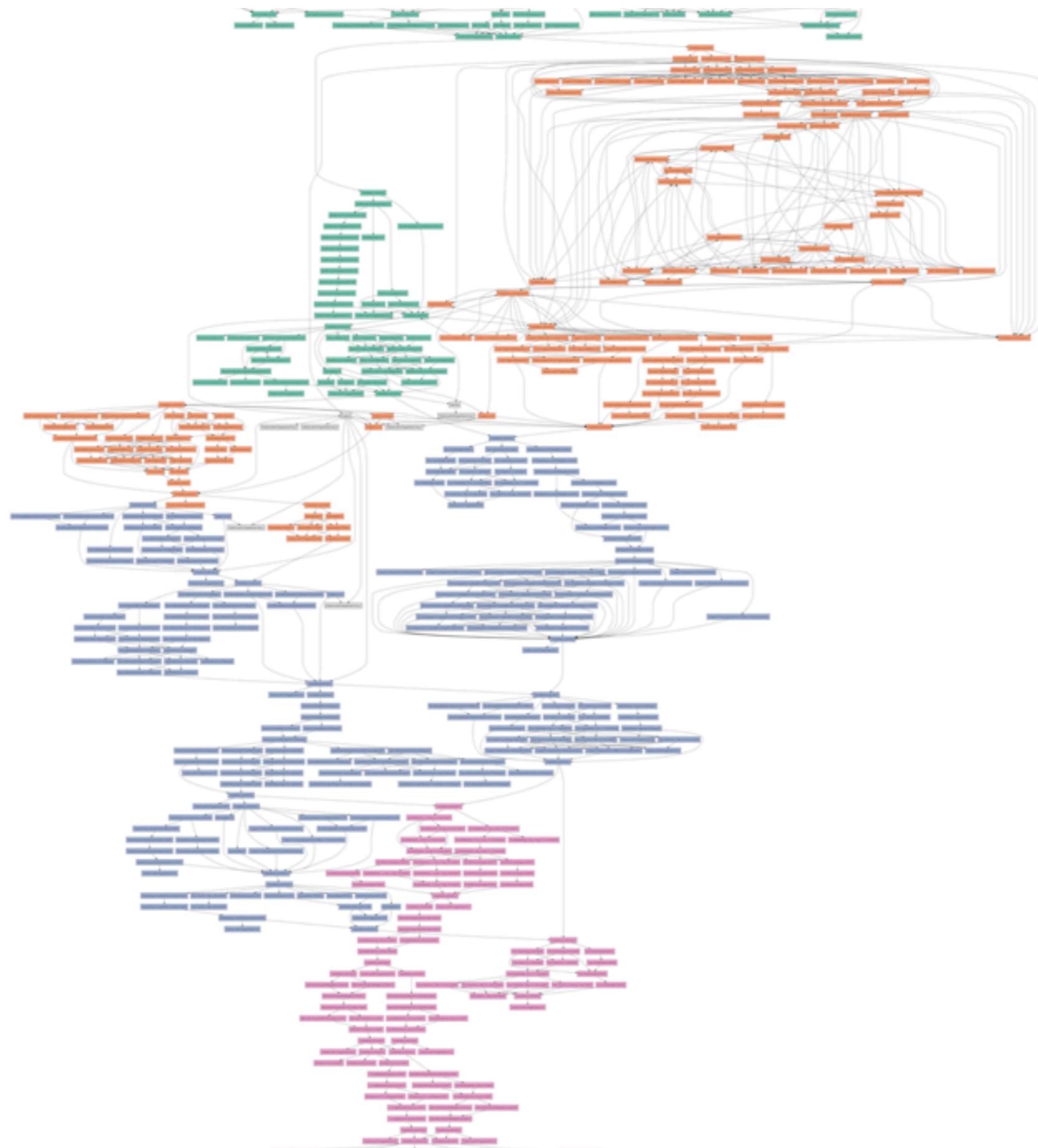


```
def draw_graph(lessons, sequences)
  digraph do
    lessons.each do |l|
      node(l["id"]).label l["name"]
    end

    sequences.each do |s|
      edge s["pre_req"], s["lesson_id"]
    end
  end
end
```



On a Larger Scale



Automated Updates

Hudson/Jenkins

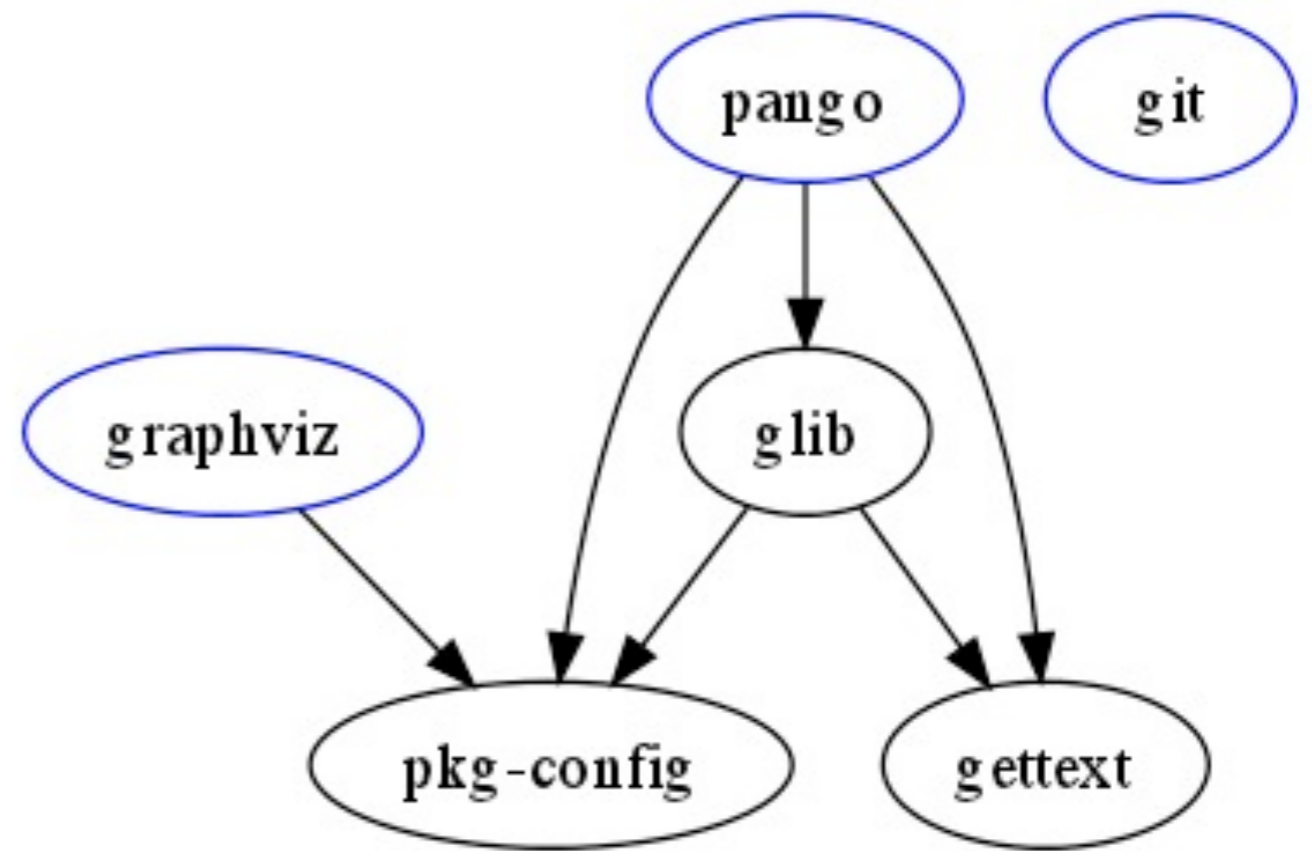
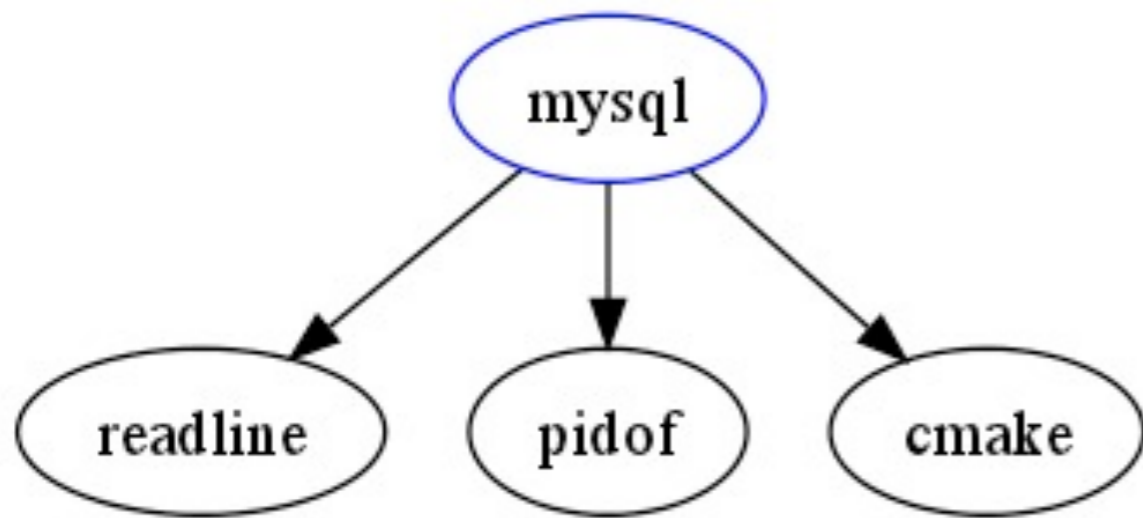
- When data changes:
 - Automatically regenerates the graphs
 - Copies graphs to the internal network
 - Sends mail

More Fun with Graph

Visualize Dependencies

Example

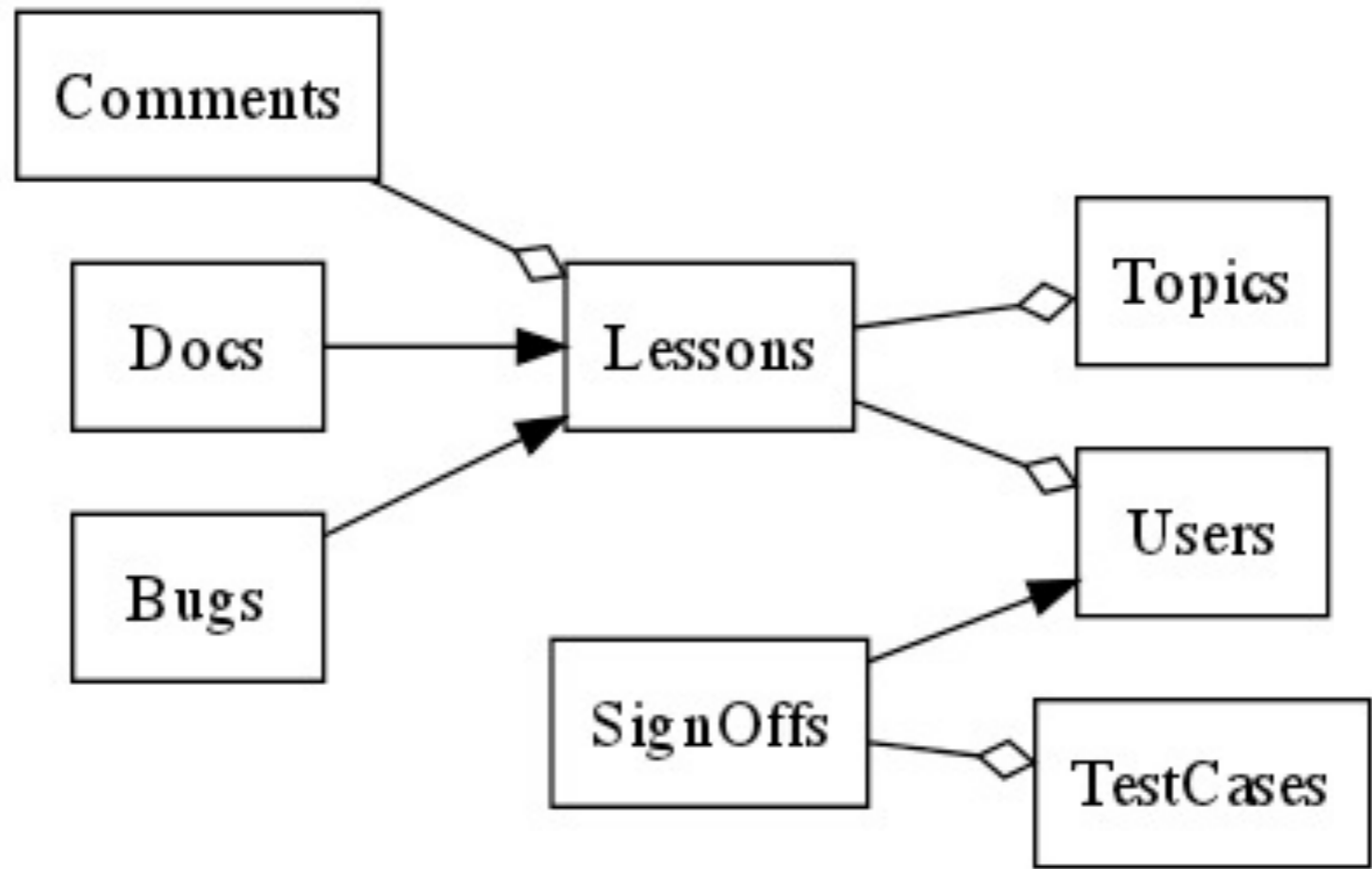
\$ graph homebrew



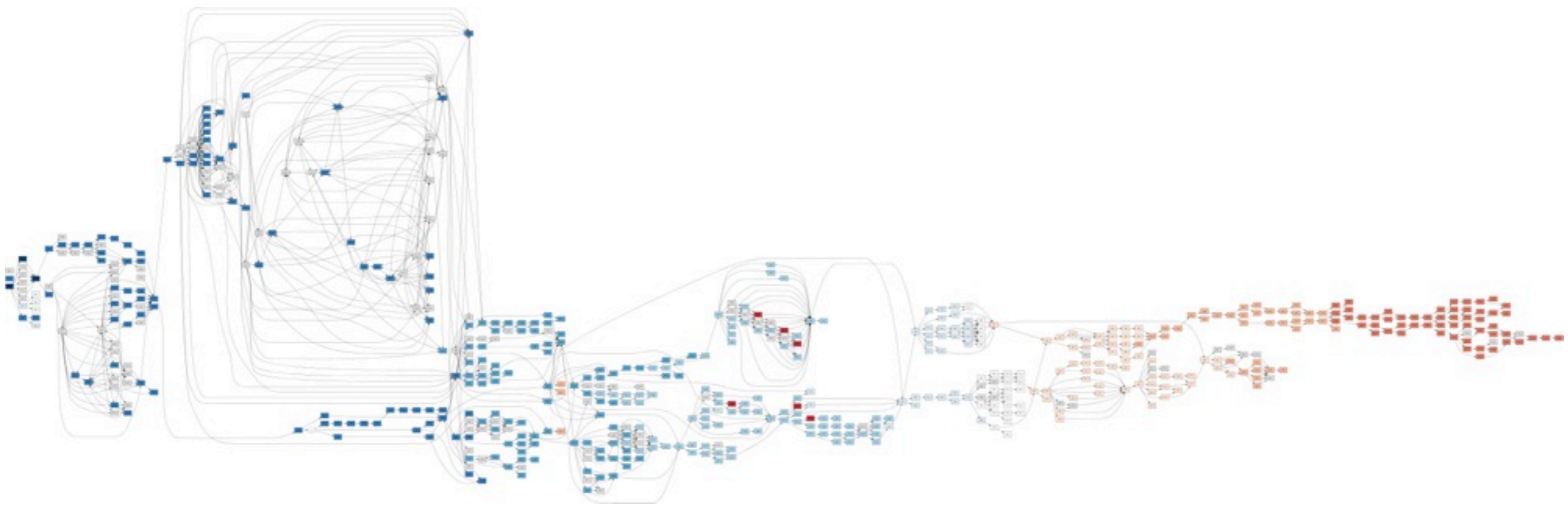
Analyzers

- RubyGems
- Homebrew
- FreeBSD Ports
- MacPorts

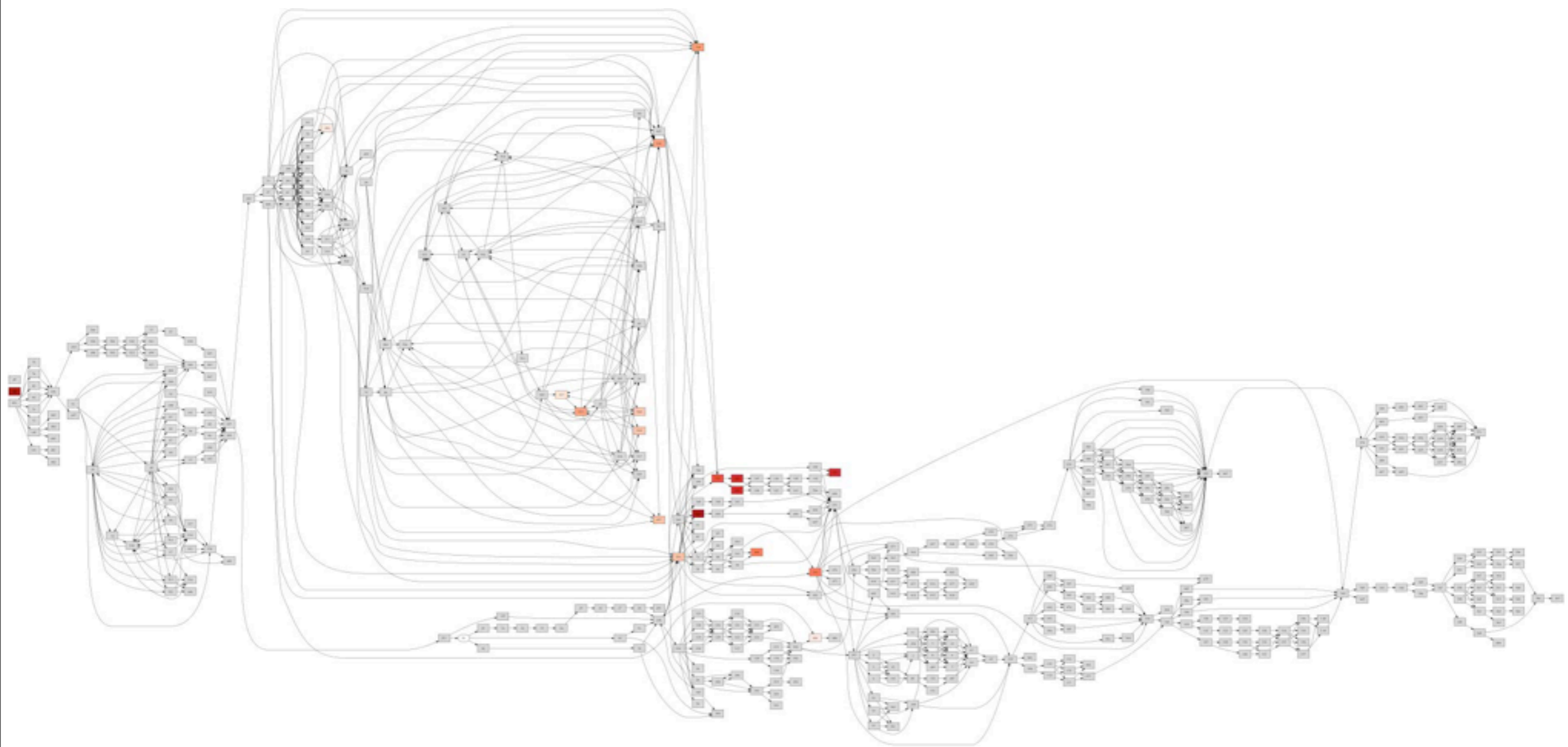
Dynamic Schema Diagrams



Illustrate History



Animation



Thank You

- Ryan Davis for graph
- Aaron Patterson for Nokogiri

Thank You