

# Appendix A: Screen Shots

## 1.1 Appendix A.1: Karaf Console

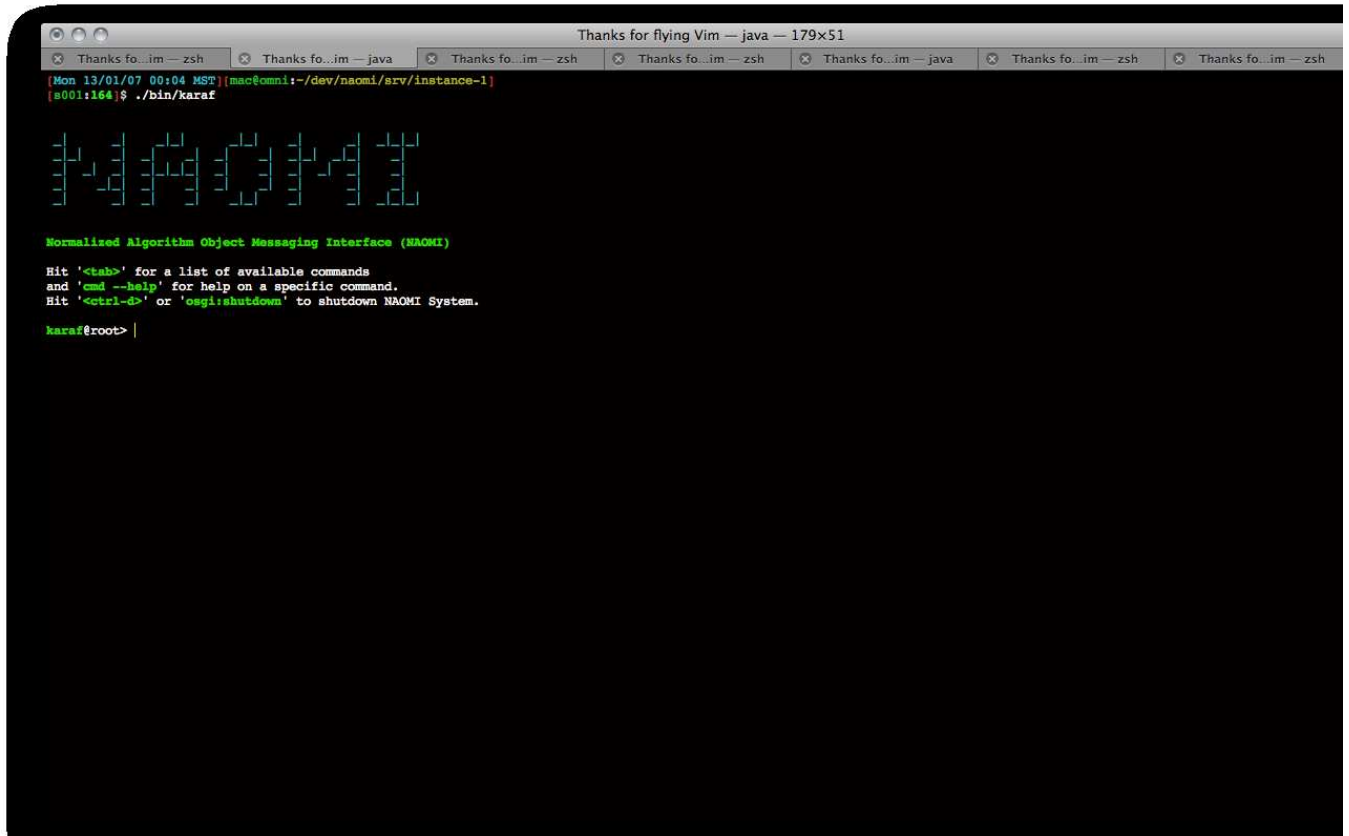
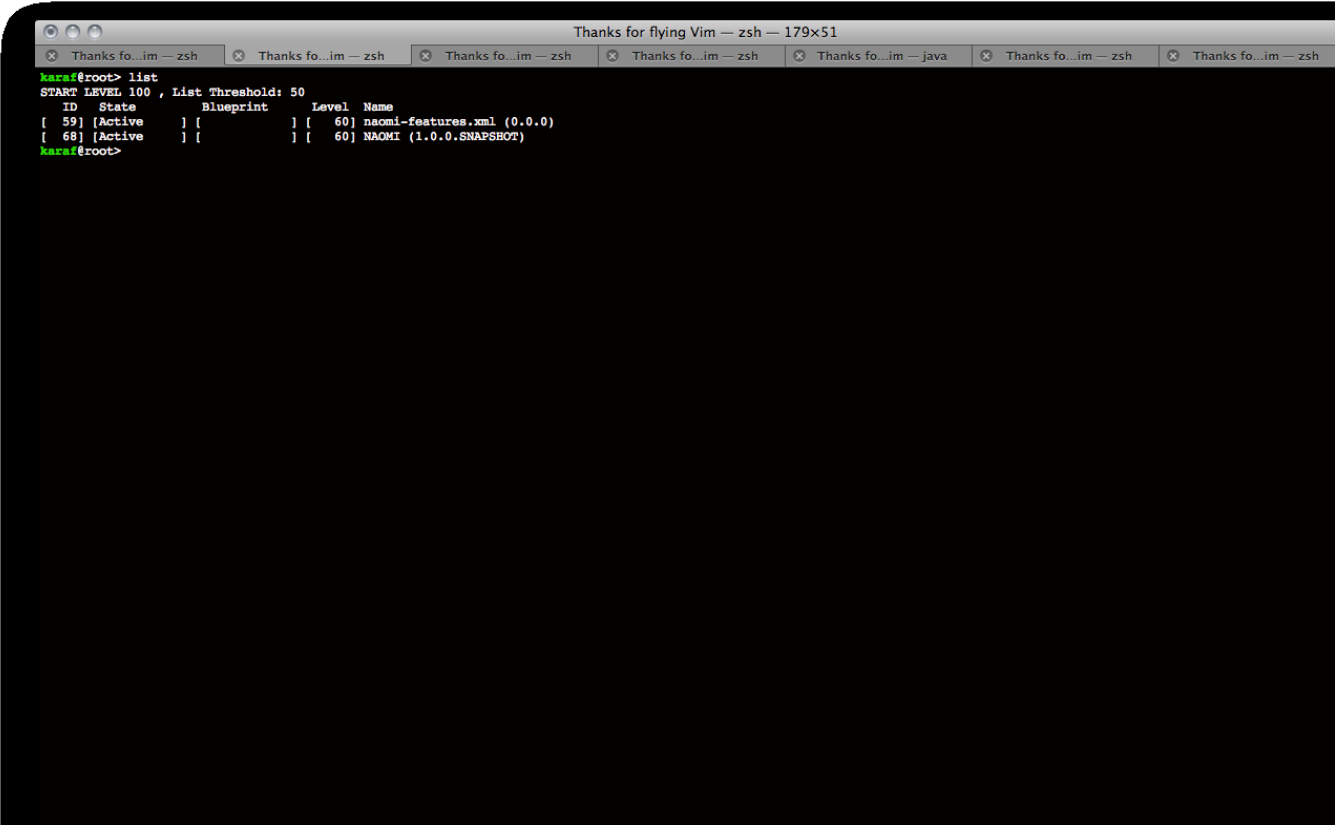


Figure 1: NAOMI Karaf Console

## 1.2 Appendix A.2: OSGi Bundles



The screenshot shows a Karaf console window with the title "Thanks for flying Vim — zsh — 179x51". The window contains the following text:

```
karaf@root> list
START LEVEL 100 , List Threshold: 50
ID      State      Blueprint      Level  Name
[ 59] [Active]      ] [          ] [ 60] naomi-features.xml (0.0.0)
[ 60] [Active]      ] [          ] [ 60] NAOMI (1.0.0.SNAPSHOT)
karaf@root>
```

Figure 2: NAOMI OSGi Bundles

### 1.3 Appendix A.3: ROAR WUMPUS Resource p3 (page 1 of 3)

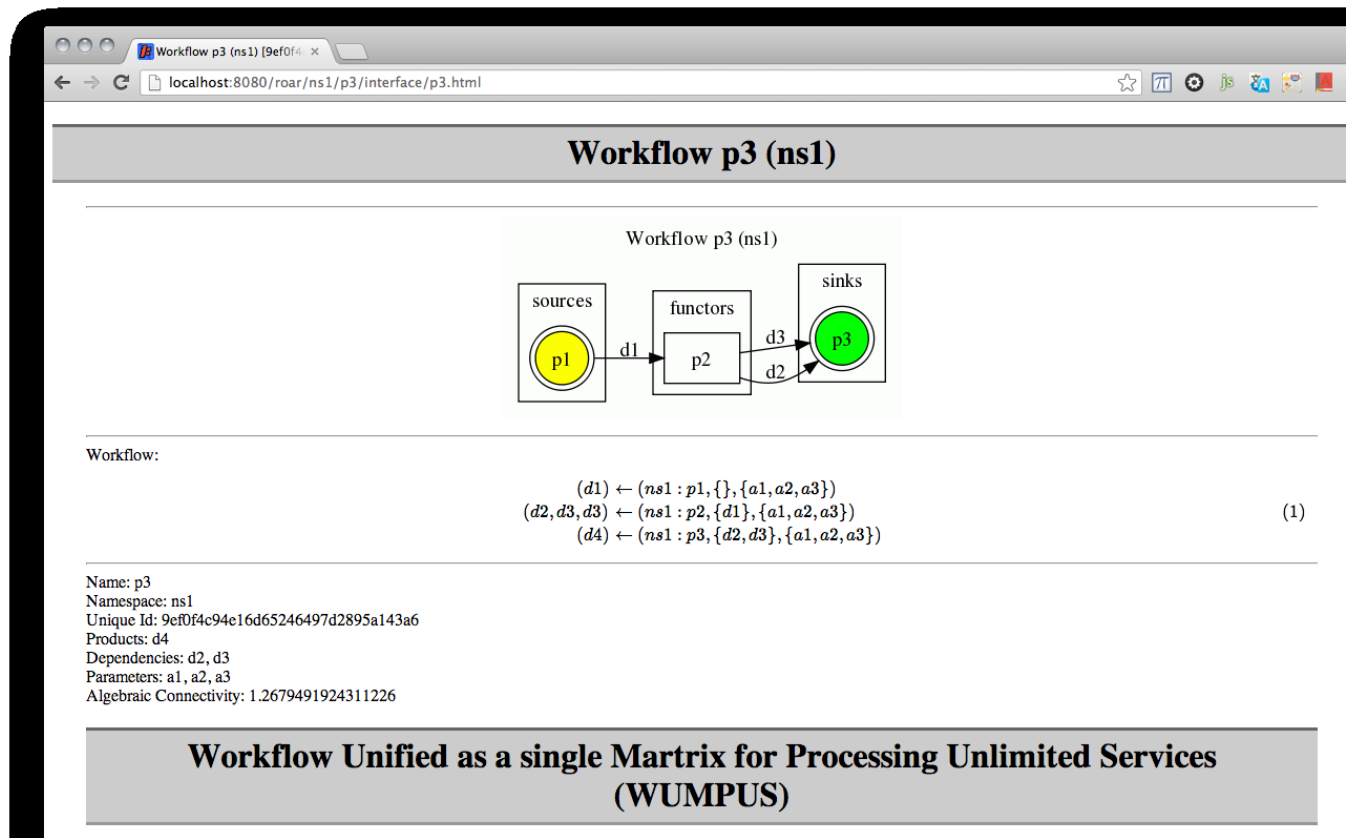
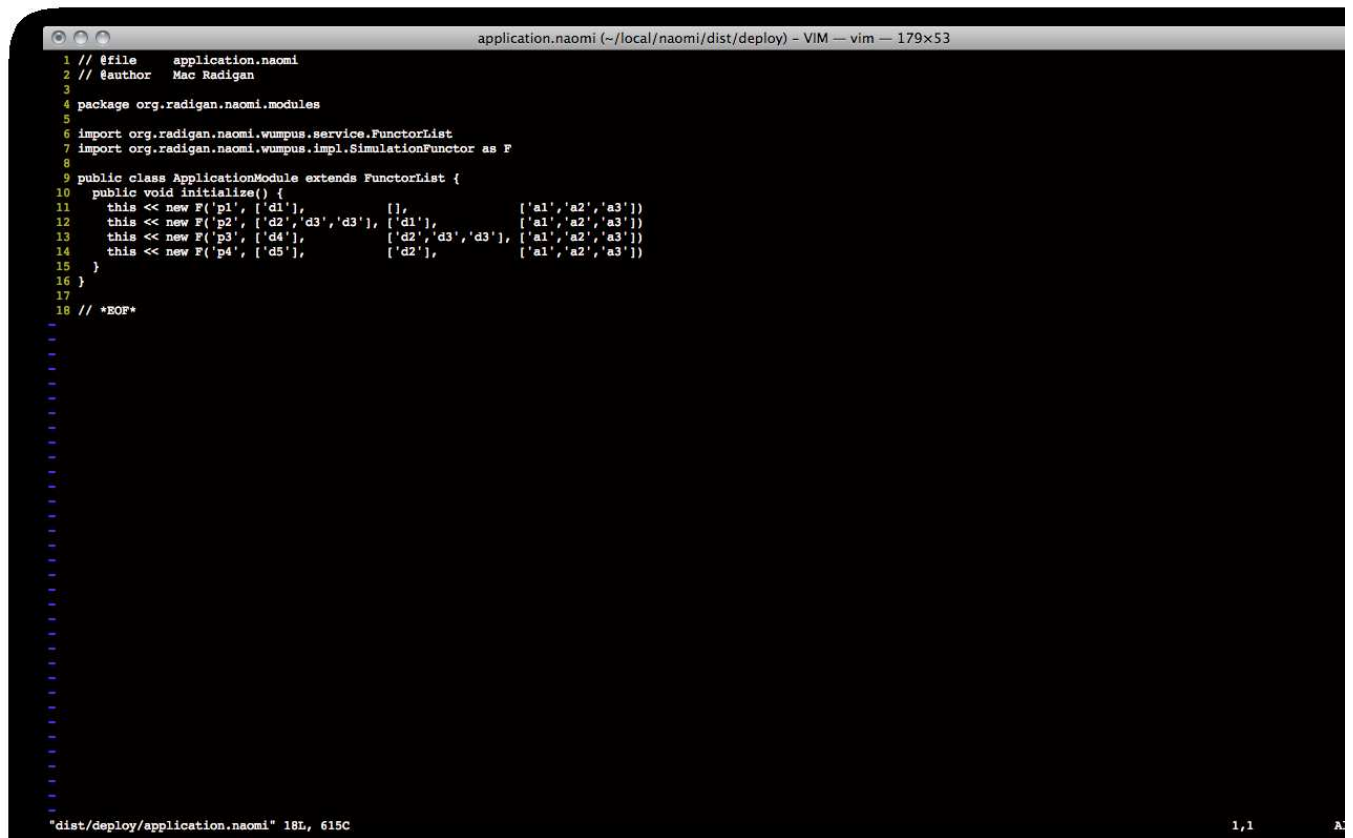


Figure 3: ROAR WUMPUS Resource p3 (page 1 of 3)

## 1.4 Appendix A.6: RUTH Dependency Injection



```
1 // #file    application.naomi
2 // #author  Mac Radigan
3
4 package org.radigan.naomi.modules
5
6 import org.radigan.naomi.wumpus.service.FunctorList
7 import org.radigan.naomi.wumpus.impl.SimulationFunctor as F
8
9 public class ApplicationModule extends FunctorList {
10     public void initialize() {
11         this << new F('p1', ['d1'], [], ['a1','a2','a3'])
12         this << new F('p2', ['d2', 'd3', 'd3'], ['d1'], ['a1','a2','a3'])
13         this << new F('p3', ['d4'], ['d2', 'd3', 'd3'], ['a1','a2','a3'])
14         this << new F('p4', ['d5'], ['d2'], ['a1','a2','a3'])
15     }
16 }
17
18 // *BOF*
```

"dist/deploy/application.naomi" 18L, 615C 1,1 A

Figure 4: RUTH Dependency Injection

## 1.5 Appendix A.4: ROAR WUMPUS Resource p31 (page 1 of 3)

### 1.5.1 Appendix A.4.1: ROAR WUMPUS Resource p31

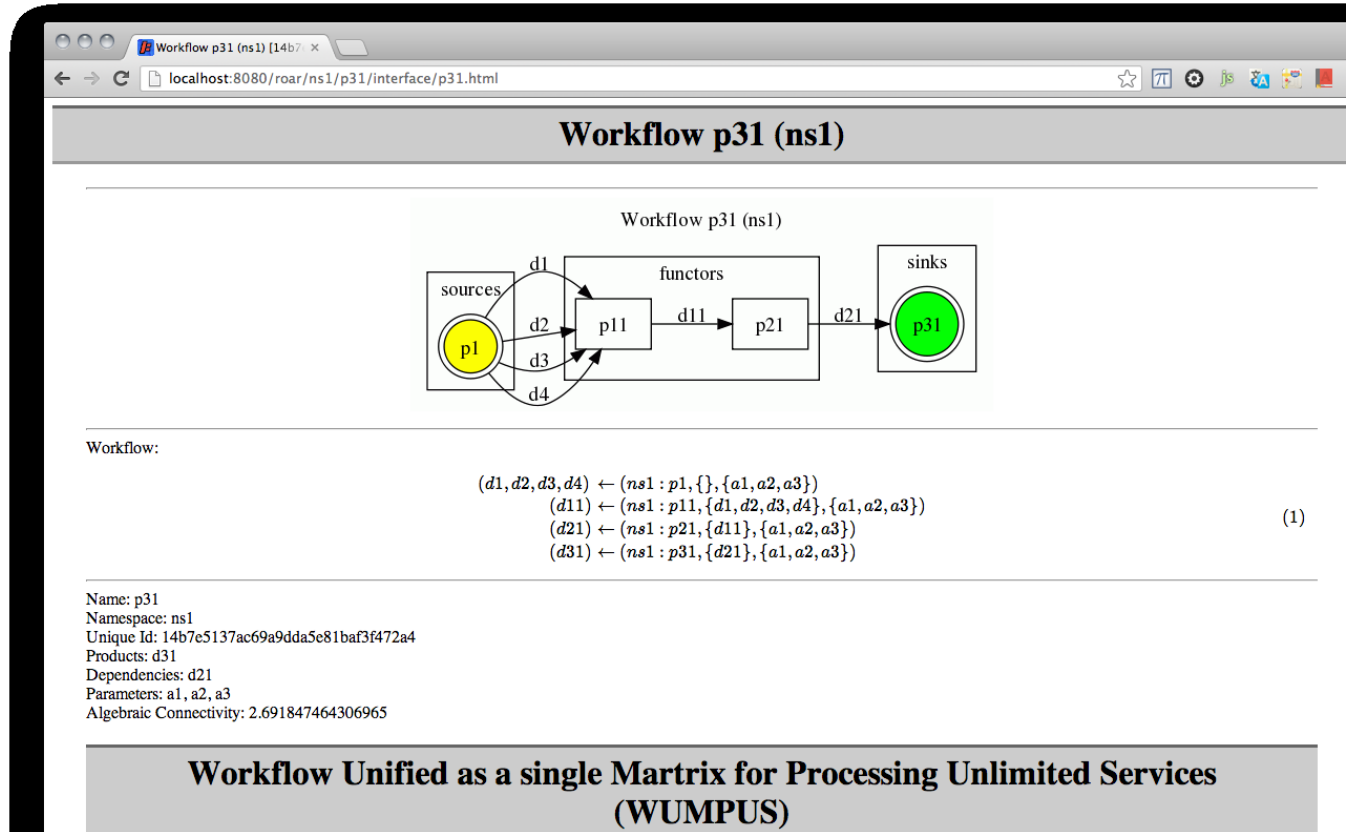


Figure 5: ROAR WUMPUS Resource p31 (page 1 of 3)

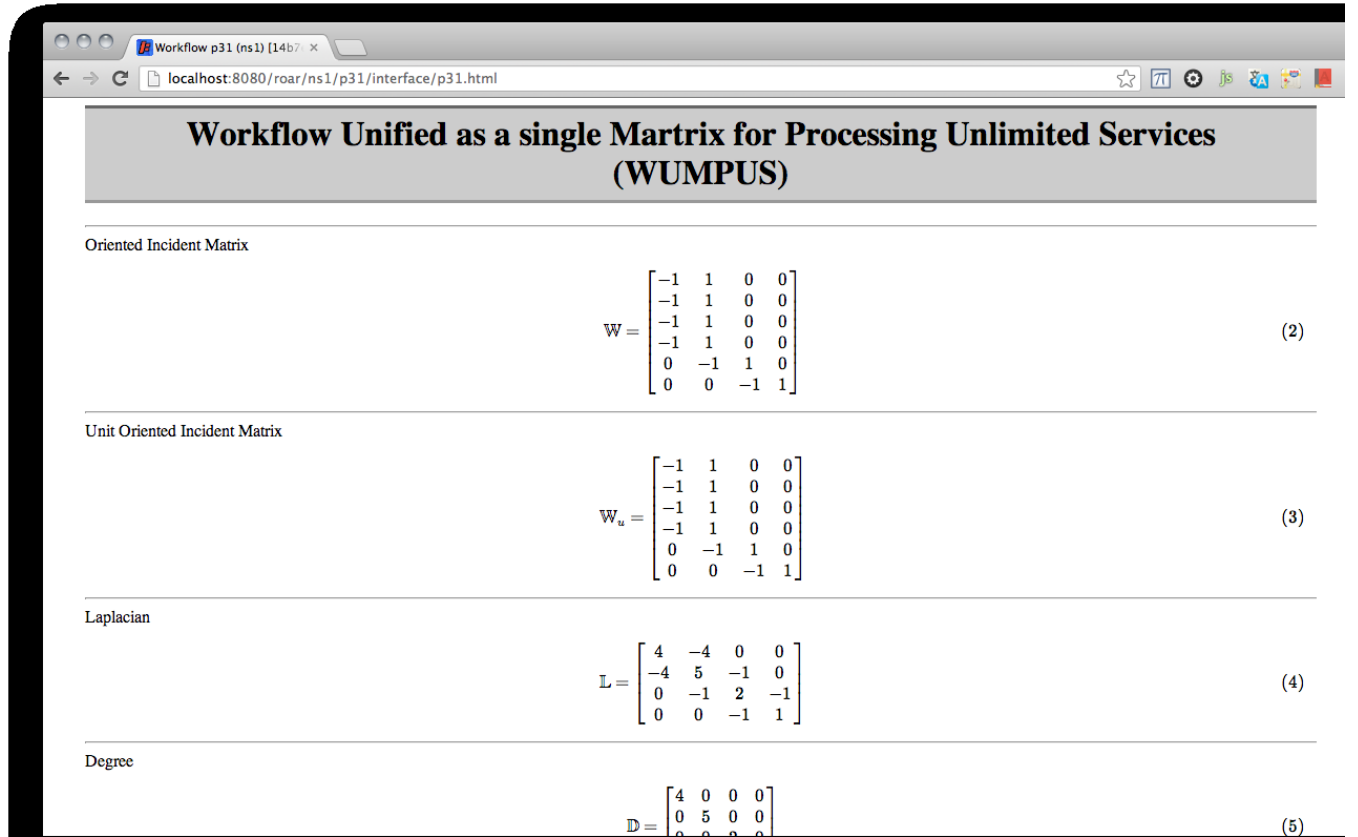


Figure 6: ROAR WUMPUS Resource p31 (page 2 of 3)

### 1.5.2 Appendix A.4.2: ROAR WUMPUS Resource p32

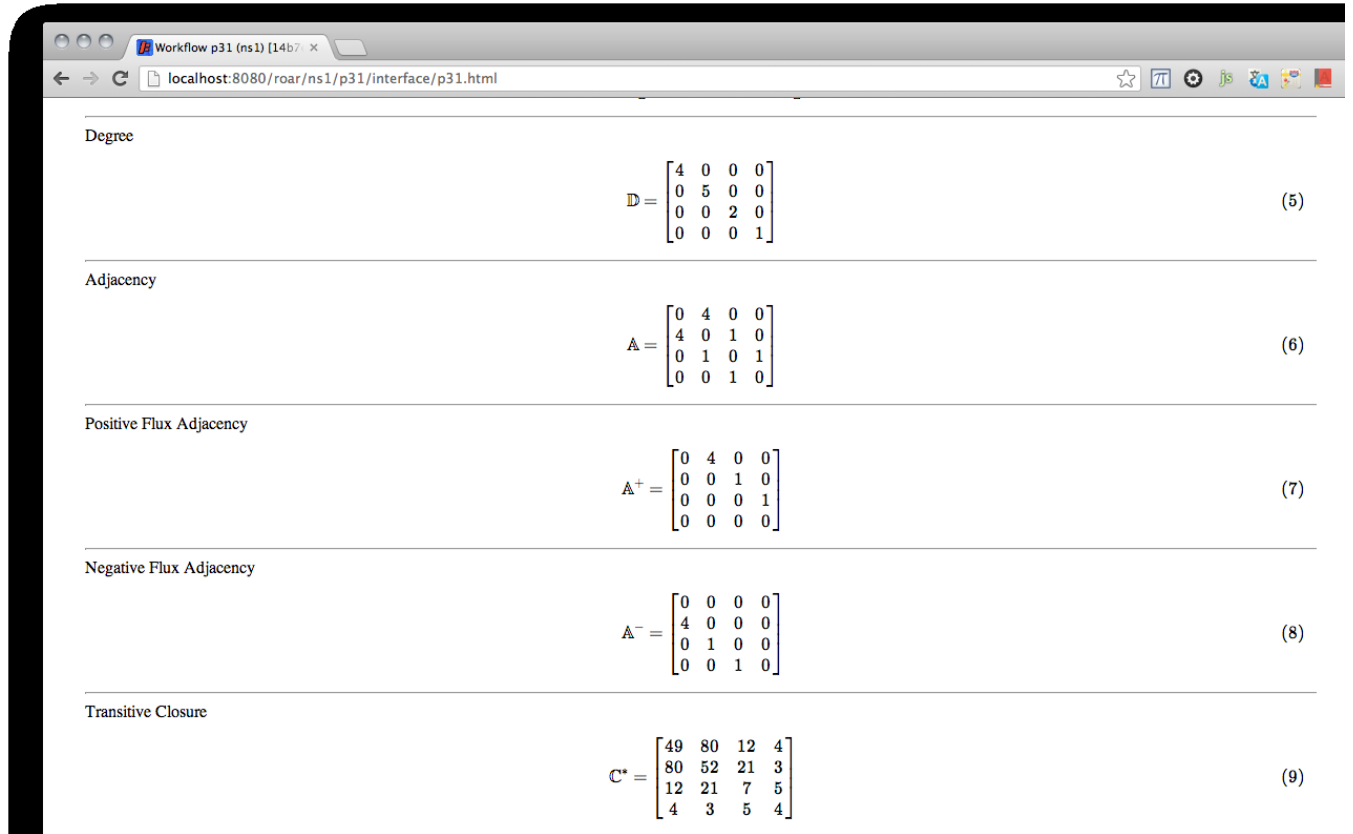


Figure 7: ROAR WUMPUS Resource p31 (page 3 of 3)

### 1.5.3 Appendix A.4.3: ROAR WUMPUS Resource p33

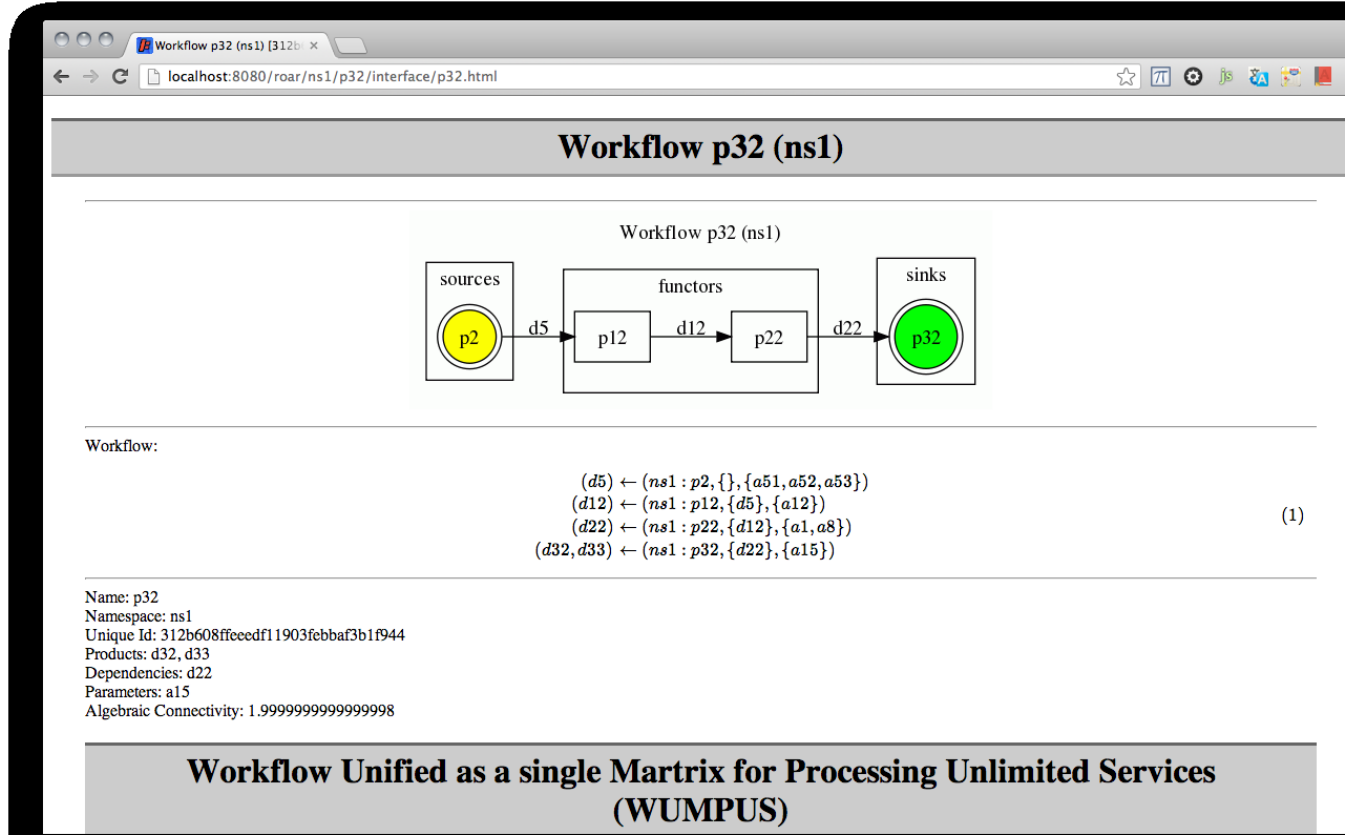


Figure 8: ROAR WUMPUS Resource p32 (page 1 of 3)

#### 1.5.4 Appendix A.4.4: ROAR WUMPUS Resource p34



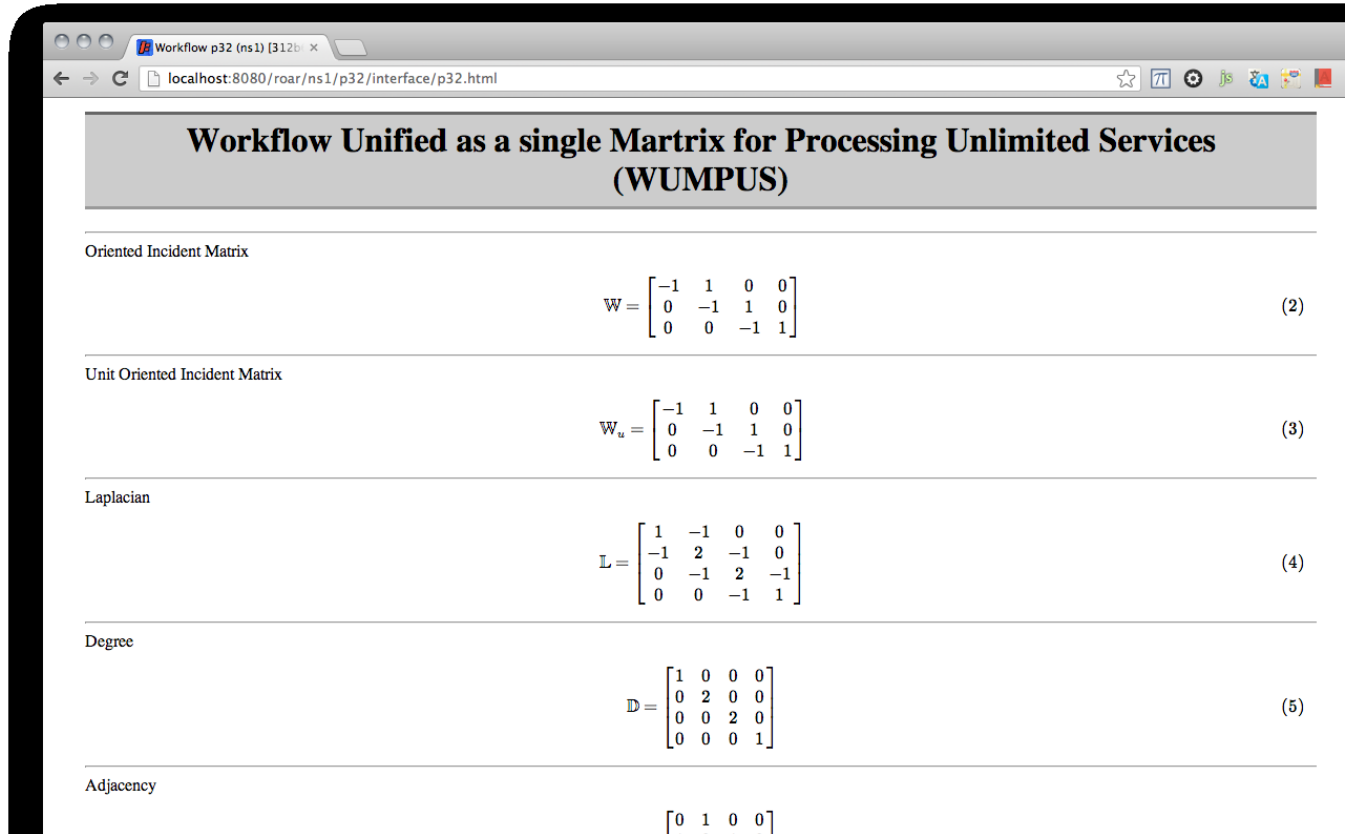


Figure 9: ROAR WUMPUS Resource p32 (page 2 of 3)

#### 1.5.5 Appendix A.4.5: ROAR WUMPUS Resource p35

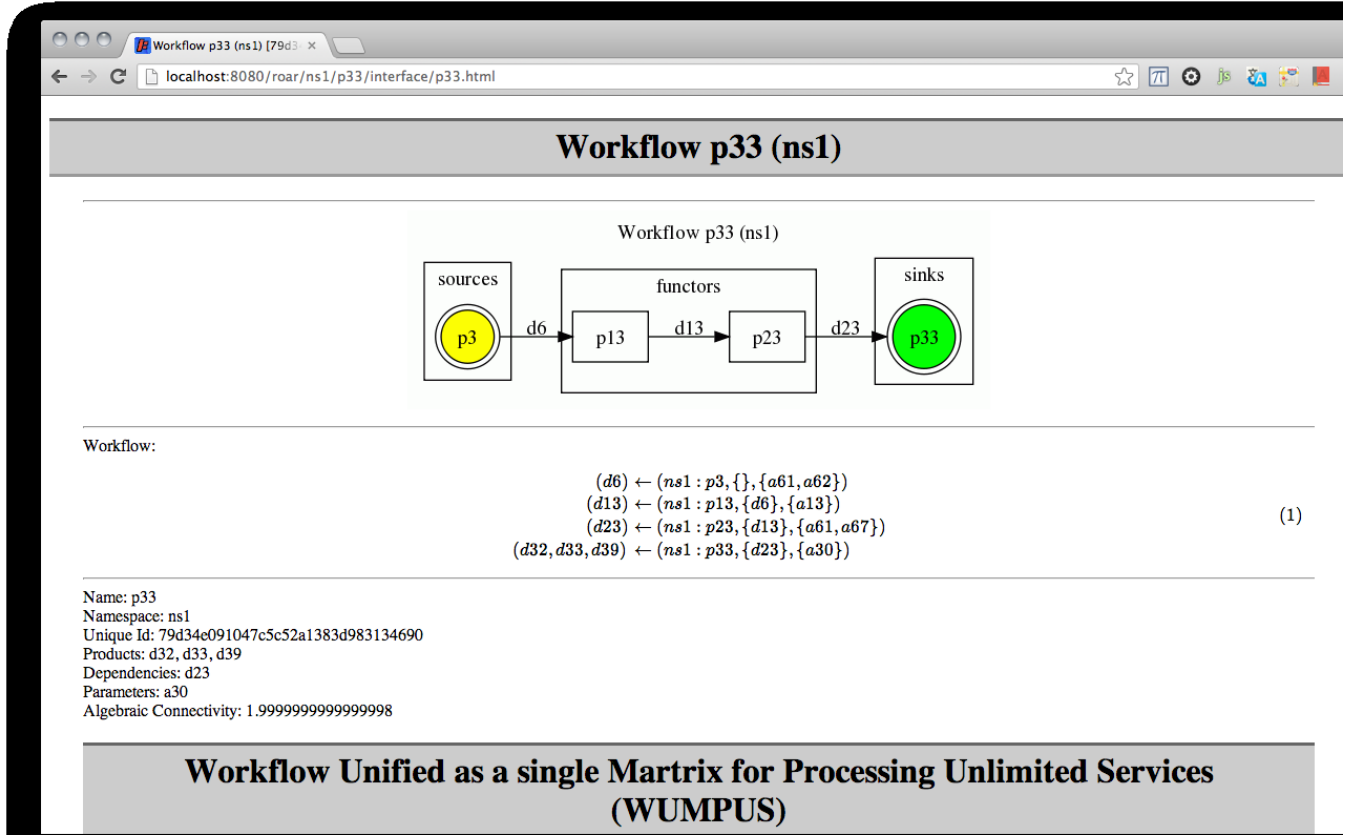


Figure 10: ROAR WUMPUS Resource p33 (page 1 of 3)

#### 1.5.6 Appendix A.4.6: ROAR WUMPUS Resource p36

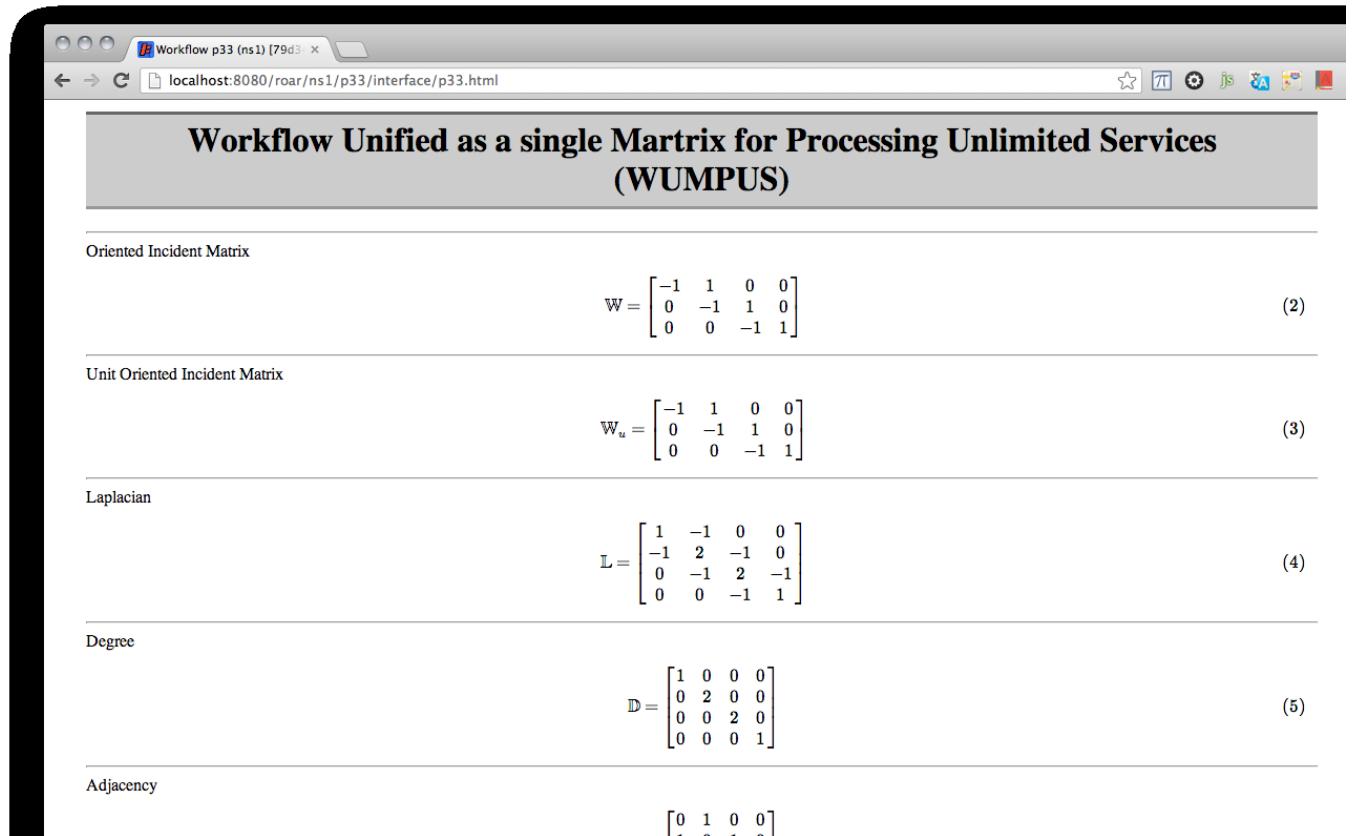


Figure 11: ROAR WUMPUS Resource p33 (page 2 of 3)

#### 1.5.7 Appendix A.4.7: ROAR WUMPUS Resource p37

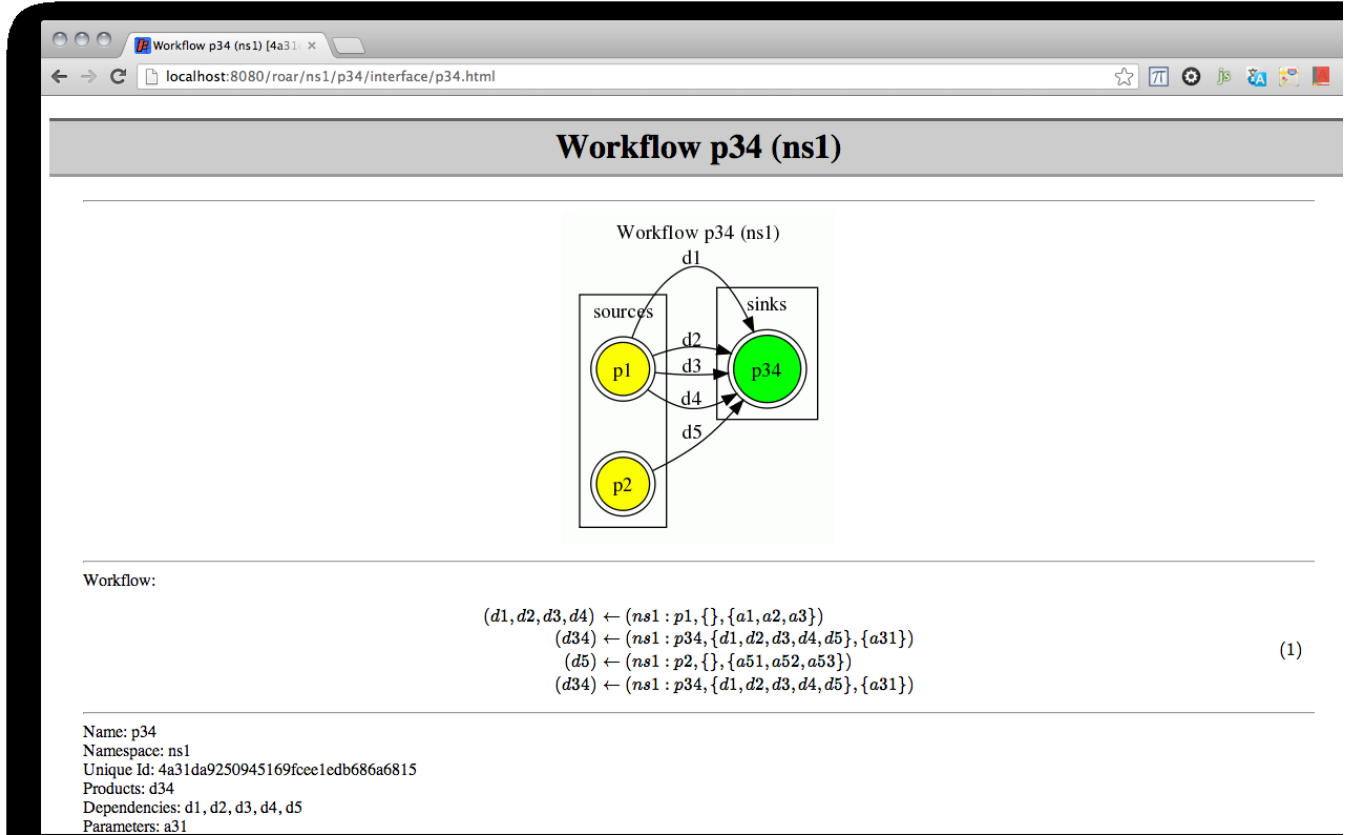


Figure 12: ROAR WUMPUS Resource p34 (page 1 of 3)

### 1.5.8 Appendix A.4.8: ROAR WUMPUS Resource p38

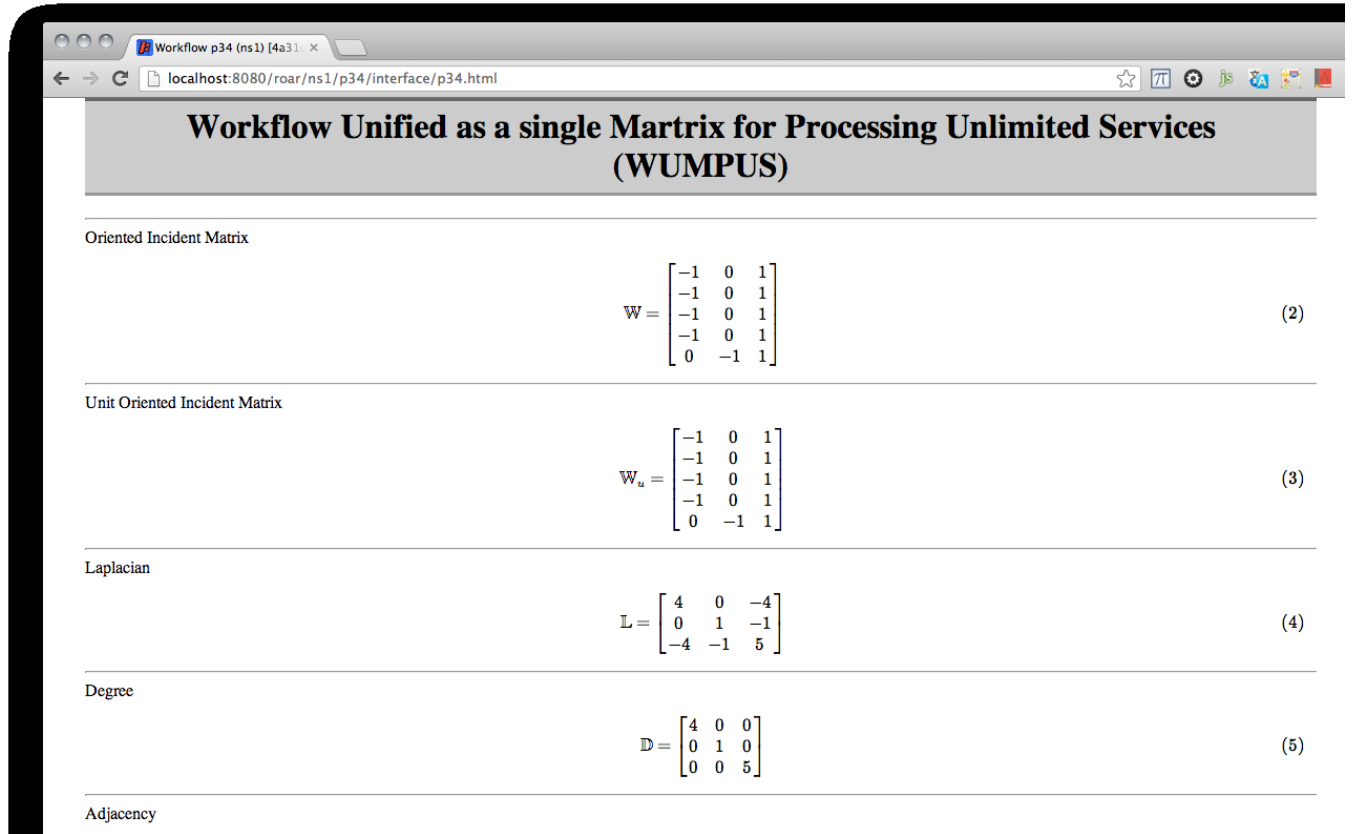


Figure 13: ROAR WUMPUS Resource p34 (page 2 of 3)

#### 1.5.9 Appendix A.4.9: ROAR WUMPUS Resource p39

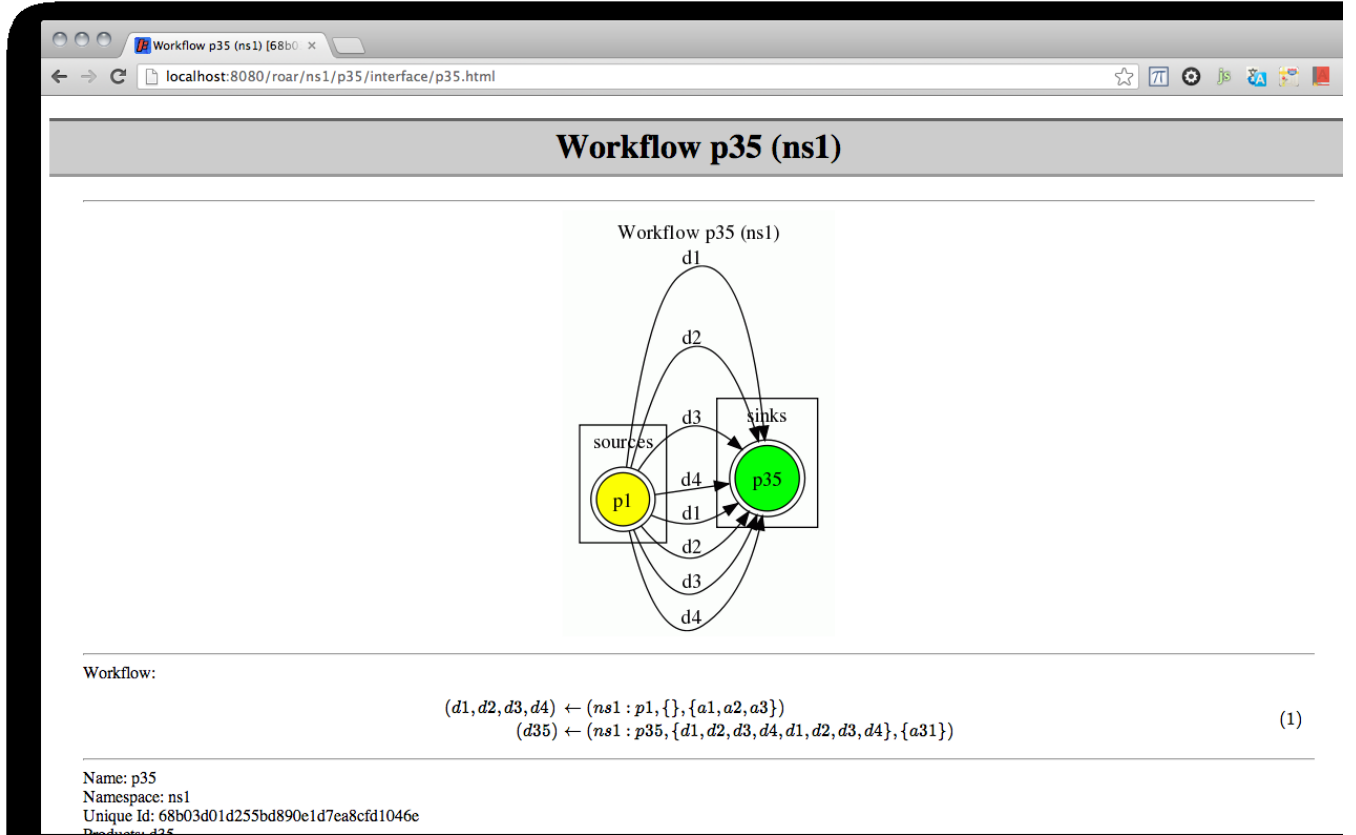


Figure 14: ROAR WUMPUS Resource p35 (page 1 of 3)

## 1.6 Appendix A.5: ROAR Octave Resource p3

### 1.6.1 Appendix A.5.1: ROAR Octave Resource p31

### 1.6.2 Appendix A.5.2: ROAR Octave Resource p32

### 1.6.3 Appendix A.5.3: ROAR Octave Resource p33

### 1.6.4 Appendix A.5.4: ROAR Octave Resource p34

### 1.6.5 Appendix A.5.5: ROAR Octave Resource p35

### 1.6.6 Appendix A.5.6: ROAR Octave Resource p36

### 1.6.7 Appendix A.5.7: ROAR Octave Resource p37

### 1.6.8 Appendix A.5.8: ROAR Octave Resource p38

### 1.6.9 Appendix A.5.9: ROAR Octave Resource p39

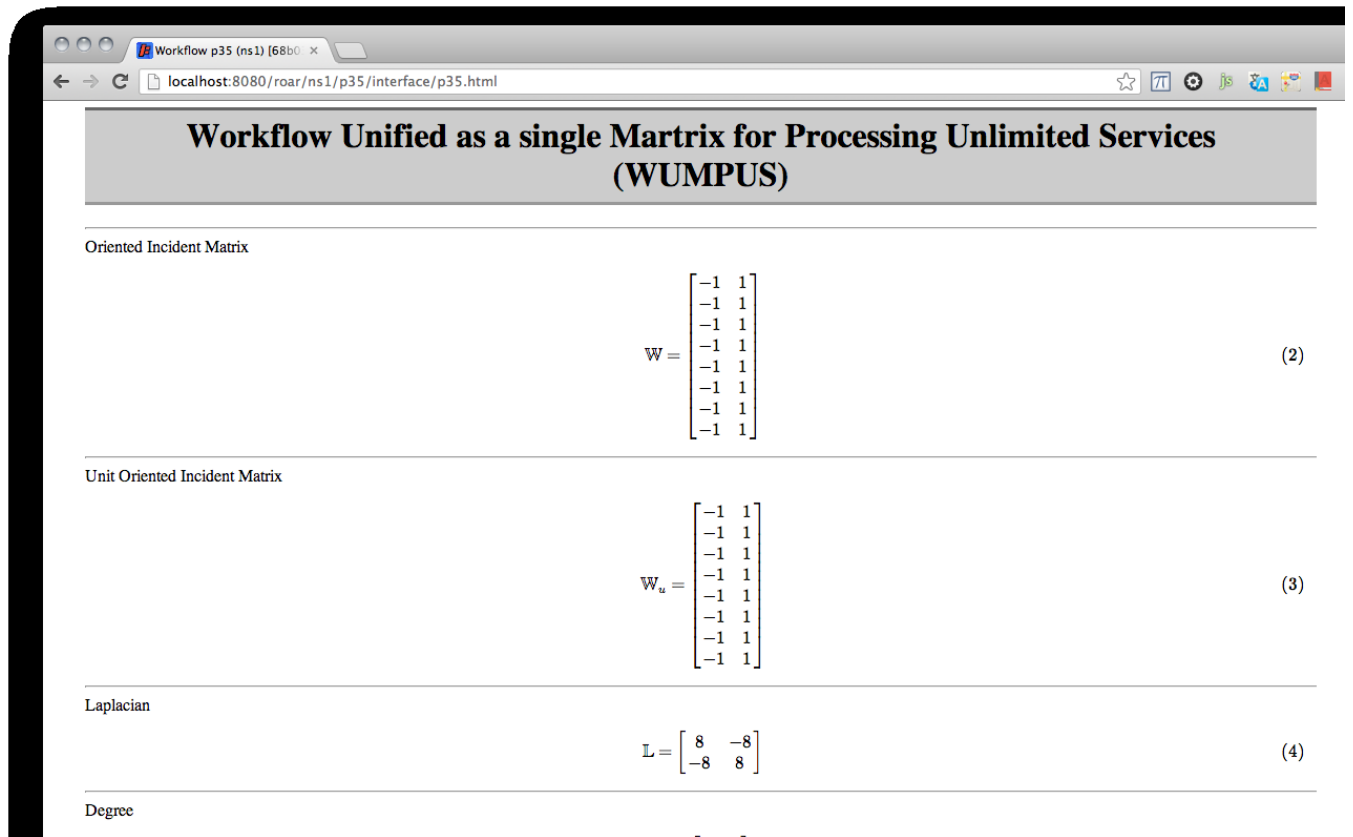


Figure 15: ROAR WUMPUS Resource p35 (page 2 of 3)

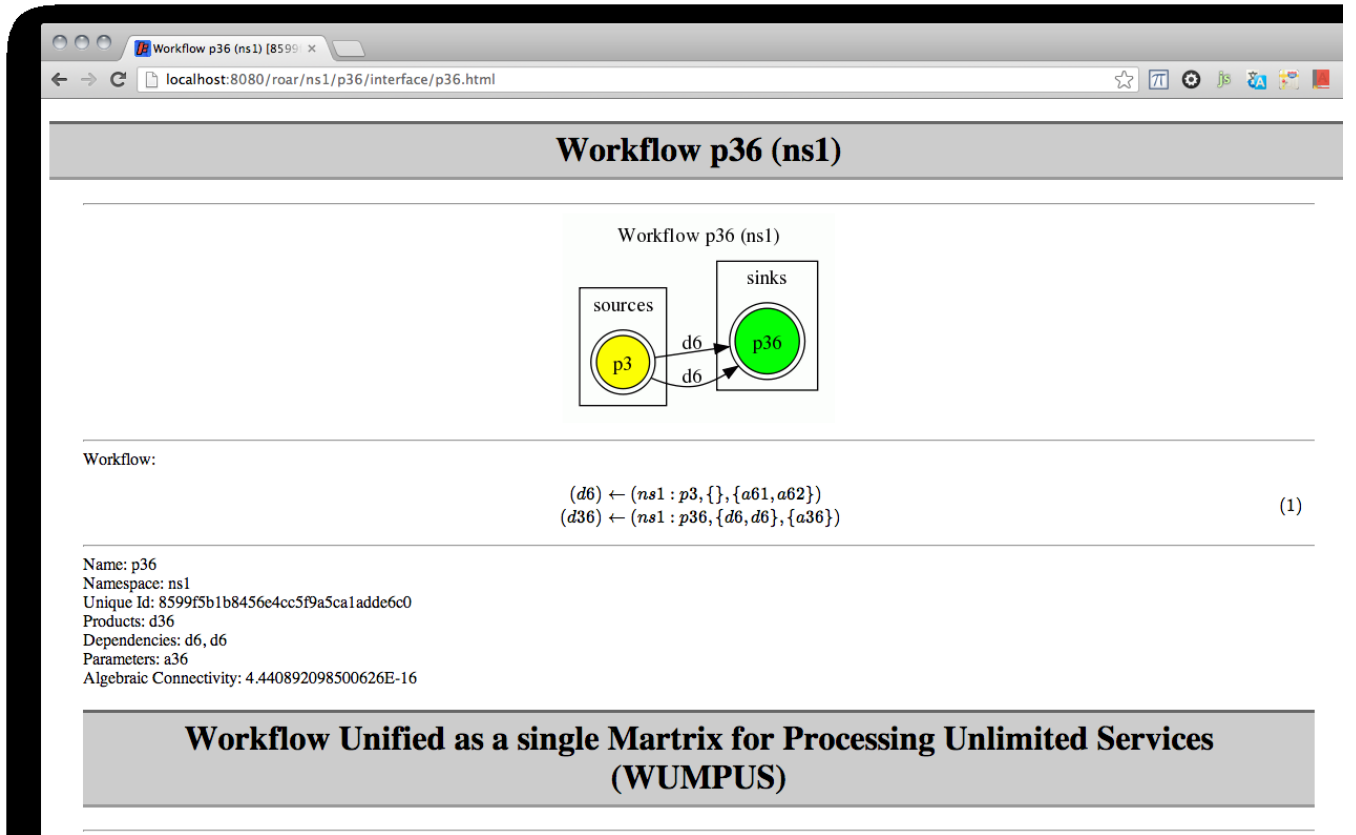


Figure 16: ROAR WUMPUS Resource p36 (page 1 of 3)



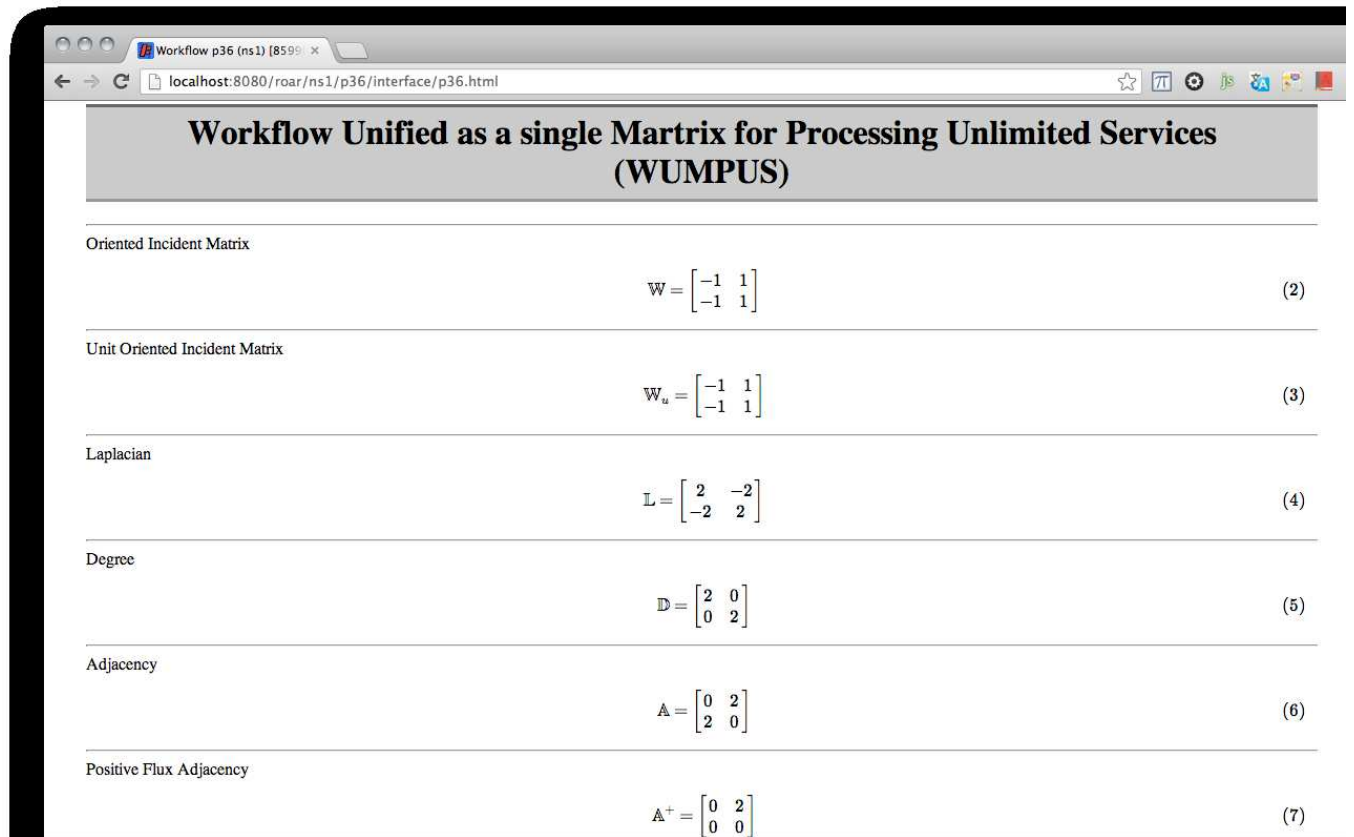


Figure 17: ROAR WUMPUS Resource p36 (page 2 of 3)

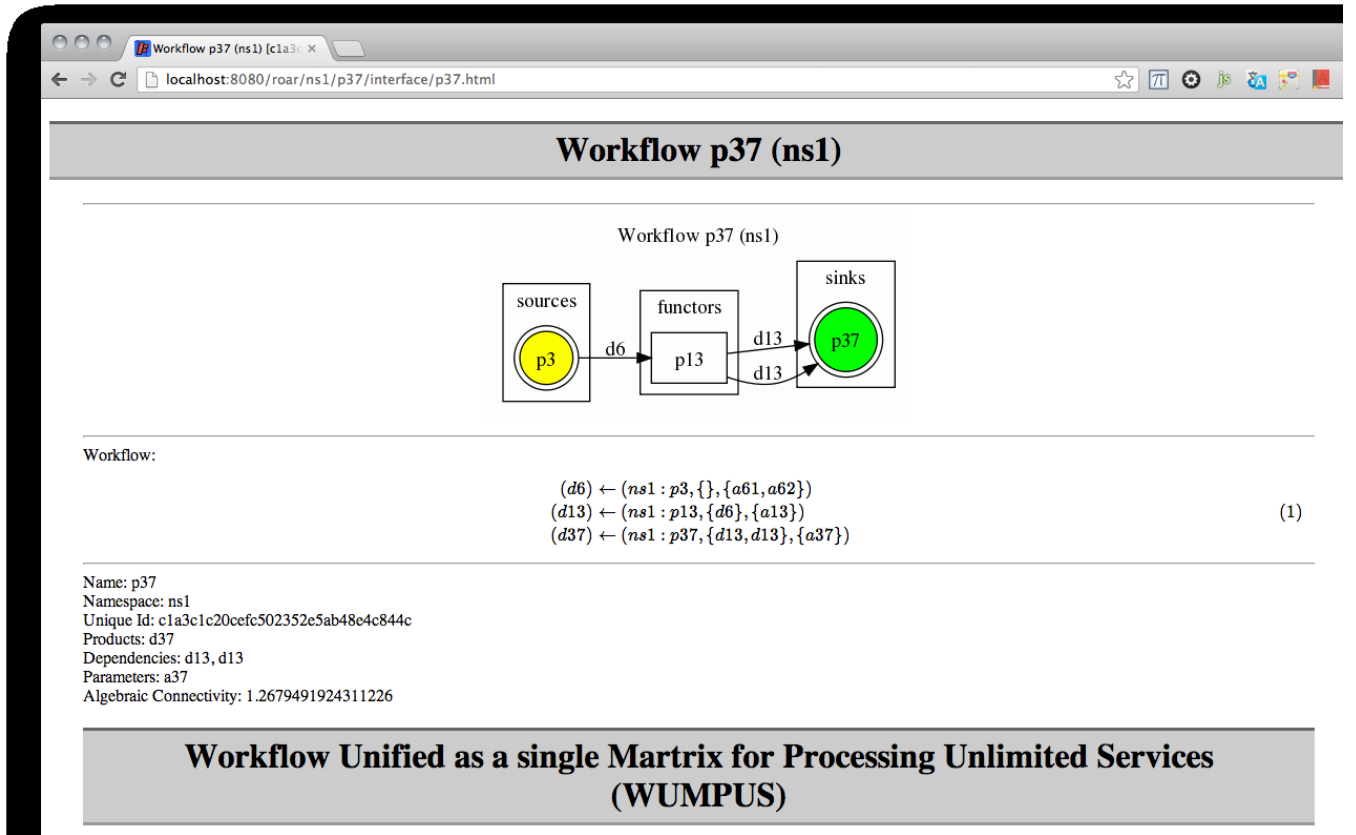


Figure 18: ROAR WUMPUS Resource p37 (page 1 of 3)

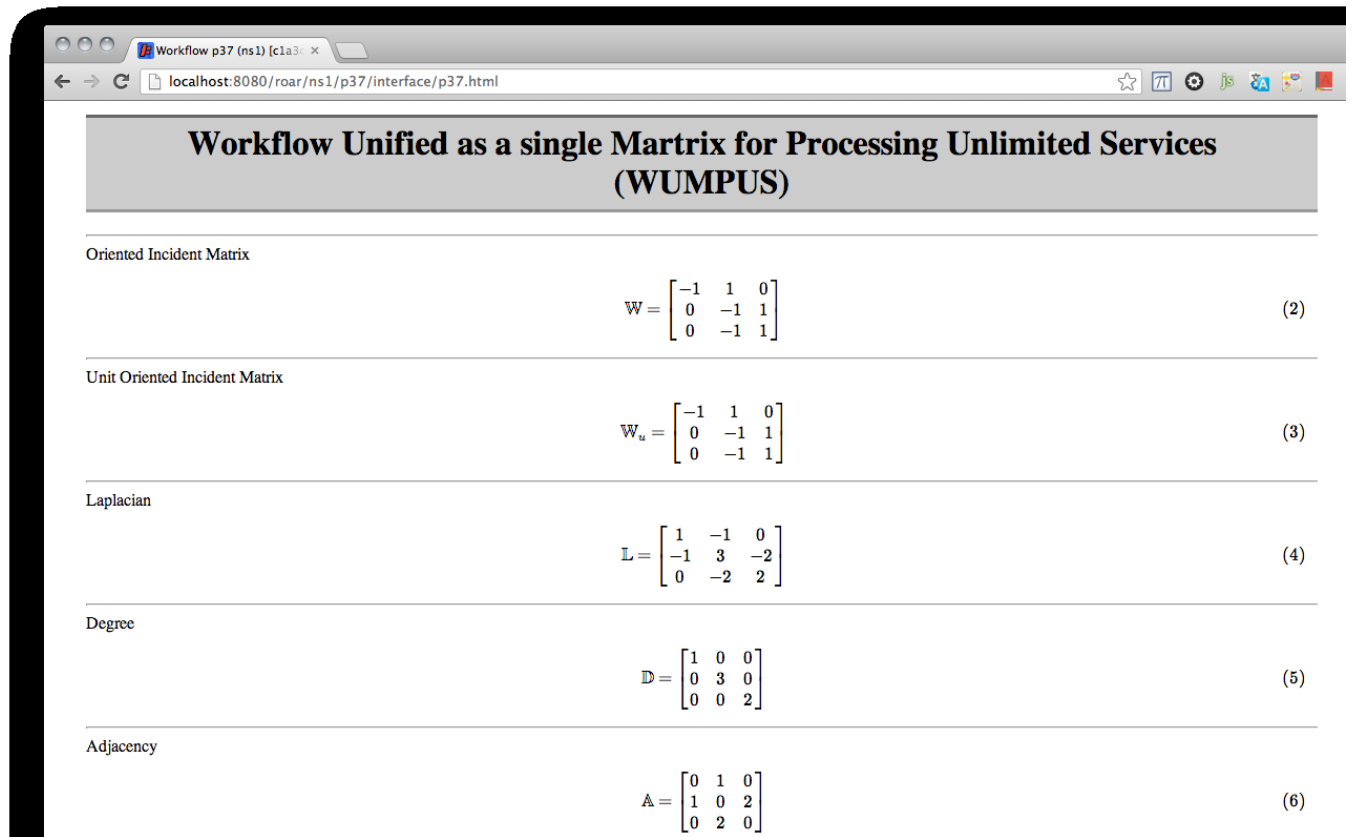


Figure 19: ROAR WUMPUS Resource p37 (page 2 of 3)

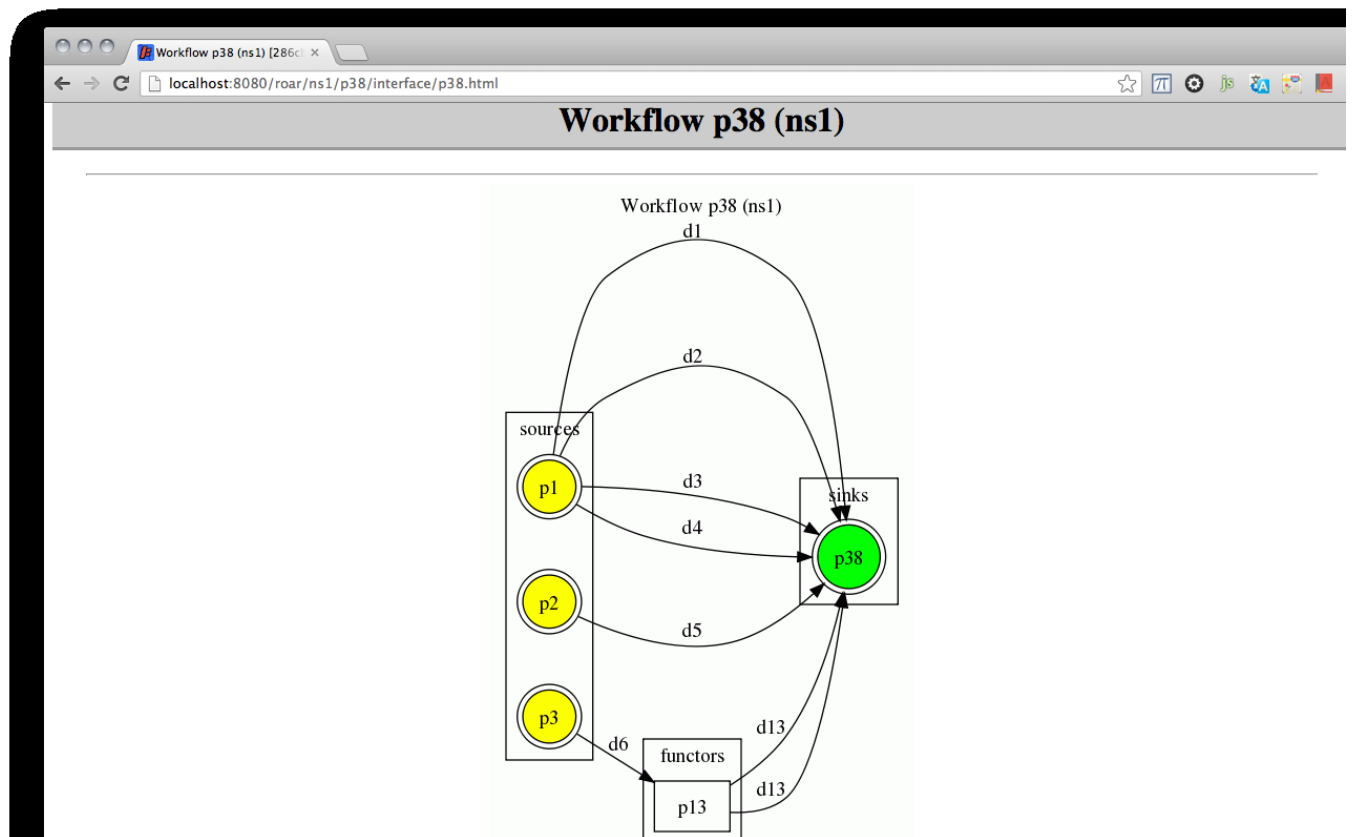


Figure 20: ROAR WUMPUS Resource p38 (page 1 of 3)

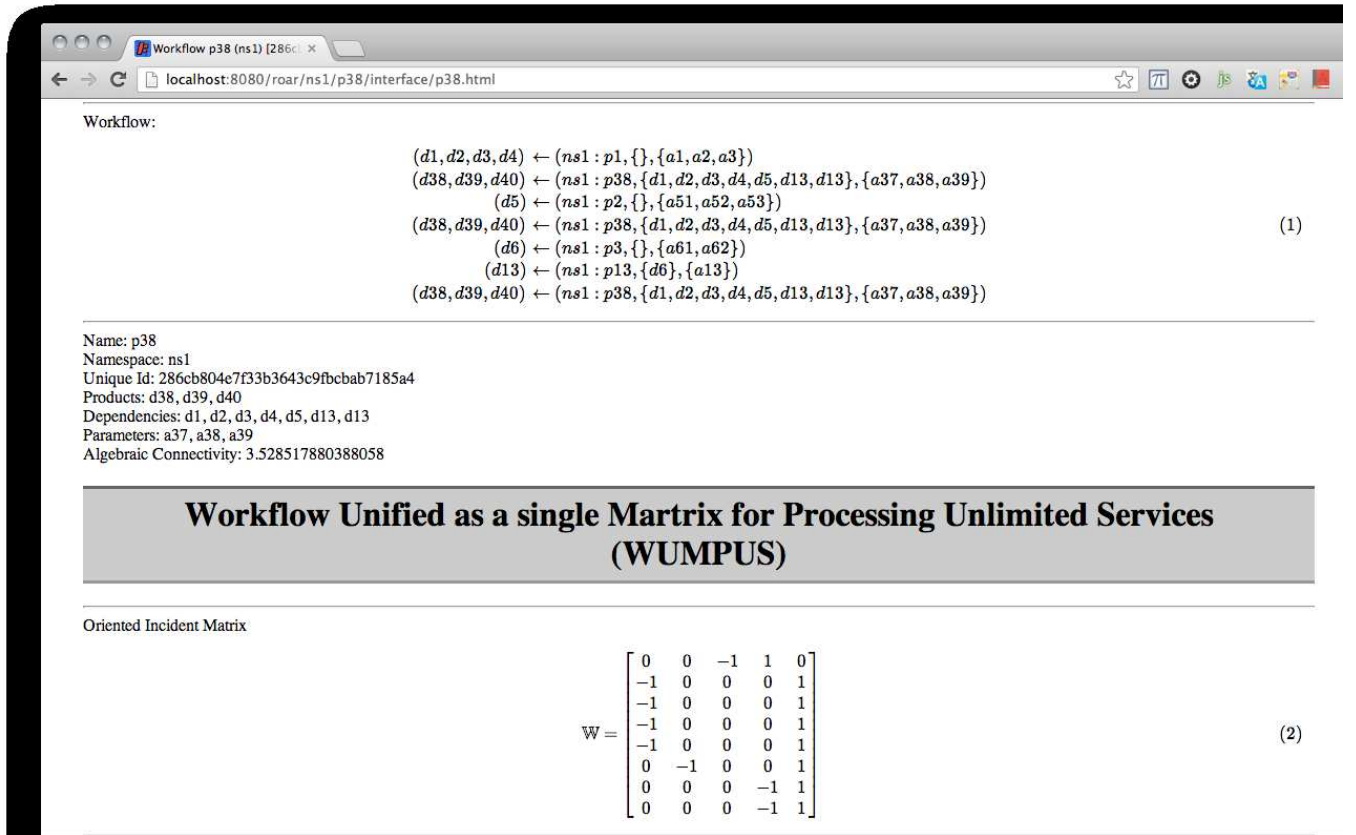


Figure 21: ROAR WUMPUS Resource p38 (page 2 of 3)

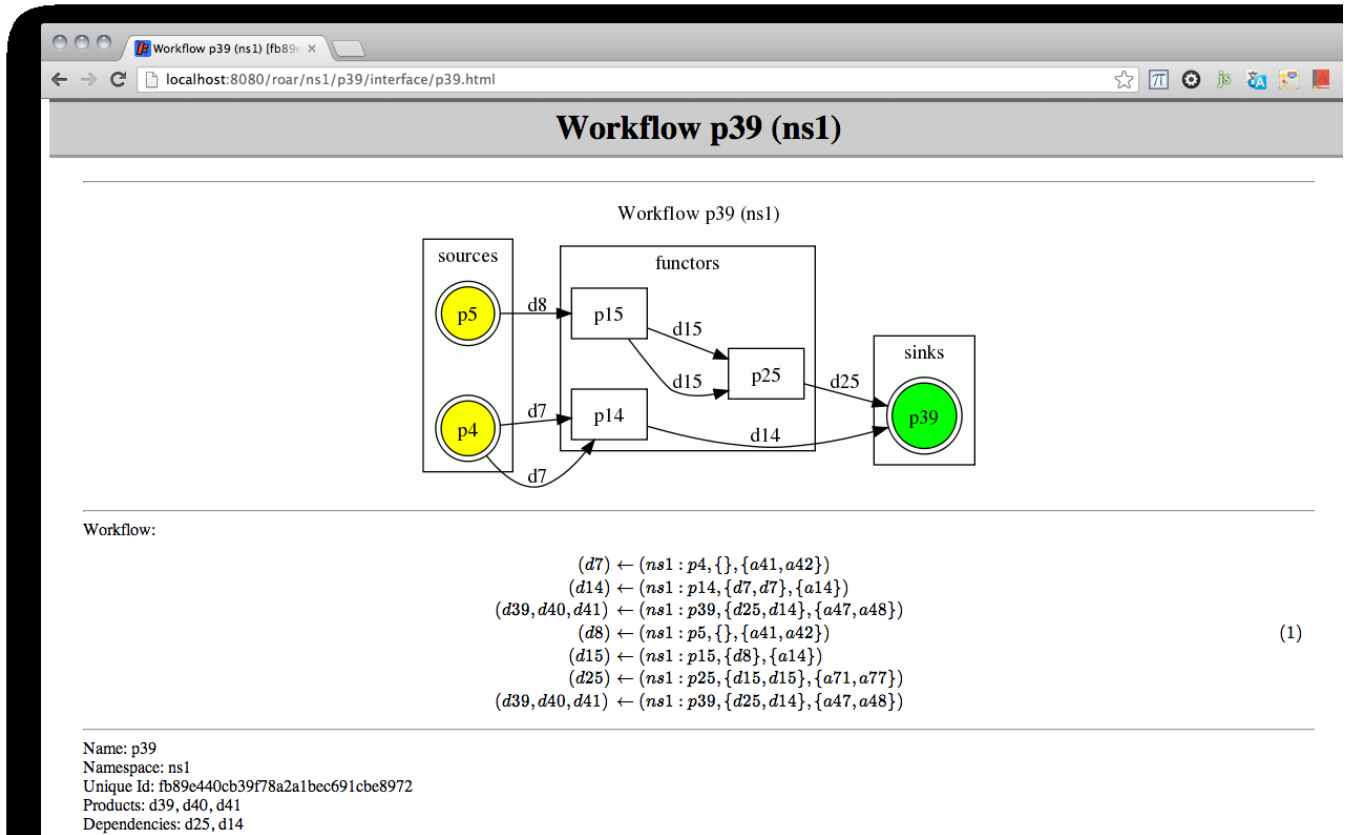


Figure 22: ROAR WUMPUS Resource p39 (page 1 of 3)

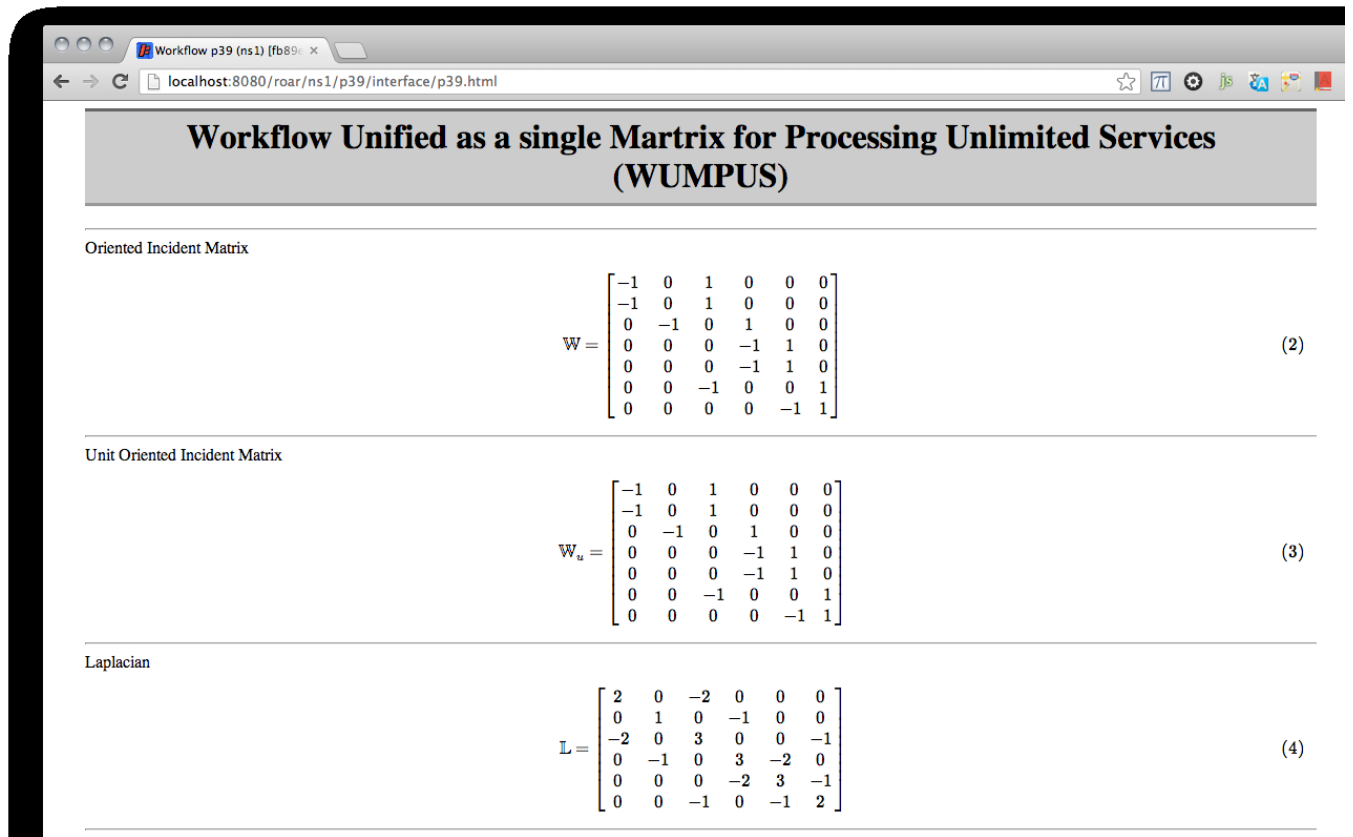
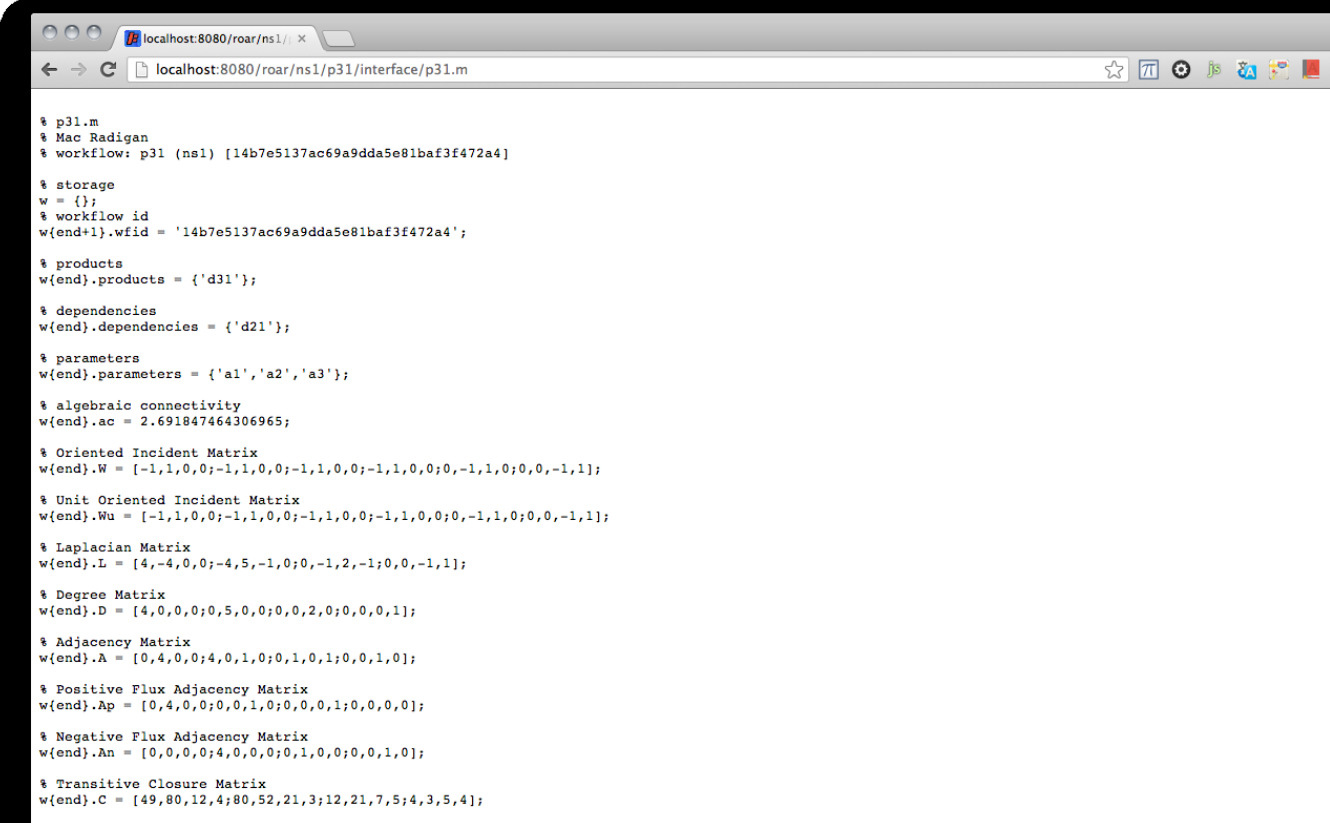


Figure 23: ROAR WUMPUS Resource p39 (page 2 of 3)



```
% p31.m
% Mac Radigan
% workflow: p31 (ns1) [14b7e5137ac69a9dda5e81baf3f472a4]

% storage
w = {};
% workflow id
w{end+1}.wfid = '14b7e5137ac69a9dda5e81baf3f472a4';

% products
w{end}.products = {'d31'};

% dependencies
w{end}.dependencies = {'d21'};

% parameters
w{end}.parameters = {'a1', 'a2', 'a3'};

% algebraic connectivity
w{end}.ac = 2.691847464306965;

% Oriented Incident Matrix
w{end}.W = [-1,1,0,0;-1,1,0,0;-1,1,0,0;-1,1,0,0;0,-1,1,0;0,-1,1,0;0,-1,1];

% Unit Oriented Incident Matrix
w{end}.Wu = [-1,1,0,0;-1,1,0,0;-1,1,0,0;-1,1,0,0;0,-1,1,0;0,-1,1,0;0,-1,1];

% Laplacian Matrix
w{end}.L = [4,-4,0,0;-4,5,-1,0;0,-1,2,-1;0,0,-1,1];

% Degree Matrix
w{end}.D = [4,0,0,0;0,5,0,0;0,0,2,0;0,0,0,1];

% Adjacency Matrix
w{end}.A = [0,4,0,0;4,0,1,0;0,1,0,1;0,0,1,0];

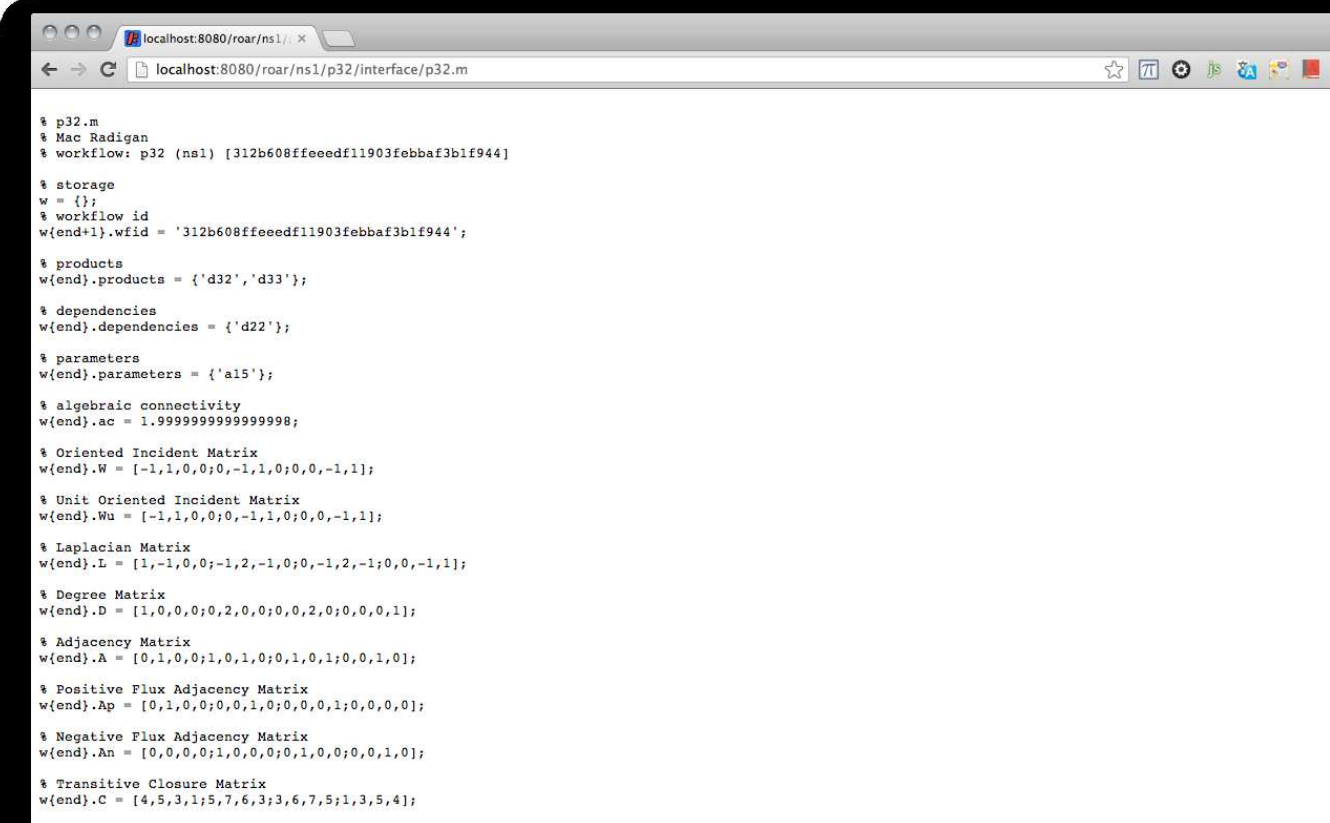
% Positive Flux Adjacency Matrix
w{end}.Ap = [0,4,0,0;0,0,1,0;0,0,0,1;0,0,0,0];

% Negative Flux Adjacency Matrix
w{end}.An = [0,0,0,0;4,0,0,0;0,1,0,0;0,0,1,0];

% Transitive Closure Matrix
w{end}.C = [49,80,12,4;80,52,21,3;12,21,7,5;4,3,5,4];
```

Figure 24: ROAR Octave Resource p31





```
% p32.m
% Mac Radigan
% workflow: p32 (ns1) [312b608ffeedf11903febbaf3b1f944]

% storage
w = {};
% workflow id
w{end+1}.wfid = '312b608ffeedf11903febbaf3b1f944';

% products
w{end}.products = {'d32','d33'};

% dependencies
w{end}.dependencies = {'d22'};

% parameters
w{end}.parameters = {'a15'};

% algebraic connectivity
w{end}.ac = 1.9999999999999998;

% Oriented Incident Matrix
w{end}.W = [-1,1,0,0;0,-1,1,0;0,0,-1,1];

% Unit Oriented Incident Matrix
w{end}.Wu = [-1,1,0,0;0,-1,1,0;0,0,-1,1];

% Laplacian Matrix
w{end}.L = [1,-1,0,0;-1,2,-1,0;0,-1,2,-1;0,0,-1,1];

% Degree Matrix
w{end}.D = [1,0,0,0;0,2,0,0;0,0,2,0;0,0,0,1];

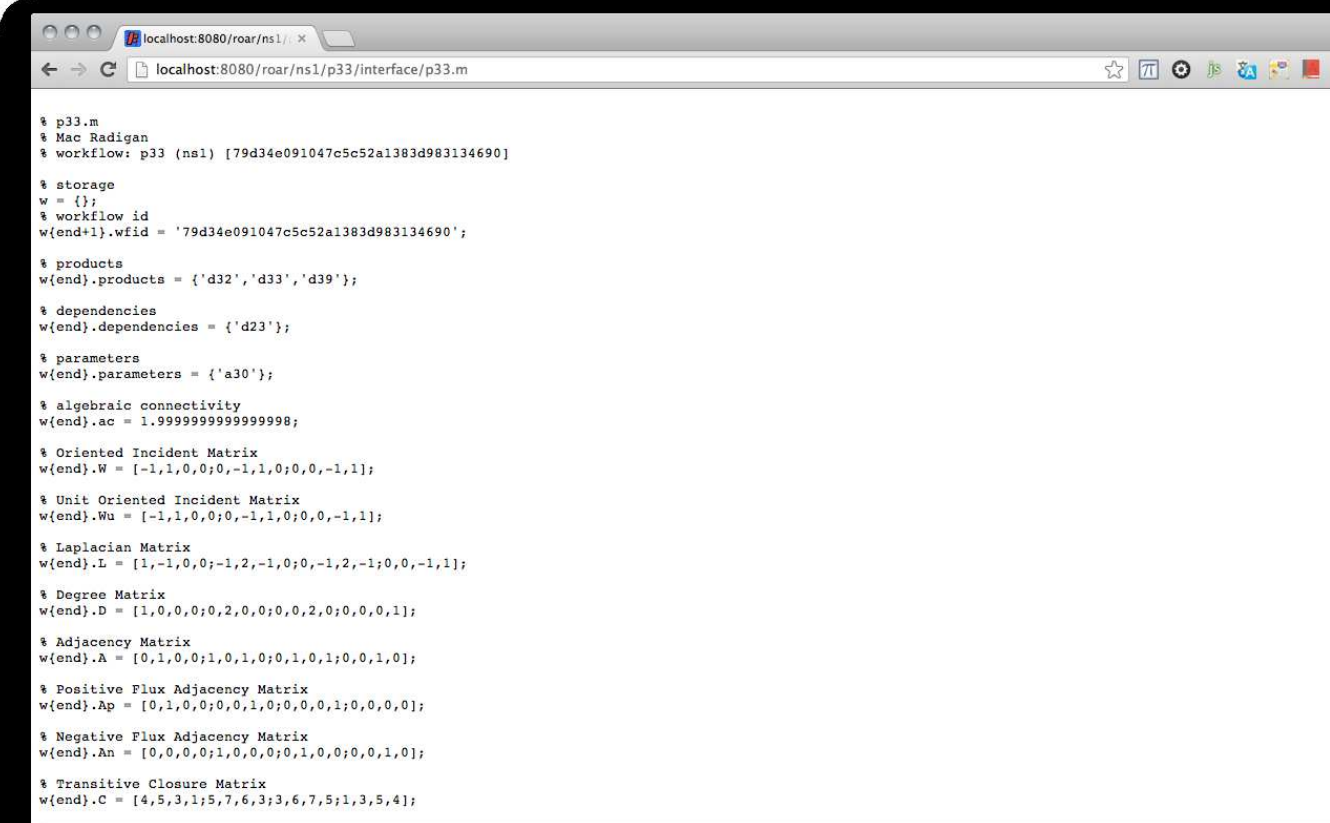
% Adjacency Matrix
w{end}.A = [0,1,0,0;1,0,1,0;0,1,0,1;0,0,1,0];

% Positive Flux Adjacency Matrix
w{end}.Ap = [0,1,0,0;0,0,1,0;0,0,0,1;0,0,0,0];

% Negative Flux Adjacency Matrix
w{end}.An = [0,0,0,0;1,0,0,0;0,1,0,0;0,0,1,0];

% Transitive Closure Matrix
w{end}.C = [4,5,3,1;5,7,6,3;3,6,7,5;1,3,5,4];
```

Figure 25: ROAR Octave Resource p32



```
% p33.m
% Mac Radigan
% workflow: p33 (ns1) [79d34e091047c5c52a1383d983134690]

% storage
w = {};
% workflow id
w{end+1}.wfid = '79d34e091047c5c52a1383d983134690';

% products
w{end}.products = {'d32','d33','d39'};

% dependencies
w{end}.dependencies = {'d23'};

% parameters
w{end}.parameters = {'a30'};

% algebraic connectivity
w{end}.ac = 1.9999999999999998;

% Oriented Incident Matrix
w{end}.W = [-1,1,0,0;0,-1,1,0;0,0,-1,1];

% Unit Oriented Incident Matrix
w{end}.Wu = [-1,1,0,0;0,-1,1,0;0,0,-1,1];

% Laplacian Matrix
w{end}.L = [1,-1,0,0;-1,2,-1,0;0,-1,2,-1;0,0,-1,1];

% Degree Matrix
w{end}.D = [1,0,0,0;0,2,0,0;0,0,2,0;0,0,0,1];

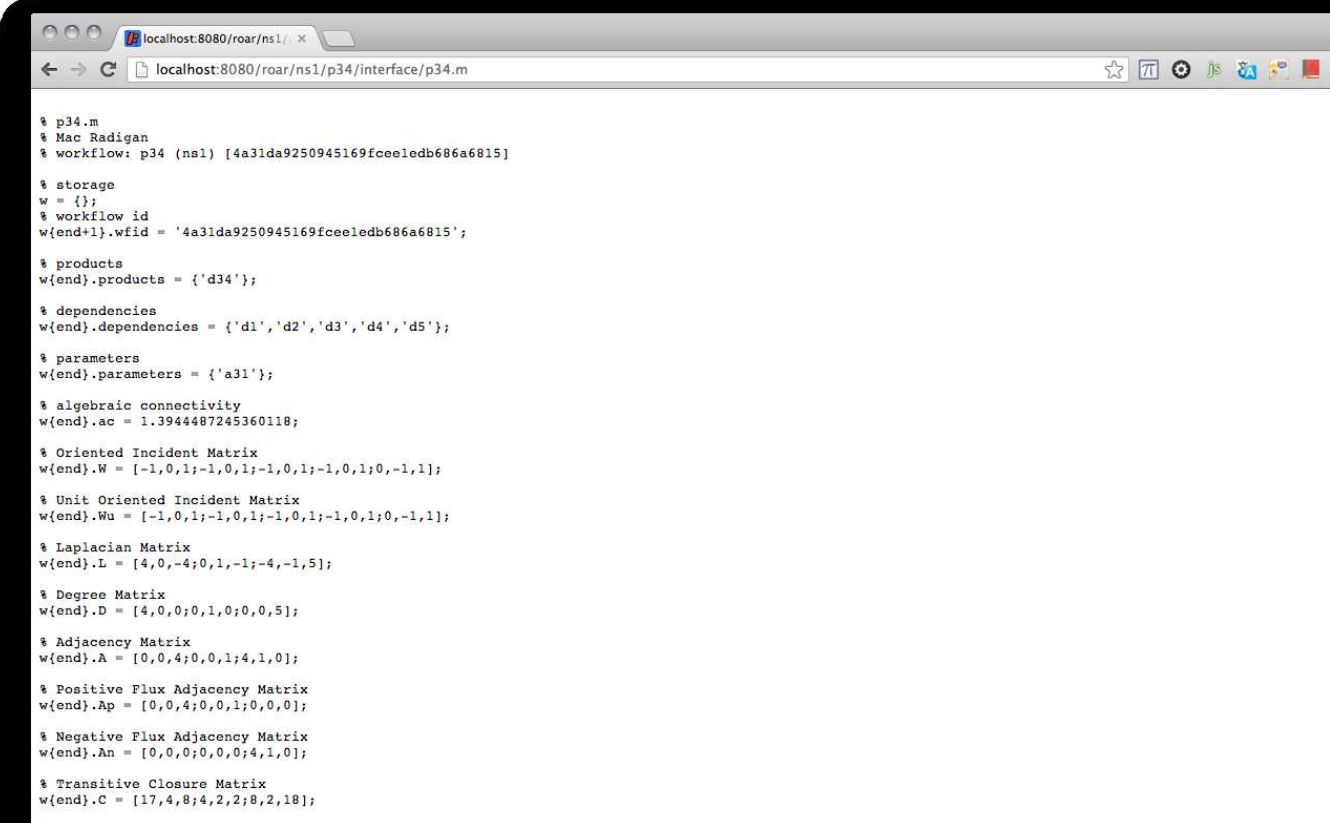
% Adjacency Matrix
w{end}.A = [0,1,0,0;1,0,1,0;0,1,0,1;0,0,1,0];

% Positive Flux Adjacency Matrix
w{end}.Ap = [0,1,0,0;0,0,1,0;0,0,0,1;0,0,0,0];

% Negative Flux Adjacency Matrix
w{end}.An = [0,0,0,0;1,0,0,0;0,1,0,0;0,0,1,0];

% Transitive Closure Matrix
w{end}.C = [4,5,3,1;5,7,6,3;3,6,7,5;1,3,5,4];
```

Figure 26: ROAR Octave Resource p33

A screenshot of a web browser window. The address bar shows the URL 'localhost:8080/roar/ns1/p34/interface/p34.m'. The page content is a text-based representation of an Octave script. It starts with a comment '% p34.m' and '% Mac Radigan'. The workflow is defined as 'p34 (ns1) [4a31da9250945169fceeledb686a6815]'. The script defines a workflow 'w' with a workflow ID '4a31da9250945169fceeledb686a6815'. It then defines several matrices: 'W' (Oriented Incident Matrix), 'Wu' (Unit Oriented Incident Matrix), 'L' (Laplacian Matrix), 'D' (Degree Matrix), 'A' (Adjacency Matrix), 'Ap' (Positive Flux Adjacency Matrix), 'An' (Negative Flux Adjacency Matrix), and 'C' (Transitive Closure Matrix).

```
% p34.m
% Mac Radigan
% workflow: p34 (ns1) [4a31da9250945169fceeledb686a6815]

% storage
w = {};
% workflow id
w{end+1}.wfid = '4a31da9250945169fceeledb686a6815';

% products
w{end}.products = {'d34'};

% dependencies
w{end}.dependencies = {'d1','d2','d3','d4','d5'};

% parameters
w{end}.parameters = {'a31'};

% algebraic connectivity
w{end}.ac = 1.3944487245360118;

% Oriented Incident Matrix
w{end}.W = [-1,0,1;-1,0,1;-1,0,1;-1,0,1;0,-1,1];

% Unit Oriented Incident Matrix
w{end}.Wu = [-1,0,1;-1,0,1;-1,0,1;-1,0,1;0,-1,1];

% Laplacian Matrix
w{end}.L = [4,0,-4;0,1,-1;-4,-1,5];

% Degree Matrix
w{end}.D = [4,0,0;0,1,0;0,0,5];

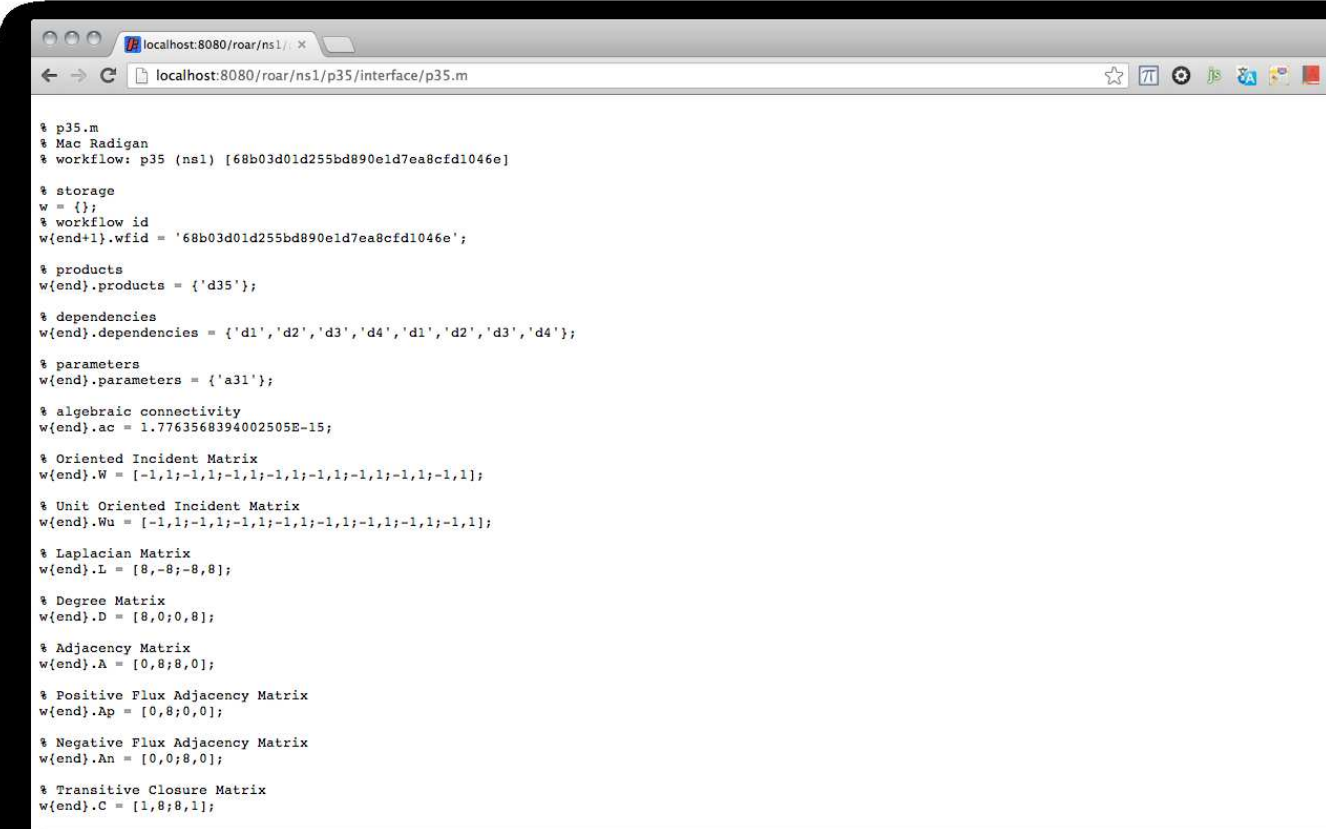
% Adjacency Matrix
w{end}.A = [0,0,4;0,0,1;4,1,0];

% Positive Flux Adjacency Matrix
w{end}.Ap = [0,0,4;0,0,1;0,0,0];

% Negative Flux Adjacency Matrix
w{end}.An = [0,0,0;0,0,0;4,1,0];

% Transitive Closure Matrix
w{end}.C = [17,4,8;4,2,2;8,2,18];
```

Figure 27: ROAR Octave Resource p34



```
% p35.m
% Mac Radigan
% workflow: p35 (ns1) [68b03d01d255bd890e1d7ea8cfd1046e]

% storage
w = {};
% workflow id
w{end+1}.wfid = '68b03d01d255bd890e1d7ea8cfd1046e';

% products
w{end}.products = {'d35'};

% dependencies
w{end}.dependencies = {'d1','d2','d3','d4','d1','d2','d3','d4'};

% parameters
w{end}.parameters = {'a31'};

% algebraic connectivity
w{end}.ac = 1.7763568394002505E-15;

% Oriented Incident Matrix
w{end}.W = [-1,1;-1,1;-1,1;-1,1;-1,1;-1,1;-1,1;-1,1];

% Unit Oriented Incident Matrix
w{end}.Wu = [-1,1;-1,1;-1,1;-1,1;-1,1;-1,1;-1,1;-1,1];

% Laplacian Matrix
w{end}.L = [8,-8;-8,8];

% Degree Matrix
w{end}.D = [8,0;0,8];

% Adjacency Matrix
w{end}.A = [0,8;8,0];

% Positive Flux Adjacency Matrix
w{end}.Ap = [0,8;0,0];

% Negative Flux Adjacency Matrix
w{end}.An = [0,0;8,0];

% Transitive Closure Matrix
w{end}.C = [1,8;8,1];
```

Figure 28: ROAR Octave Resource p35

```
% p36.m
% Mac Radigan
% workflow: p36 (ns1) [8599f5b1b8456e4cc5f9a5caladde6c0]

% storage
w = {};
% workflow id
w{end+1}.wfid = '8599f5b1b8456e4cc5f9a5caladde6c0';

% products
w{end}.products = {'d36'};

% dependencies
w{end}.dependencies = {'d6', 'd6'};

% parameters
w{end}.parameters = {'a36'};

% algebraic connectivity
w{end}.ac = 4.440892098500626E-16;

% Oriented Incident Matrix
w{end}.W = [-1,1;-1,1];

% Unit Oriented Incident Matrix
w{end}.Wu = [-1,1;-1,1];

% Laplacian Matrix
w{end}.L = [2,-2;-2,2];

% Degree Matrix
w{end}.D = [2,0;0,2];

% Adjacency Matrix
w{end}.A = [0,2;2,0];

% Positive Flux Adjacency Matrix
w{end}.Ap = [0,2;0,0];

% Negative Flux Adjacency Matrix
w{end}.An = [0,0;2,0];

% Transitive Closure Matrix
w{end}.C = [1,2;2,1];
```

Figure 29: ROAR Octave Resource p36

```
% p37.m
% Mac Radigan
% workflow: p37 (ns1) [c1a3c1c20cefc502352e5ab48e4c844c]

% storage
w = {};
% workflow id
w{end+1}.wfid = 'c1a3c1c20cefc502352e5ab48e4c844c';

% products
w{end}.products = {'d37'};

% dependencies
w{end}.dependencies = {'d13', 'd13'};

% parameters
w{end}.parameters = {'a37'};

% algebraic connectivity
w{end}.ac = 1.2679491924311226;

% Oriented Incident Matrix
w{end}.W = [-1,1,0;0,-1,1;0,-1,1];

% Unit Oriented Incident Matrix
w{end}.Wu = [-1,1,0;0,-1,1;0,-1,1];

% Laplacian Matrix
w{end}.L = [1,-1,0;-1,3,-2;0,-2,2];

% Degree Matrix
w{end}.D = [1,0,0;0,3,0;0,0,2];

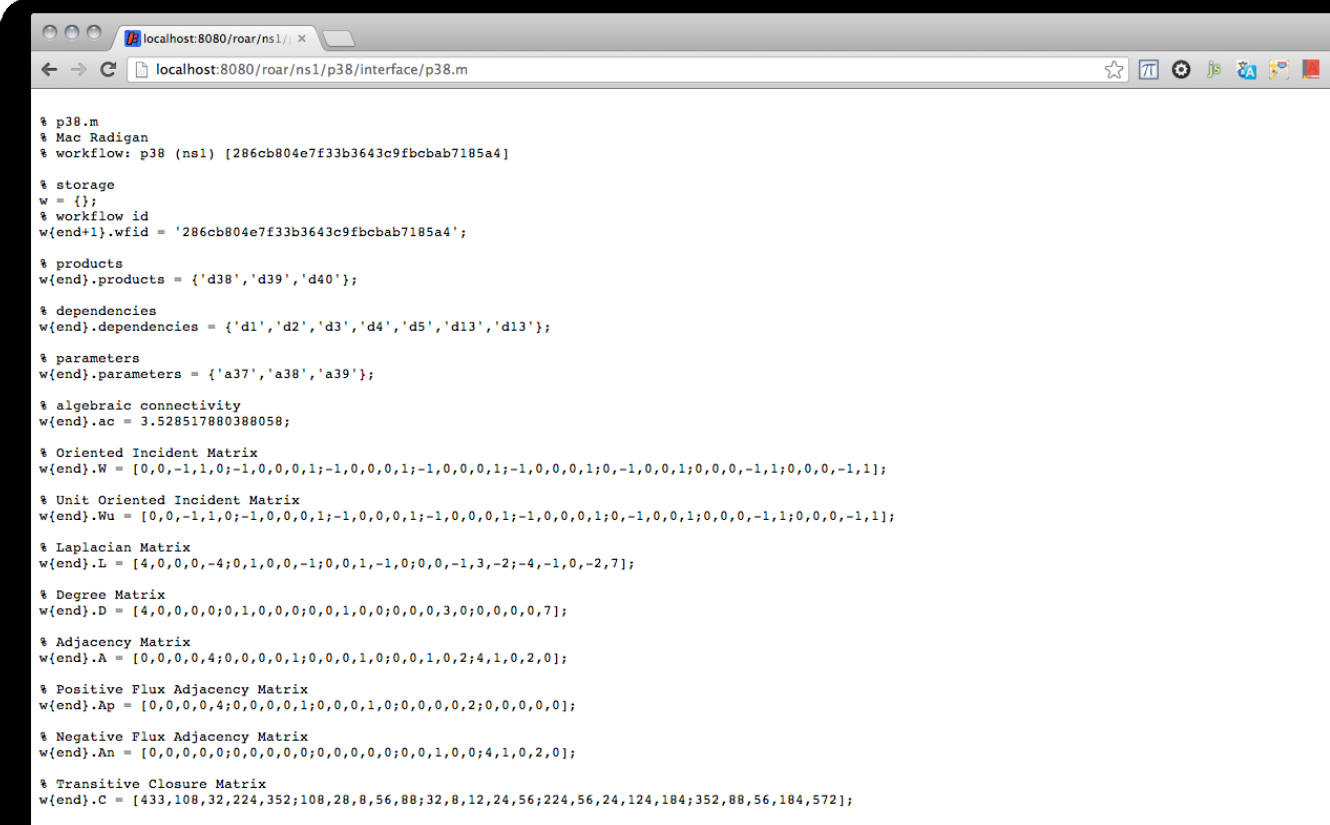
% Adjacency Matrix
w{end}.A = [0,1,0;1,0,2;0,2,0];

% Positive Flux Adjacency Matrix
w{end}.Ap = [0,1,0;0,0,2;0,0,0];

% Negative Flux Adjacency Matrix
w{end}.An = [0,0,0;1,0,0;0,2,0];

% Transitive Closure Matrix
w{end}.C = [2,2,2;2,6,4;2,4,5];
```

Figure 30: ROAR Octave Resource p37



```
% p38.m
% Mac Radigan
% workflow: p38 (ns1) [286cb804e7f33b3643c9fbcab7185a4]

% storage
w = {};
% workflow id
w{end+1}.wfid = '286cb804e7f33b3643c9fbcab7185a4';

% products
w{end}.products = {'d38','d39','d40'};

% dependencies
w{end}.dependencies = {'d1','d2','d3','d4','d5','d13','d13'};

% parameters
w{end}.parameters = {'a37','a38','a39'};

% algebraic connectivity
w{end}.ac = 3.528517880388058;

% Oriented Incident Matrix
w{end}.W = [0,0,-1,1,0;-1,0,0,0,1;-1,0,0,0,1;-1,0,0,0,1;0,-1,0,0,1;0,0,0,-1,1;0,0,0,-1,1];

% Unit Oriented Incident Matrix
w{end}.Wu = [0,0,-1,1,0;-1,0,0,0,1;-1,0,0,0,1;-1,0,0,0,1;-1,0,0,0,1;0,-1,0,0,1;0,0,0,-1,1;0,0,0,-1,1];

% Laplacian Matrix
w{end}.L = [4,0,0,0,-4;0,1,0,0,-1;0,0,1,-1,0;0,0,-1,3,-2;-4,-1,0,-2,7];

% Degree Matrix
w{end}.D = [4,0,0,0,0;0,1,0,0,0;0,0,1,0,0;0,0,0,1,0;0,0,0,0,3];

% Adjacency Matrix
w{end}.A = [0,0,0,0,4;0,0,0,0,1;0,0,0,1,0;0,0,1,0,2;4,1,0,2,0];

% Positive Flux Adjacency Matrix
w{end}.Ap = [0,0,0,0,4;0,0,0,0,1;0,0,0,1,0;0,0,0,0,2;0,0,0,0,0];

% Negative Flux Adjacency Matrix
w{end}.An = [0,0,0,0,0;0,0,0,0,0;0,0,0,0,0;0,0,1,0,0;4,1,0,2,0];

% Transitive Closure Matrix
w{end}.C = [433,108,32,224,352;108,28,8,56,88;32,8,12,24,56;224,56,24,124,184;352,88,56,184,572];
```

Figure 31: ROAR Octave Resource p38