Tutorial 1: Bogor

CISC422/853

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Overview

- Installing Bogor
- Starting Bogor
- General Usage and Tips
- Advice for Assignment 1

Installing Bogor

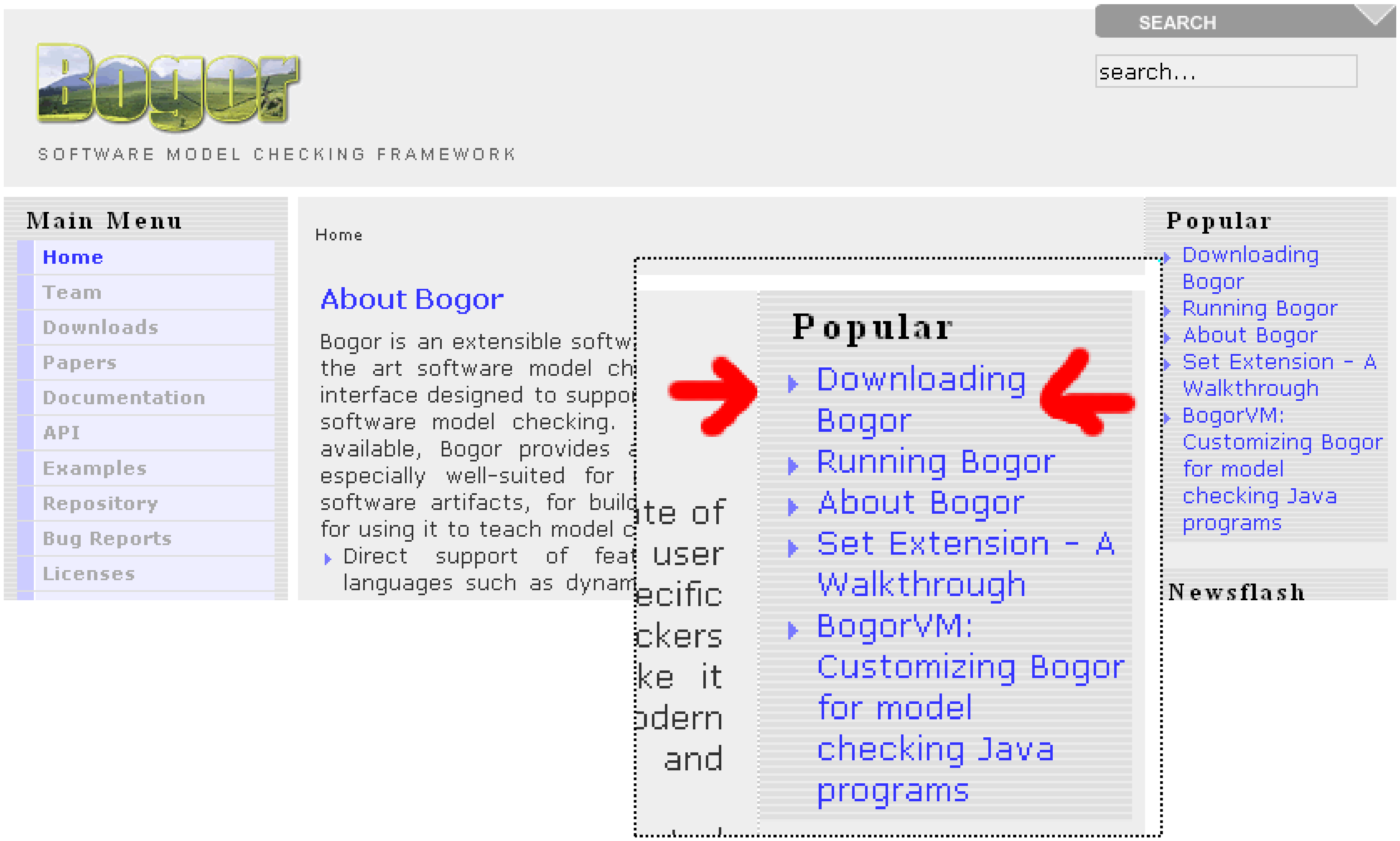
- Bogor is installed on the lab machines
- However, you might want to work from home, or you might just love Bogor

- Easiest to work with as an Eclipse Plugin
  - http://www.eclipse.org/
  - http://bogor.projects.cis.ksu.edu/

Installing Bogor

- Eclipse
  - Eclipse is, at its core, an open IDE for developing in a number of programming languages
  - You download a distribution based on what type of software you are developing, and a number of useful tools are included
  - For Bogor, this isn't so important, since we are just interested in the Eclipse IDE
  - I recommend: Eclipse IDE for Java Developers (85 MB) - unzip anywhere, it is self-contained

Installing Bogor



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SOFTWARE MODEL CHECKING FRAMEWORK

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About Bogor

Bogor is an extensible softw the art software model ch interface designed to suppo software model checking. available, Bogor provides a especially well-suited for software artifacts, for build for using it to teach model c

- Direct support of feat languages such as dynam

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- Downloading Bogor
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- BogorVM: Customizing Bogor for model checking Java programs

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Popular

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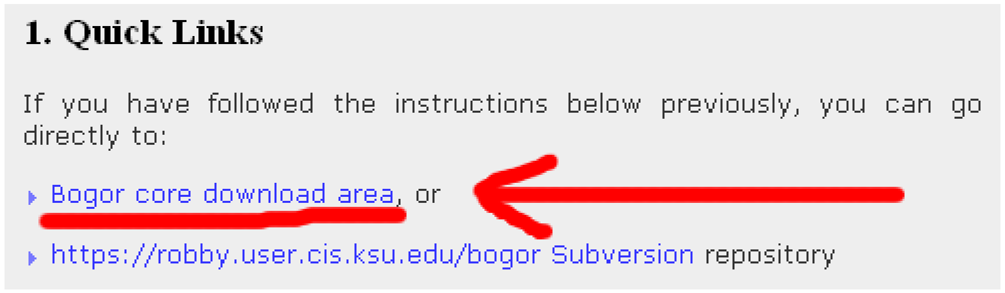
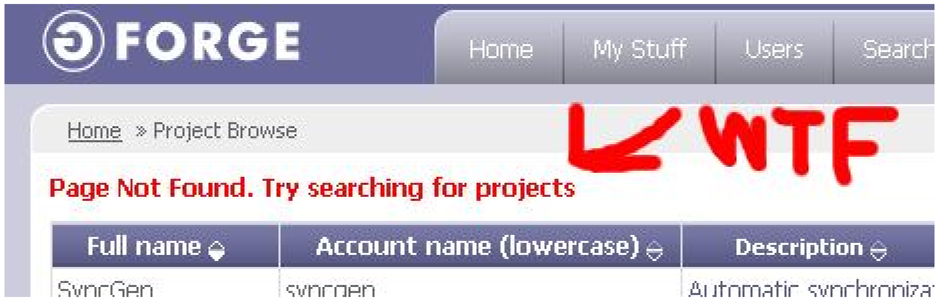
Installing Bogor



1. Quick Links

If you have followed the instructions below previously, you can go directly to:

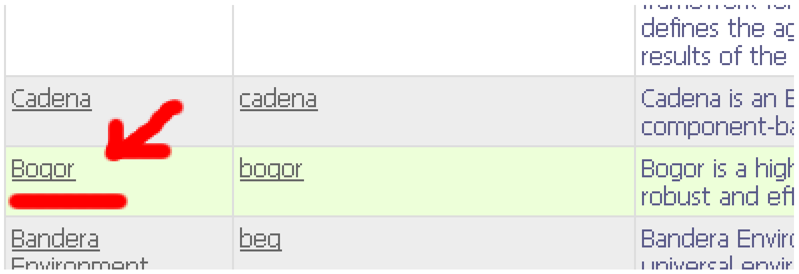
- Bogor core download area, or
- https://robby.user.cis.ksu.edu/bogor Subversion repository



Home » Project Browse

Page Not Found. Try searching for projects

Full name	Account name (lowercase)	Description
SyncGen	syncgen	Automatic synchroniza



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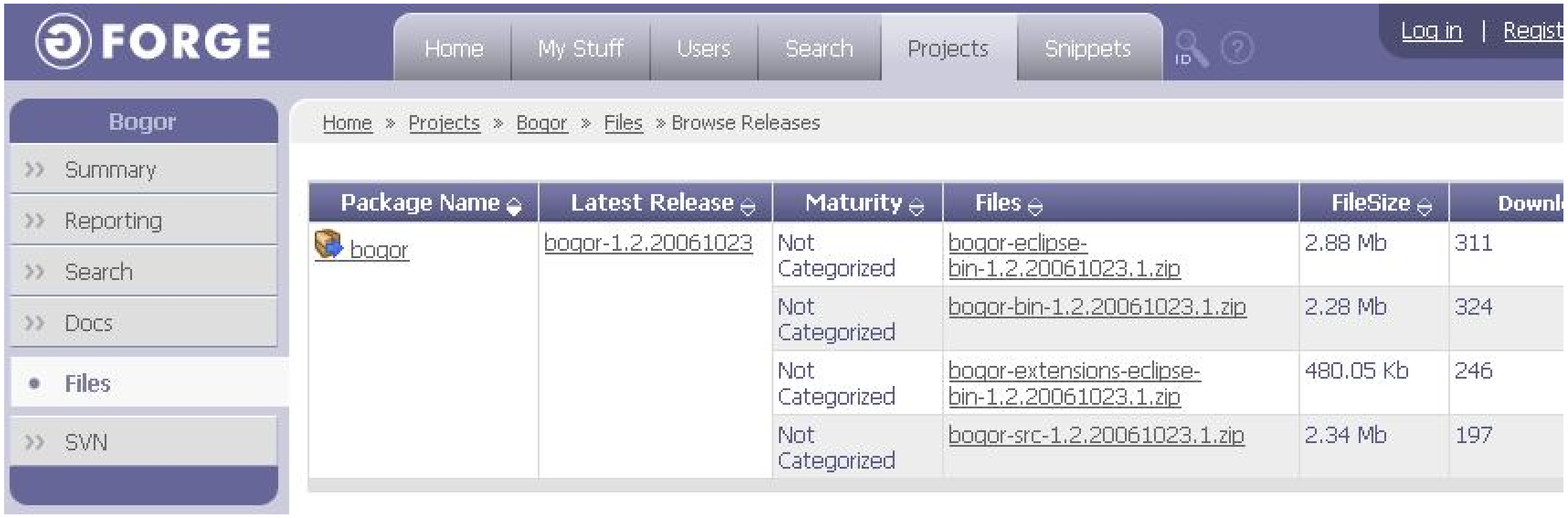
Cadena	cadena	Cadena is an E component-ba
Bogor	bogor	Bogor is a high robust and eff
Bandera Environment	beg	Bandera Enviro universal envir

Installing Bogor

- bogor-eclipse-bin-xxx.zip

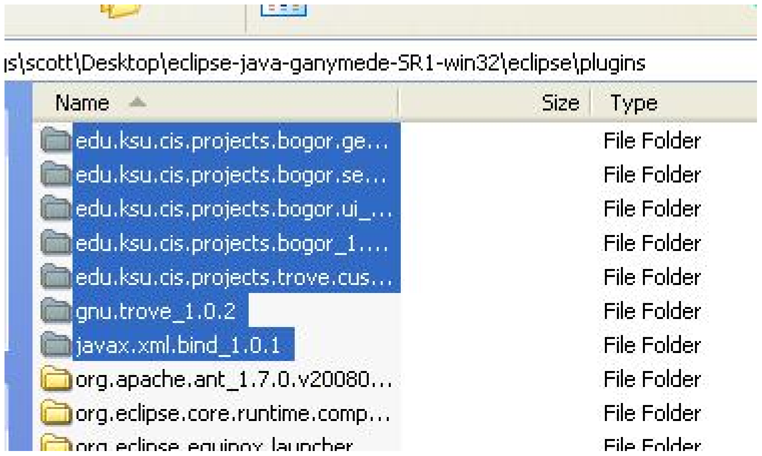


Home » Projects » Bogor » Files » Browse Releases

Package Name	Latest Release	Maturity	Files	FileSize	Downl
bogor	bogor-1.2.20061023	Not Categorized	bogor-eclipse-bin-1.2.20061023.1.zip	2.88 Mb	311
		Not Categorized	bogor-bin-1.2.20061023.1.zip	2.28 Mb	324
		Not Categorized	bogor-extensions-eclipse-bin-1.2.20061023.1.zip	480.05 Kb	246
		Not Categorized	bogor-src-1.2.20061023.1.zip	2.34 Mb	197

Installing Bogor

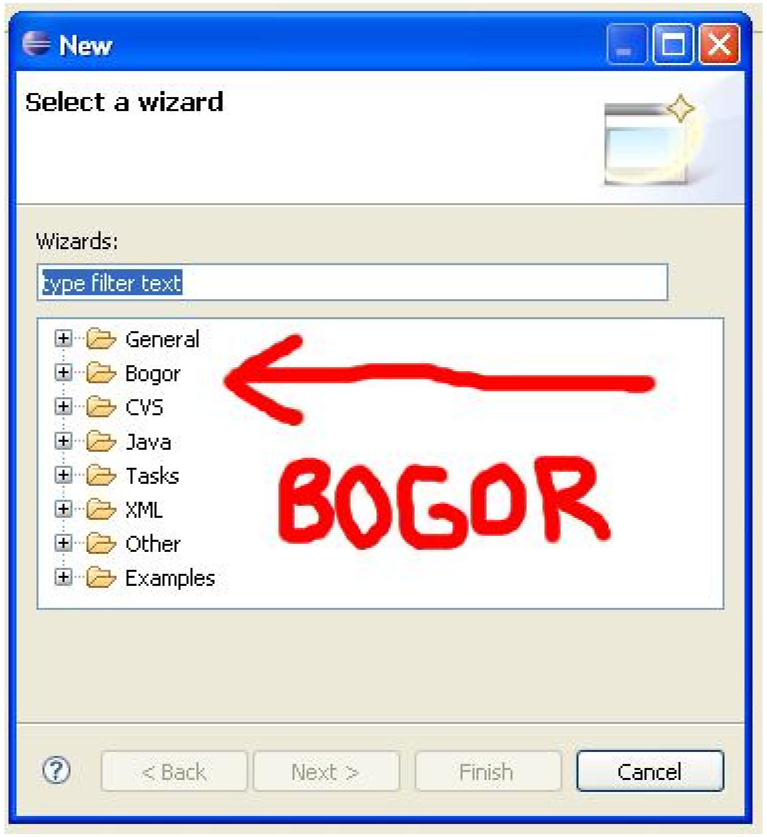
- Drag and Drop, FTW
  - bogor-eclipse-bin-xxx.zip should contain seven directories
    - Five start with edu.ksu.cis.projects, one starts with gnu.trove, and one starts with javax.xml.bind.
  - Copy all of these into the \eclipse\plugins directory of your new Eclipse installation.


s\scott\Desktop\eclipse-java-ganymede-SR1-win32\eclipse\plugins

Name	Size	Type
edu.ksu.cis.projects.bogor.ge...		File Folder
edu.ksu.cis.projects.bogor.se...		File Folder
edu.ksu.cis.projects.bogor.ui_...		File Folder
edu.ksu.cis.projects.bogor_1....		File Folder
edu.ksu.cis.projects.trove.cus...		File Folder
gnu.trove_1.0.2		File Folder
javax.xml.bind_1.0.1		File Folder
org.apache.ant_1.7.0.v20080...		File Folder
org.eclipse.core.runtime.comp...		File Folder
org.eclipse.equinox.launcher		File Folder

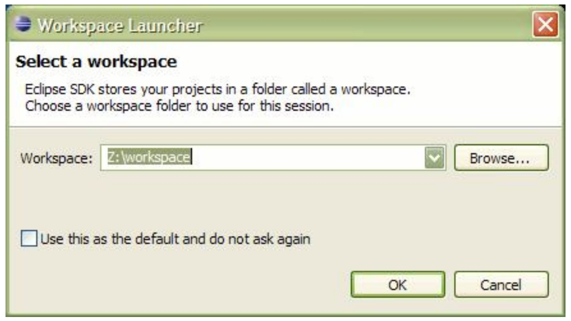
Installing Bogor

- How do I know it worked?
  - Start Eclipse, and go to File -> New -> Other



Starting Bogor

- In the labs
  - Start -> Programs -> Program Development -> Eclipse 3.3.0
- What's a "workspace"?
  - Eclipse stores information about your projects there, and you're fine to use the default..
  - .. but not in the labs, it seems. If you have problems, try:
    - z:\workspace



Select a workspace

Eclipse SDK stores your projects in a folder called a workspace.
Choose a workspace folder to use for this session.

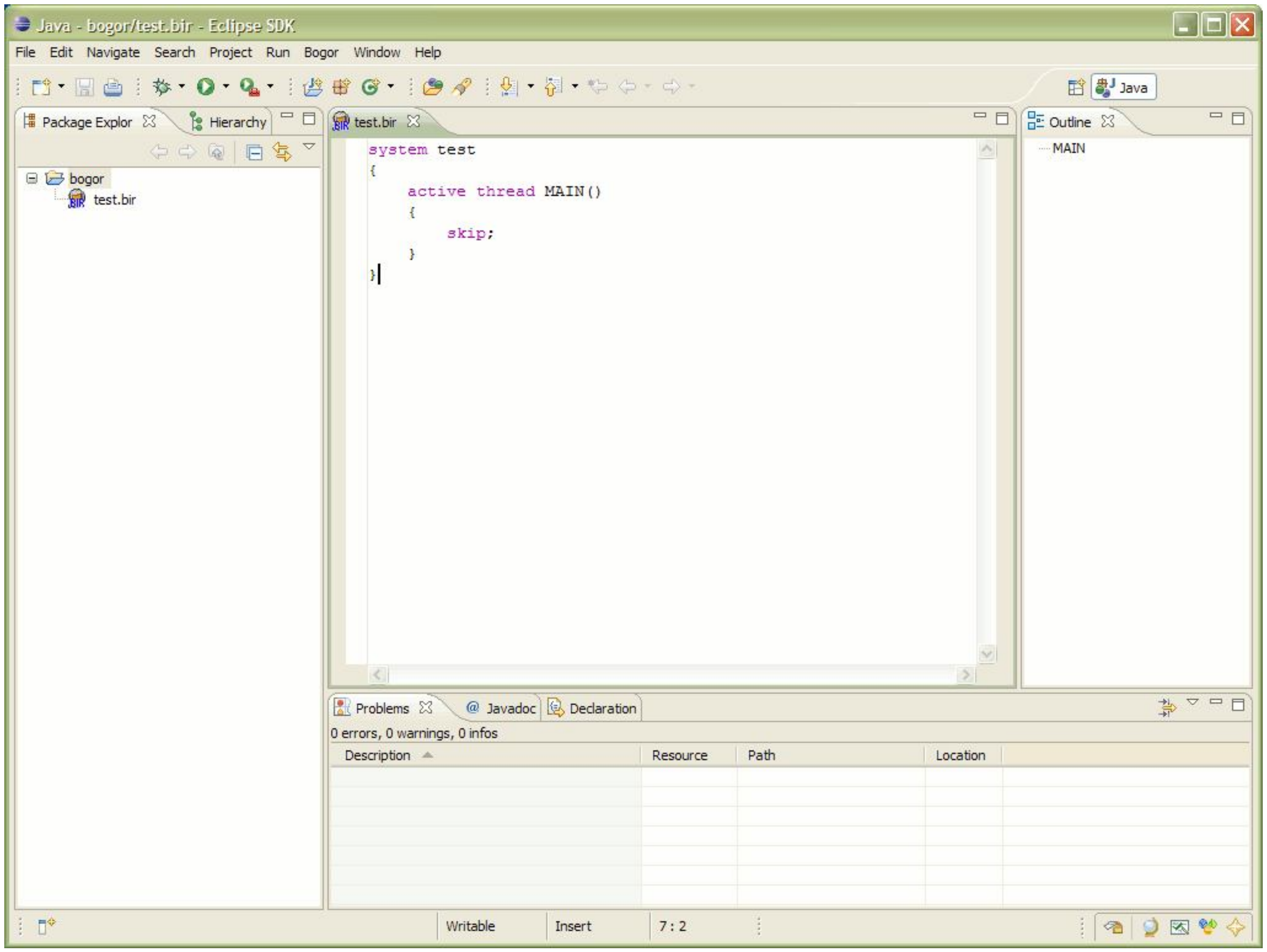
Workspace: Z:\workspace

☐ Use this as the default and do not ask again

Starting Bogor

- Create a project
  - File -> New -> Project
  - General -> Project
  - Project Name: whatever you'd like. bogor?
- Create a BIR Model in which to write code
  - File -> New -> Other
  - Bogor -> BIR Model
  - File Name: your_file.bir
    - (Filename must end with .bir, otherwise it's up to you)

Starting Bogor



```
system test
{
    active thread MAIN()
    {
        skip;
    }
}
```

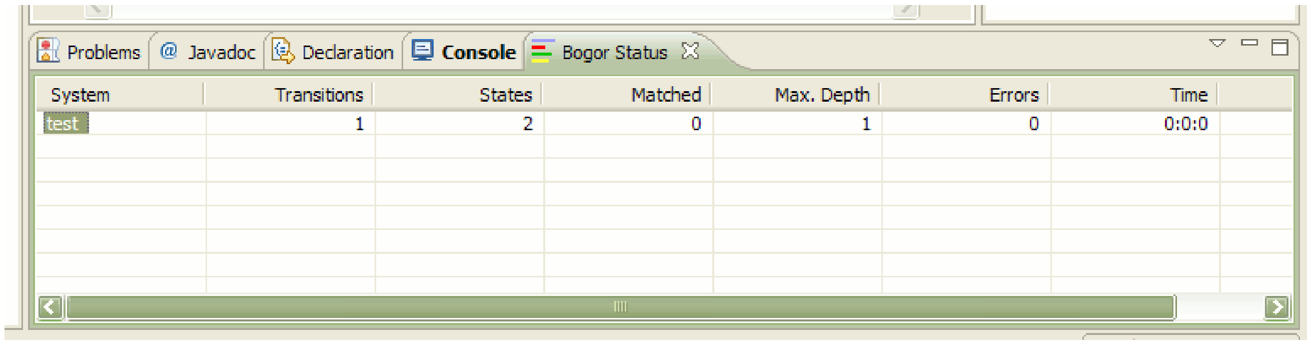
0 errors, 0 warnings, 0 infos

Starting Bogor

- How do you actually run Bogor?
  - Bogor -> Model Check
    - (Or you can right-click in the work area, and choose Model Check)
  - Choose "Config 0: Default Configuration"
    - If you don't explicitly choose it, nothing is selected by default. This sounds pedantic, but it can be confusing when you choose OK, and nothing runs. Gah!

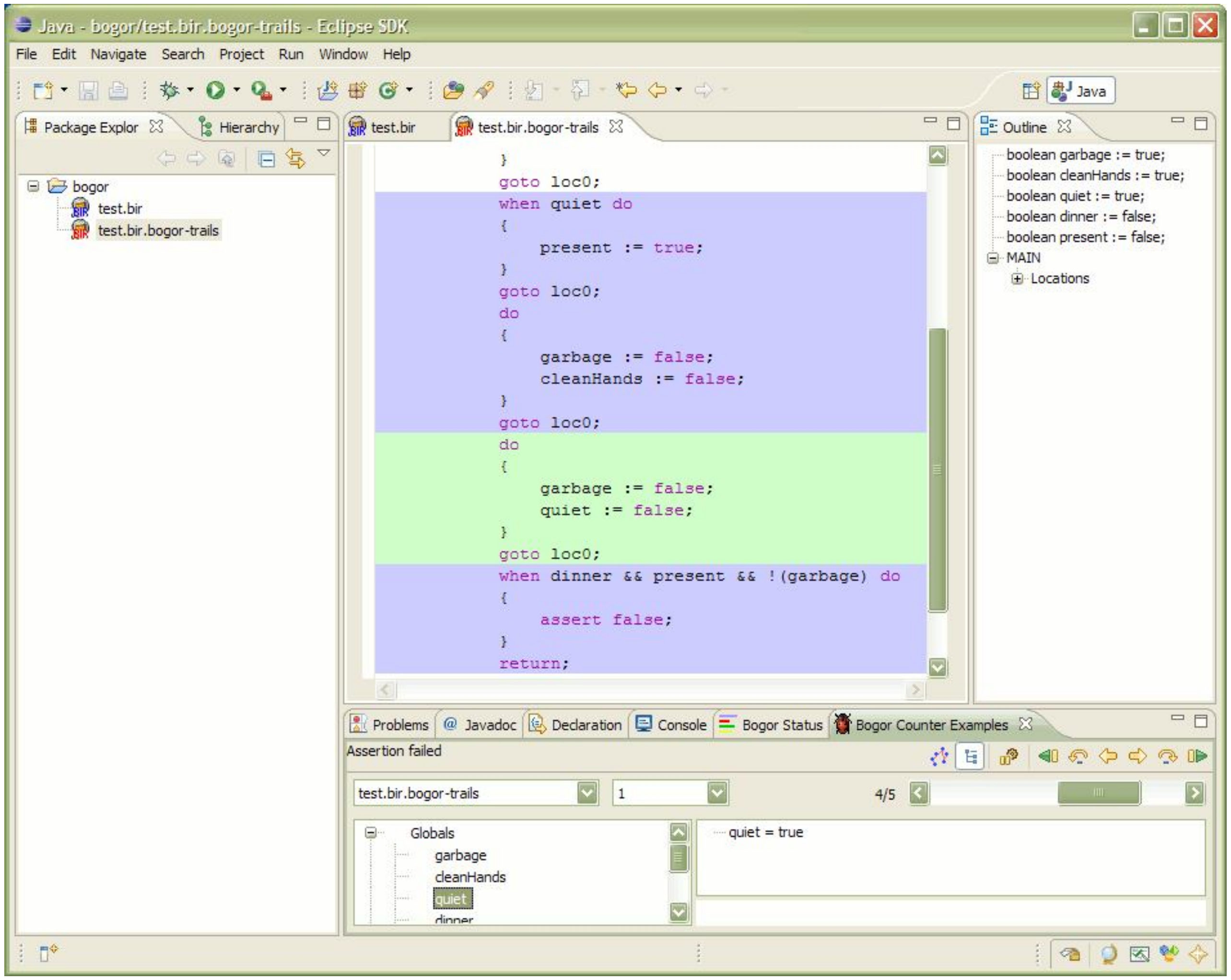
Starting Bogor

- What am I looking at?
  - Bogor writes a trail file with the extension bogor-trails if any errors have been found.
  - The trail file contains schedule information and state transitions that lead to the errors.
  - You can open the counter-example display by double-clicking the trail file.



System	Transitions	States	Matched	Max. Depth	Errors	Time
test	1	2	0	1	0	0:0:0

Starting Bogor



```
        }
        goto loc0;
        when quiet do
        {
            present := true;
        }
        goto loc0;
        do
        {
            garbage := false;
            cleanHands := false;
        }
        goto loc0;
        do
        {
            garbage := false;
            quiet := false;
        }
        goto loc0;
        when dinner && present && !(garbage) do
        {
            assert false;
        }
        return;
```

```
boolean garbage := true;
boolean cleanHands := true;
boolean quiet := true;
boolean dinner := false;
boolean present := false;
MAIN
  Locations
```

Assertion failed

test.bir.bogor-trails   1   4/5

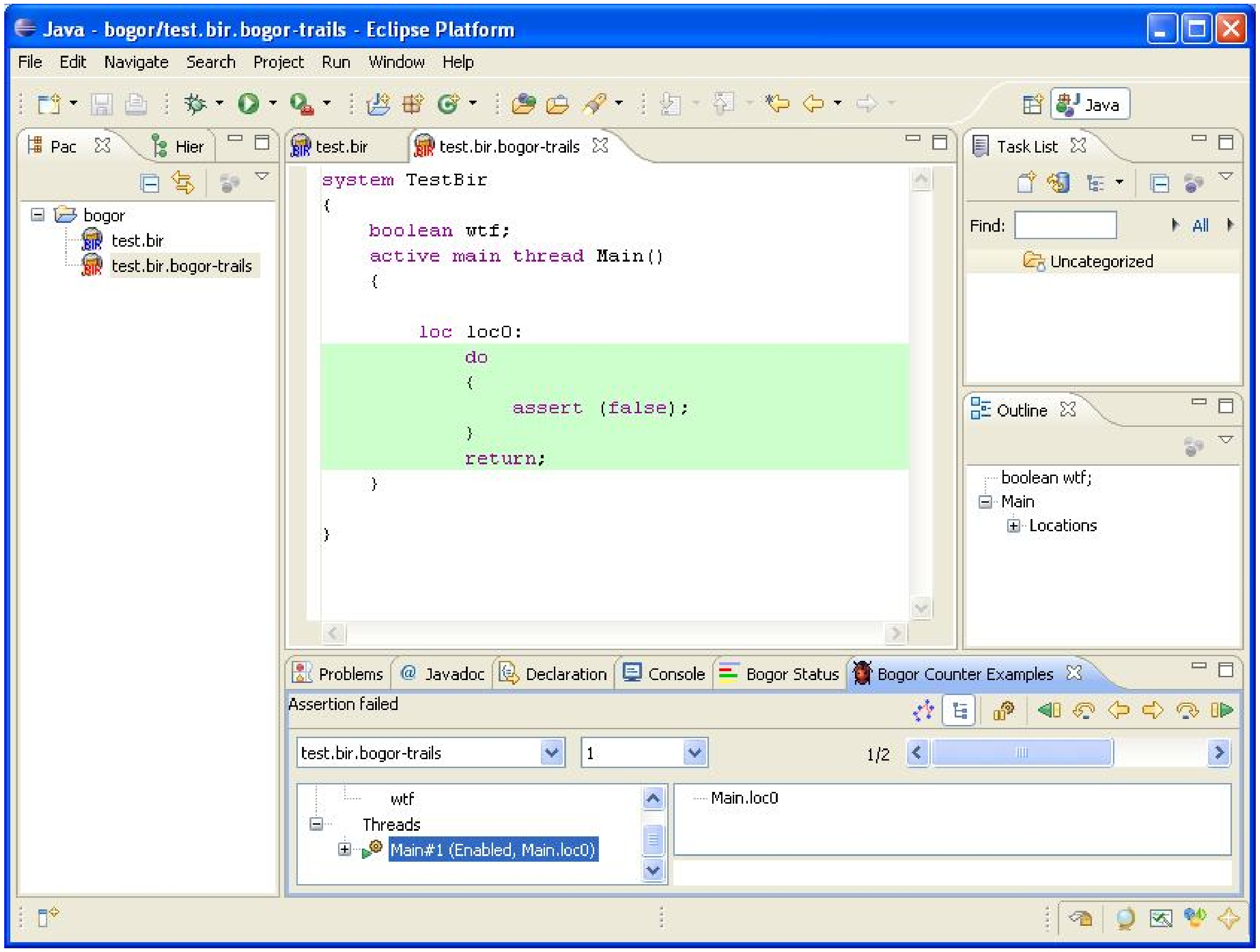
```
Globals
  garbage
  cleanHands
  quiet
  dinner
```

quiet = true

General Usage and Tips

- Bogor Trails
  - Double-click on the bogor-trails file, if it is generated after an error occurs.
  - You can examine each error trail, at each step of execution, and can observe the values that caused the error to occur.
  - These trails can get quite large in some examples!

General Usage and Tips



```
system TestBir
{
    boolean wtf;
    active main thread Main()
    {

        loc loc0:
            do
            {
                assert (false);
            }
            return;
    }

}
```

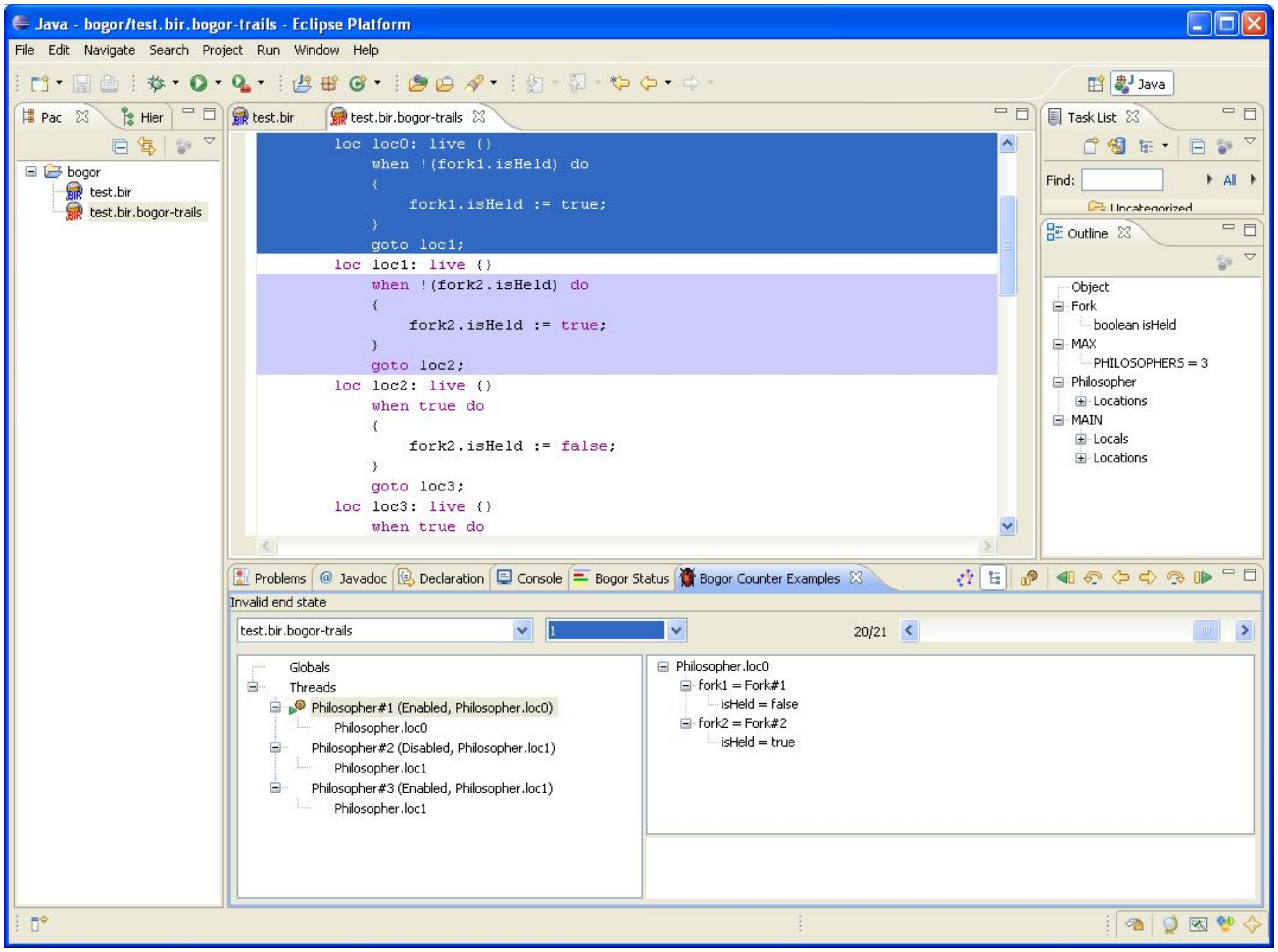
Assertion failed

test.bir.bogor-trails | 1 | 1/2

```
wtf
Threads
  Main#1 (Enabled, Main.loc0)
```

Main.loc0

General Usage and Tips



```
bogor
    test.bir
    test.bir.bogor-trails
```

```
        loc loc0: live {}
            when !(fork1.isHeld) do
            {
                fork1.isHeld := true;
            }
            goto loc1;
        loc loc1: live {}
            when !(fork2.isHeld) do
            {
                fork2.isHeld := true;
            }
            goto loc2;
        loc loc2: live {}
            when true do
            {
                fork2.isHeld := false;
            }
            goto loc3;
        loc loc3: live {}
            when true do
```

```
Object
Fork
    boolean isHeld
MAX
    PHILOSOPHERS = 3
Philosopher
    Locations
MAIN
    Locals
    Locations
```

Invalid end state

test.bir.bogor-trails   1   20/21

```
Globals
Threads
    Philosopher#1 (Enabled, Philosopher.loc0)
        Philosopher.loc0
    Philosopher#2 (Disabled, Philosopher.loc1)
        Philosopher.loc1
    Philosopher#3 (Enabled, Philosopher.loc1)
        Philosopher.loc1
```

```
Philosopher.loc0
    fork1 = Fork#1
        isHeld = false
    fork2 = Fork#2
        isHeld = true
```

General Usage and Tips

- Understand why paths are taken
- Watch assignments occur
- Remember how model checking can be used to solve these problems
  - For Q1/Q2, you actually want the model to "fail" when you have reached your goal

Advice for Assignment 1

- Q1
  - How are you going to represent the position of each element that crosses the river?
    - Up to you. In this case, you only really need to know which side of the shore each element is on, so a boolean or int would make sense
  - How can you prevent illegal positions from being considered?
    - Use assume(b), where b is some invalid state that we do not want to pursue

Advice for Assignment 1

```
system TestBir {
  int n;

  main thread Main() {
    loc loc0:
      do {
        n := n + 1;
      } goto loc1;
    loc loc1:
      do {
      } goto loc0;
  }
}
```

Yikes!

```
system TestBir {
  int n;

  main thread Main() {
    loc loc0:
      do {
        n := n + 1;
      } goto loc1;
    loc loc1:
      do {
        assume n < 100;
      } goto loc0;
  }
}
```

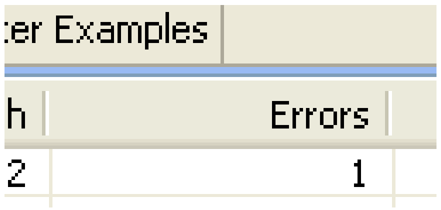
Advice for Assignment 1

- Q1
  - An assertion can demonstrate that you've reached the goal state

I claim that this model will allow n to reach a value greater than 10. How can I use Bogor to prove it? By asserting that in loc1, at some point n will not be less than or equal to 10.

```
system TestBir {
  int n;

  main thread Main() {
    loc loc0:
      do {
        n := n + 1;
      } goto loc1;
    loc loc1:
      do {
        assert n <= 10;
      } goto loc0;
  }
}
```



h	Errors
2	1

Advice for Assignment 1

- Q2
  - Many of the same rules apply, but you might need to find a different representation for the position of your elements
    - You have three shores now, so if you used one boolean previously for position, it won't be enough on its own for three positions
  - Remember how atomicity works in a location, and use the invisible keyword if necessary

Advice for Assignment 1

- Q2
  - Each farmer should be represented by its own thread
  - Otherwise, the same rules from Q1 apply!
    - Use assume to prune invalid subtrees
    - Use assert to identify the goal state
    - Don't let farmers make invalid moves, but remember that they're allowed to travel alone, as long as they don't leave two incompatible items alone on the same shore

Advice for Assignment 1

- Q3
  - Q3a asks for a brief explanation on why the simulation is insufficient to determine if the property always holds no matter how long the simulation is run.
  - Be brief!

Advice for Assignment 1

- Q3
  - Each worker in the cooperative should be represented by their own thread in memory, but the thread definition should allow for more than three workers

```
system SleeplessCode
{
  const C { N = 2; }
  // ...
  thread Worker(int id) {
    // ...
  }
```

```
active thread MAIN()
{
  int counter;
  // ...
  loc loc1:
    when counter < C.N do {
      counter := counter + 1;
      start Worker(counter);
    } goto loc1;
    when counter == C.N do {} return;
```

Advice for Assignment 1

- Q3
  - You'll need to store the rank of each worker, and the last worker to have reached a certain rank. These values will need to be observed by each Worker thread..

```
system SleeplessCode
{
  // ...
  int[] ranks;
  int[] last_promoted_at_rank;
```

```
active thread MAIN()
{
  loc loc0:
  do {
    ranks := new int[C.N + 1];
    last_promoted_at_rank := new int[C.N + 1];
  } goto loc1;
```

Advice for Assignment 1

- Q3
  - You should be able to convince yourself whether or not the properties hold
    - Step through the code, and if necessary, insert assertions to see how things progress
    - Adding assertions can be a great way to identify why your model is doing something you think it shouldn't
  - Remember how the rules of atomicity work, and remember at which points each thread can take over execution
  - Give yourself time on Q3 - it can be tricky!

Advice for Assignment 1

- If something seems unclear, explain why you made a decision
  - It's easier to read commented code than obfuscated code, and if you leave reasoning for your decisions, your intentions are clearer

Questions?

- Hope this is helpful!