SPARCworks/Ada Tutorial

SunSoft
A Sun Microsystems, Inc. Business
2550 Garcia Avenue
Mountain View, CA 94043
U.S.A

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Contents

Preface

This tutorial demonstrates SPARCworks/Ada features and facilities as they might be used when working with an actual program. The SPARCompiler Ada demonstration program is called `solve`.

In this tutorial, you use the tools to examine and fix a version of the `solve` program that does not run correctly.

Where `solve` *is Located*

The `solve` program supplied with SPARCompiler Ada is located in:

`$ADAHOME/examples/X11_examples/xmaze`

This directory contains the makefile and source files for two versions of `solve`: one that runs correctly (`maze_muncher_b.aok`), and one that contains a bug (`maze_muncher_b.deb`). You inherit the version with the bug.

Purpose of This Tutorial

Developers might use many strategies and tactics to solve the kinds of problems the `solve` program has. The SPARCworks/Ada tools themselves provide multiple ways of doing things. The approach outlined in this tutorial is just one of many ways of solving the given problems.

This tutorial demonstratesSPARCworks/Ada features and facilities. You are told to do a few things you might not ordinarily do to illustrate some things about SPARCworks/Ada.

Note – Use local execution when following the steps in the tutorial.

How This Tutorial is Organized

This tutorial consists of two chapters:

Appendix A, "List of Steps for AdaDebug Tutorial," is a step-by-step summary of the second chapter so that you can restart the AdaDebug tutorial and advance quickly to a particular step.

Examining the `solve` *Program* 1

You are assigned to take over the broken version of the maze from its original author, who has left the development team. Although you are a veteran Ada programmer, you are fairly new to SPARCworks/Ada. The `solve` program is also something of a mystery.

1.1 Listing Objectives and Tasks

A list of your objectives and the tasks required to accomplish each of them might read like the following:

1. Copying the files in the `xmaze` directory to your own workspace and renaming it `my_broken_maze` to avoid confusion with the original
2. Building the SPARCompiler Ada library `my_broken_maze`
   a. Starting AdaVision in the `my_broken_maze` directory
   b. Creating a new SPARCompiler Ada library
   c. Setting LINK directives to connect the C X11 archive
   d. Compiling and linking `my_broken_maze`
3. Running `solve` to see what the problem looks like
4. Examining the structure of `solve` in AdaVision
5. Starting AdaDebug and trying to fix the program

1.2 Getting Started

1. Copy the `xmaze` files to a working directory.

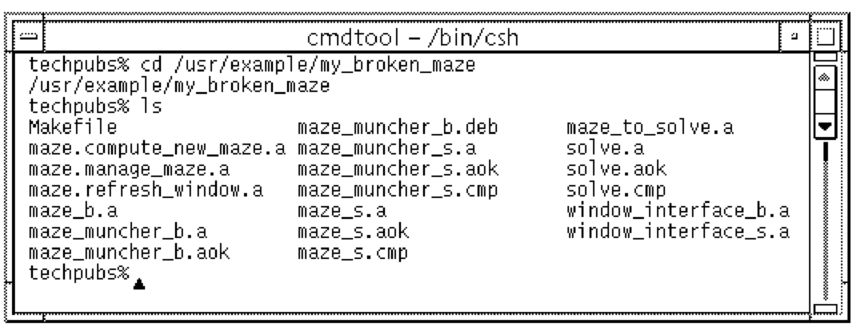
Note – `xmaze` is write-protected. Before you start the tutorial, copy the complete contents of the `$ADAHOME/examples/X11_examples/xmaze` directory to somewhere else in your file system. In this tutorial, the files are copied to `/usr/example/my_broken_maze`.

The maze tutorial directory contains a `.desc` file and some other `.`*xxx* files, so a simple `cp *` does not copy all of them. Add the option `-r` as follows:

```
% cd $ADAHOME/examples/X11_examples/xmaze
% cp -r . /usr/example/my_broken_maze
```

2. Work with the broken version of the maze and list the contents of the newly created directory as follows:

```
% cd /usr/example/my_broken_maze
% make broken
% ls
```



3. Start AdaVision from a command line by typing:

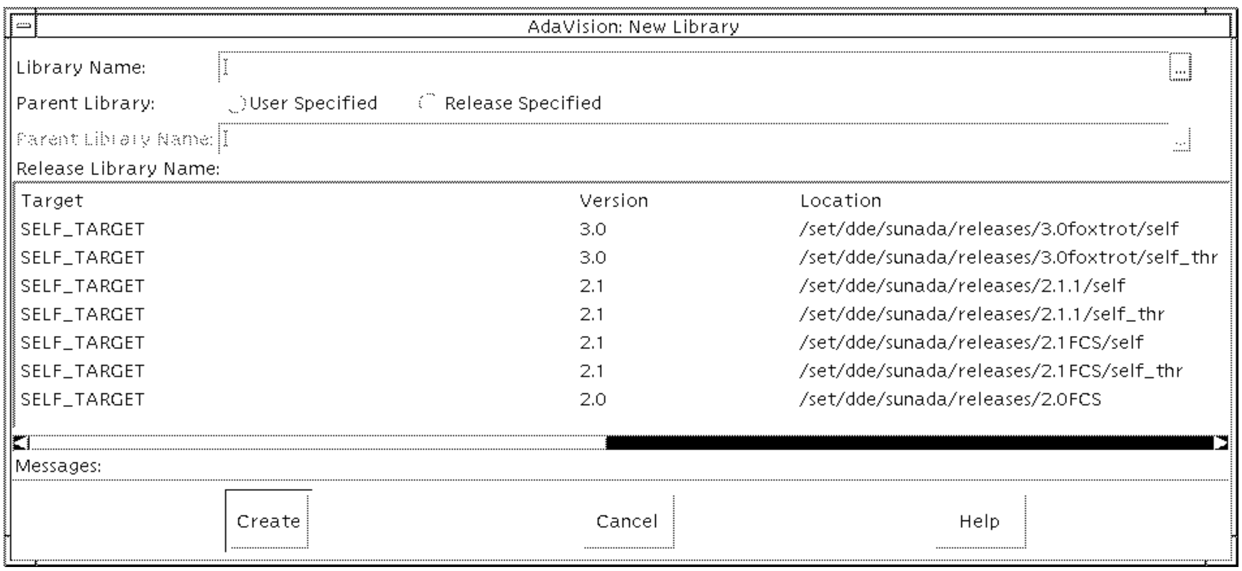
```
% adavision &
```

As you have not yet created an Ada library, the Initial Ada Library pop-up window appears:

4. **Click on New Library.**

1.3 Creating a New Library

In a few seconds, the empty AdaVision main window appears on the screen, along with the New Library pop-up window.



1. **Enter the library name**
   `/usr/example/my_broken_maze/`
   by either typing it directly into the text field or clicking on the ellipsis (. . .) button to the right of the Library Name text field to open a file chooser from which you select the name.

Note – The target release(s) as shown depend on the entries in your `/etc/VADS` file. Parent marks the release pointed to by the first line in `/etc/VADS` and designates it the default library.

---

2. **Choose Release Library:**

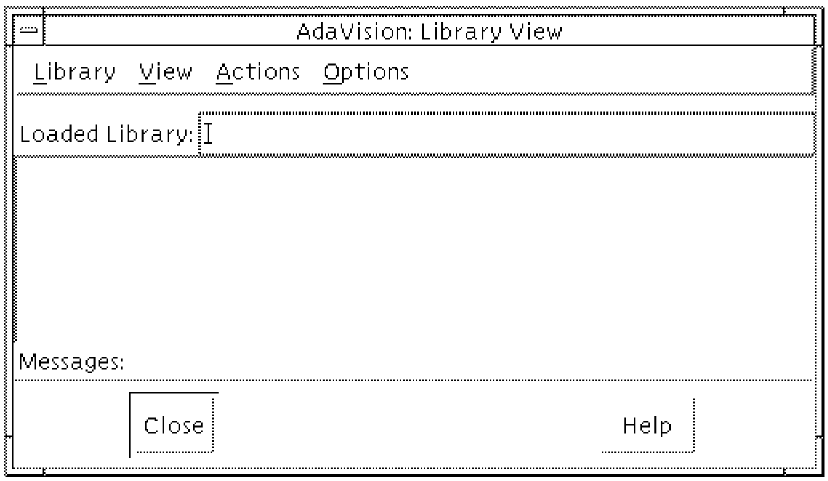
```
SELF_TARGET 3.0 opt/SUNWspro/Ada3.0/self
```

3. **Click on the Create button to create a new SPARCompiler Ada library named** `my_broken_maze` **with a parent library named:**

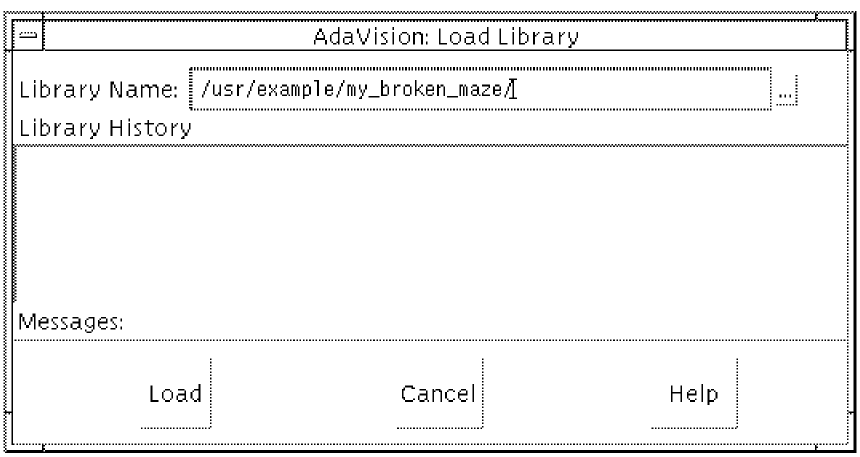
```
/opt/SUNWspro/Ada3.0/self/verdixlib
```

The New Library window then closes, and the Unit View message log indicates that the action is complete.

4. Choose View ➤ Libraries from the Unit View to open the Library View.

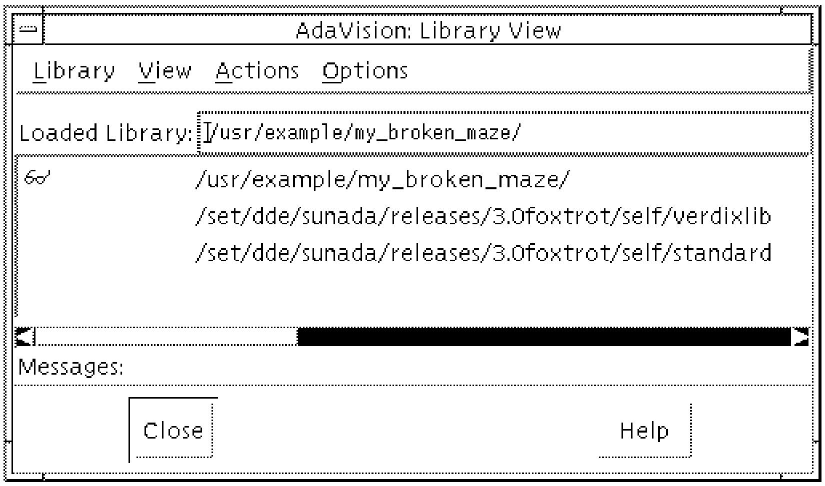


5. Choose Library ➤ Load from the Library View and type
`/usr/example/my_broken_maze/`
in the library name text field (or select it using the file chooser).



6. Click Load to load the library.

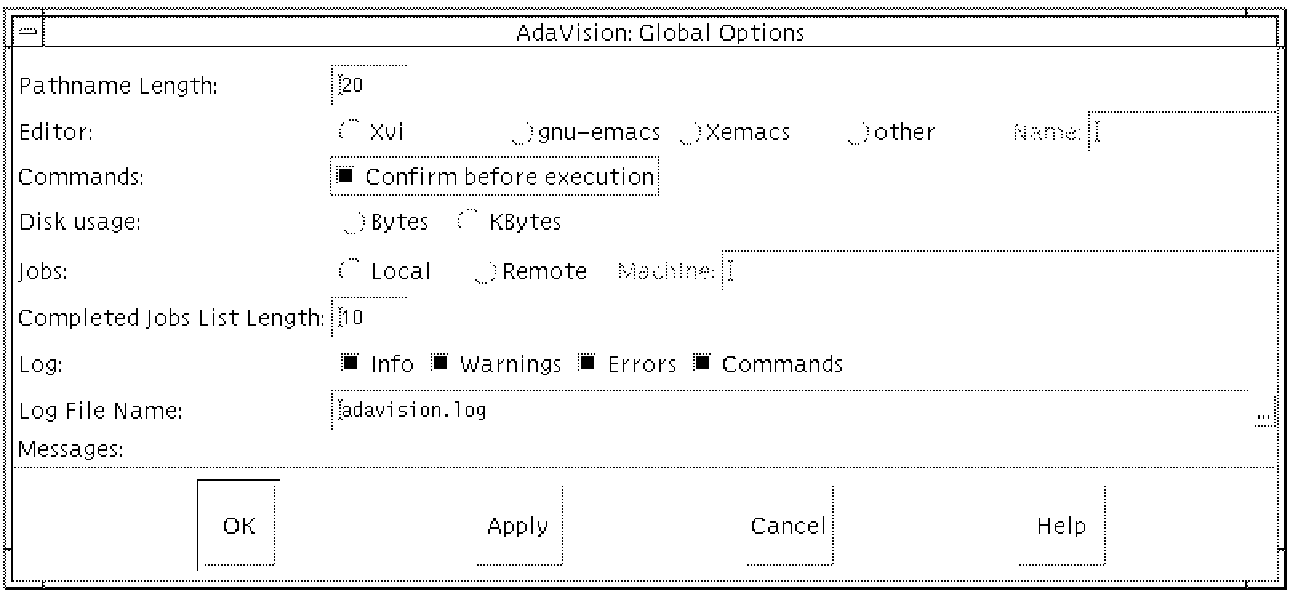
As soon as the library loads, the Load Library window closes and the Library View displays the new library (with the eyeglasses glyph) and all the libraries on its ADAPATH.



1.4 Choosing Your Editor

Open the Global Options window to determine your editor of choice. The default editor is vi.

1. **Choose Options ➤ Global to open the Global Options window.**



2. **Select your editor of choice.**

3. **Click OK to quit the window.**

1.5 Importing Units

You are now ready to import the `my_broken_maze` units into AdaVision.

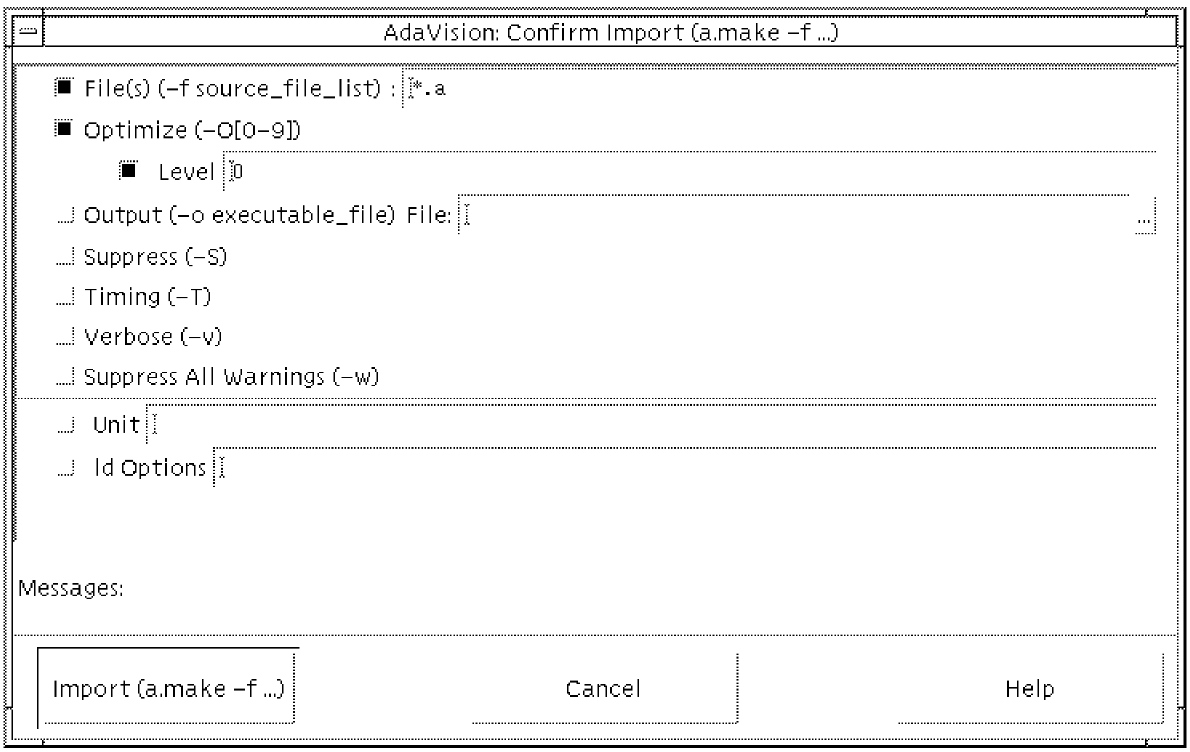
AdaVision is primarily an Ada unit-based system rather than a file-based system. When you import units, you instruct AdaVision to compile a list of Ada source files and display an object for each of the resulting units in the display pane. The unit objects are named and have graphically-coded icons.

To import:

1. **Select** `/usr/example/my_broken_maze` **by clicking on it in the scrolling list in the Library View.**

2. **Choose Actions ➤ Import, which brings up a confirmation window.**

3. Click on Optimize and enter the number 0 in the Level text field.

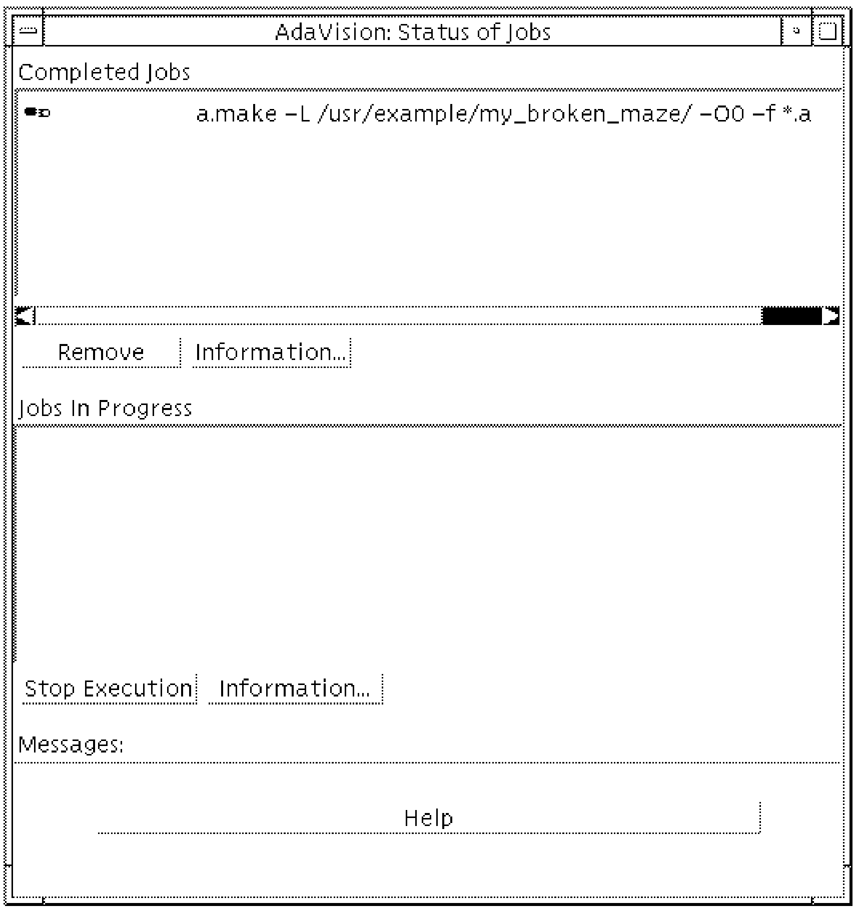


4. Click Import.

AdaVision starts an import job in the background. When the job begins, the confirmation window closes. To check on the status of the import job:

5. Select Status ➤ Jobs in the Unit View.

Job Status is displayed in the Status of Jobs window.



Unexpectedly, instead of completing a satisfactory compile, the job is displayed in the Completed Jobs pane with a broken glyph, indicating that the job terminated unsuccessfully.

1.6 Viewing Job Status

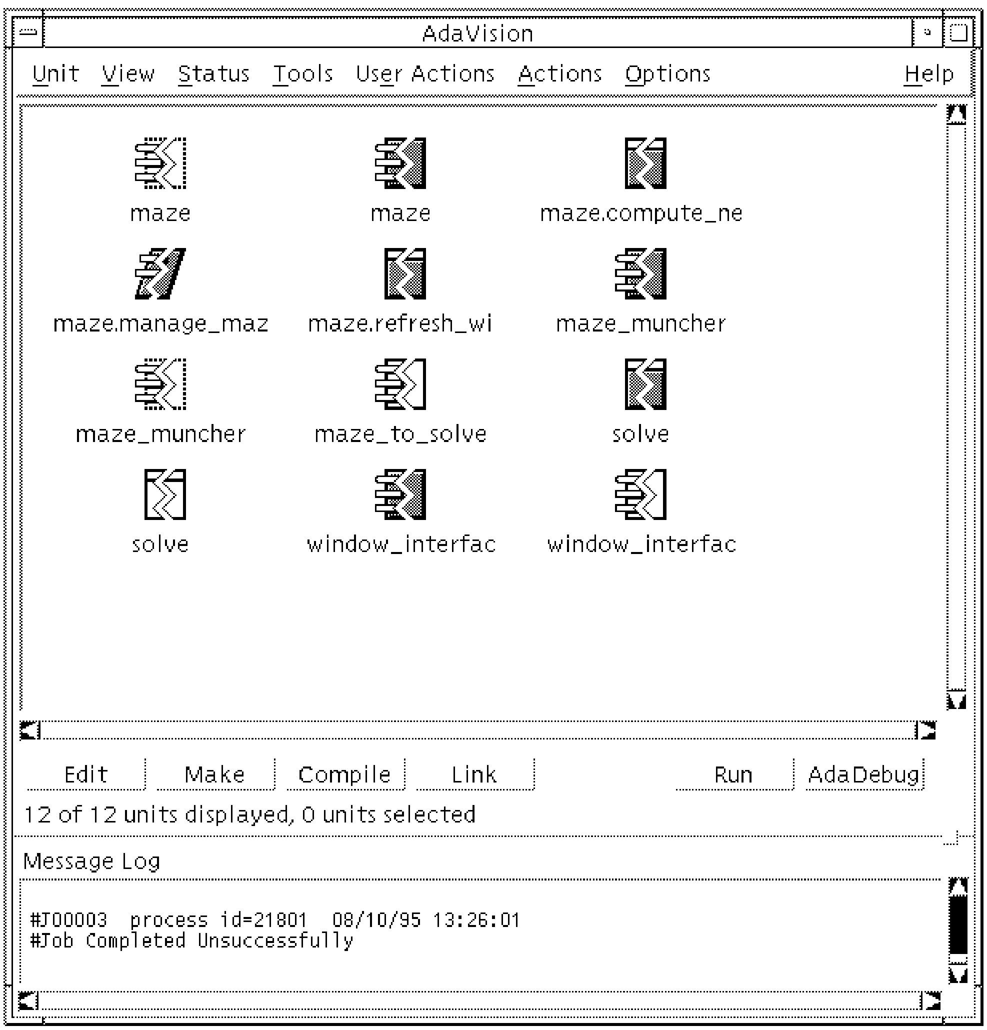
To discover what has happened:

1. **Select the unsuccessful job in the Status of Jobs window by clicking on it.**
2. **Click on the Information button under the Completed Jobs pane.**
3. **Read the message in the Job Output pane of the Job Information window.**

The output indicates that `maze` references units in a library that is not on the `my_broken_maze` ADAPATH. `publiclib` was not assigned as the parent library when creating the new library. This particular program also needs `vads_exec` and `X11` on its ADAPATH.

Rather than starting over, you can go to the `my_broken_maze` Library Options window and change the ADAPATH. Leave the Job Information and Status of Jobs windows open for later.

Although the job completed unsuccessfully, the icons associated with it appeared in the Unit View as soon as the job completed.



1.7 Changing the ADAPATH

1. **Choose Options ➤ Library in the Library View to display the Library Options pop-up window.**

In addition to changing the ADAPATH, you might as well write the link directives for the C X11 archive while the Library Options window is open.

The ADAPATH is visible in the window's main display pane.

The ADAPATH control shows only the `standard` and `verdixlib` libraries. The `vads_exec`, `X11`, and `publiclib` libraries need to be added to the ADAPATH list.

The libraries should be in the following order:

a. `../publiclib`

b. `../verdixlib`

c. `../X11`

d. `../vads_exec`

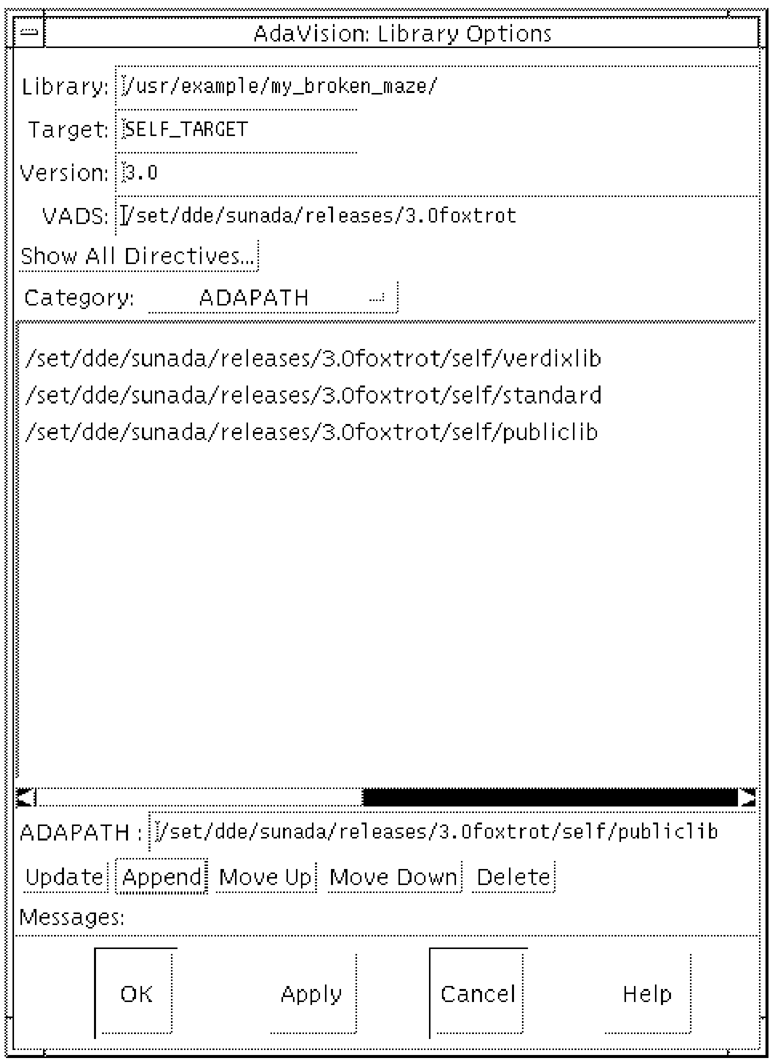
e. `../standard`

Begin by adding `publiclib`.

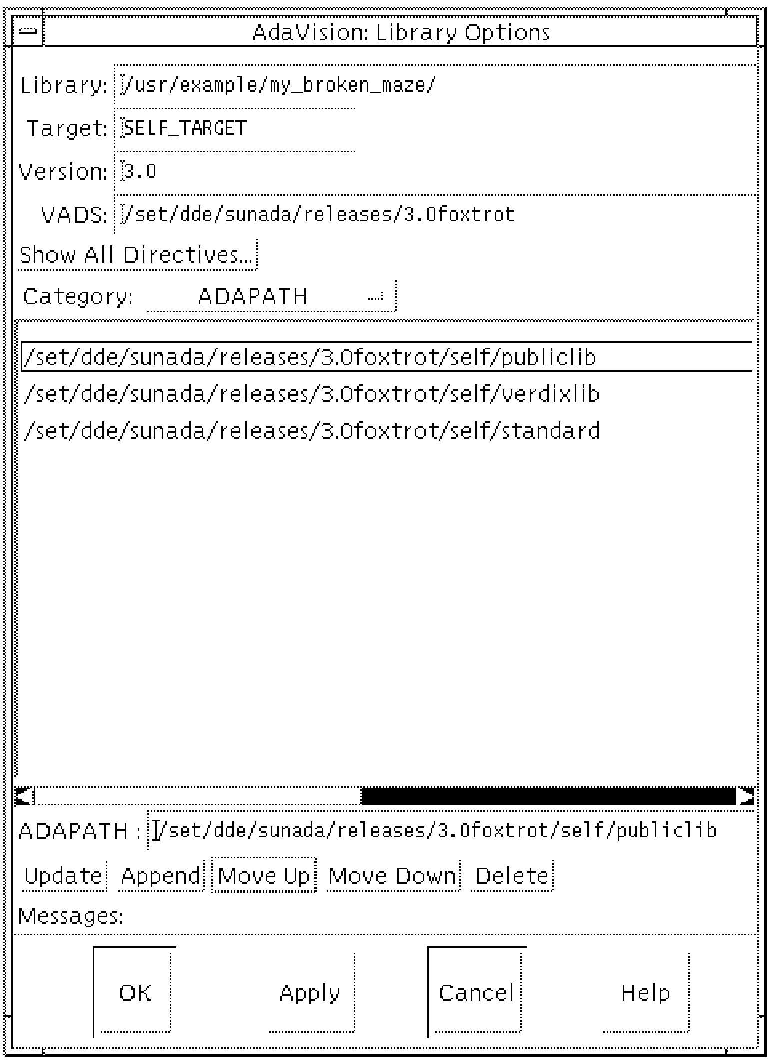
2. **Click in the ADAPATH text field at the bottom of the window and type in the ADAPATH for publiclib, where** *sunada_location* **is the location of SPARCompiler Ada (and the value of the `$ADAHOME` environment variable):**
   sunada_location`/self/publiclib`

3. **Click Append to see the change in the scrolling list.**

Note – Although the scrolling list updates, the actual ADAPATH does not change until you press Apply or OK, which you will do in a minute.

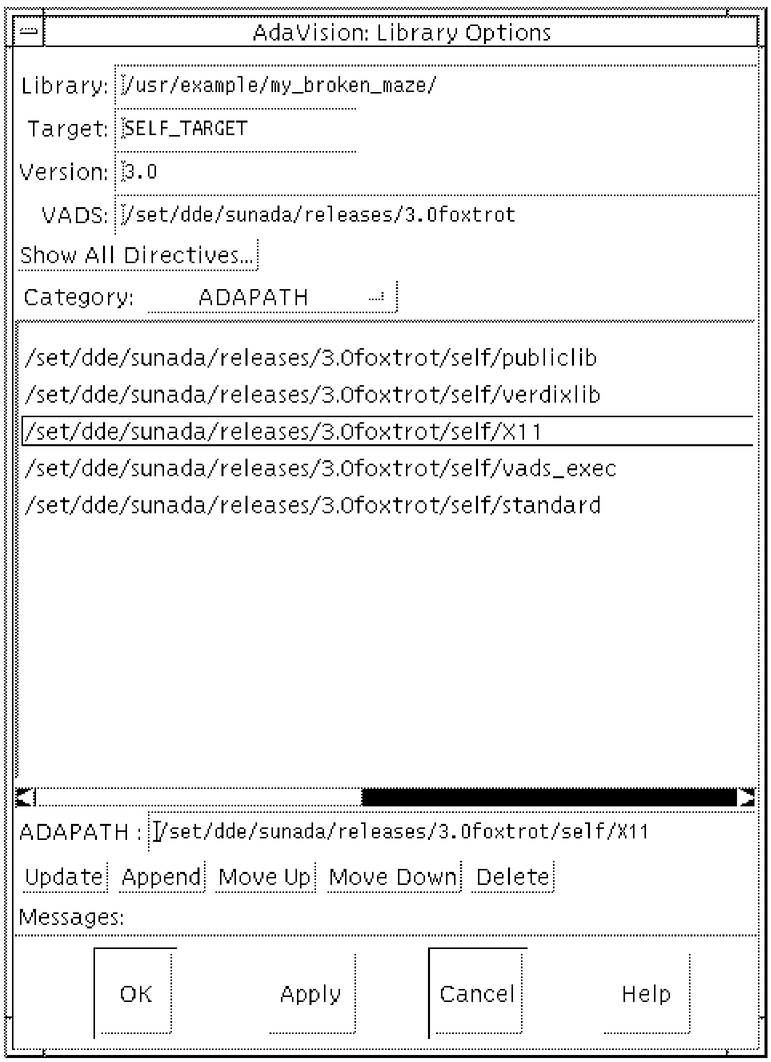


4. **Select** `publiclib` **from the scrolling list and press the Move Up button until the library is at the desired location in the list.**



5. **Press Apply to update the Library View and have the change in the ADAPATH take effect.**

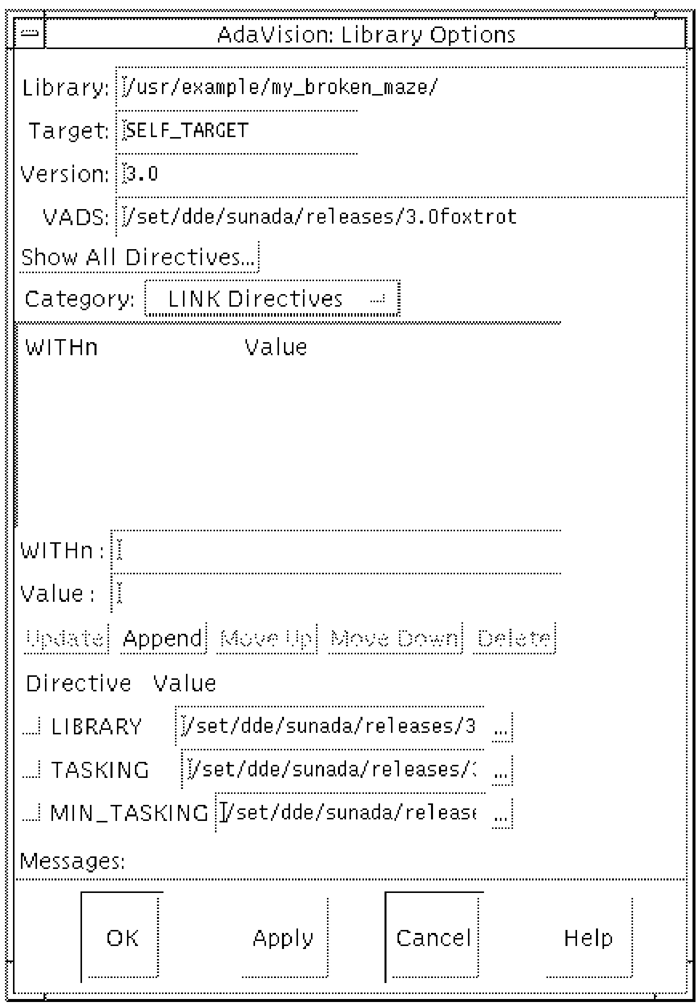
6. **Repeat Step 2 through Step 5 for the** `vads_exec` **and** `X11` **libraries.**



1.8 Setting a LINK Directive

You are now ready to write the LINK directive for the C X11 archives. Still working in the Library Options window,

1. **Select the LINK Directives setting from the Category menu to display the LINK directive controls.**



No WITH*n* directives are set in `my_broken_maze`.

You will want to set a LINK directive in `my_broken_maze` to tell AdaVision to include the shared object (or archive) `libX11` in any executable linked in this Ada library.

To set WITH*n* LINK directives in the current library:

2. **Click on the WITH*n* text field and type 1 to indicate the number of the WITH directive.**

3. **In the Value field, enter the name of the C X11 archive:**
   `-lX11`

Note – In the C X11 archive above, the hyphen is followed by a lowercase “l,” a capital “X,” and two ones.

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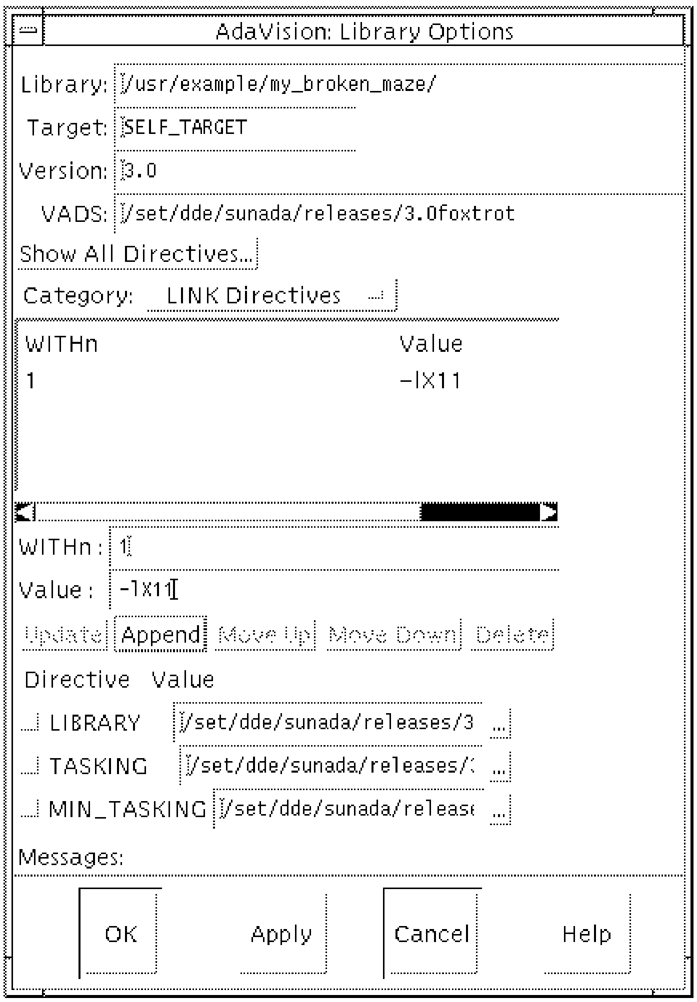
4. **Click Append to have the changes take effect in the scrolling list.**



5. **Click OK to update the Ada library. The Library Options window closes.**

You are now ready to rerun the Import job.

6. **Press the Redo Command button in the Job Information window, which was left open on the desktop.**

This time, the import is successful.

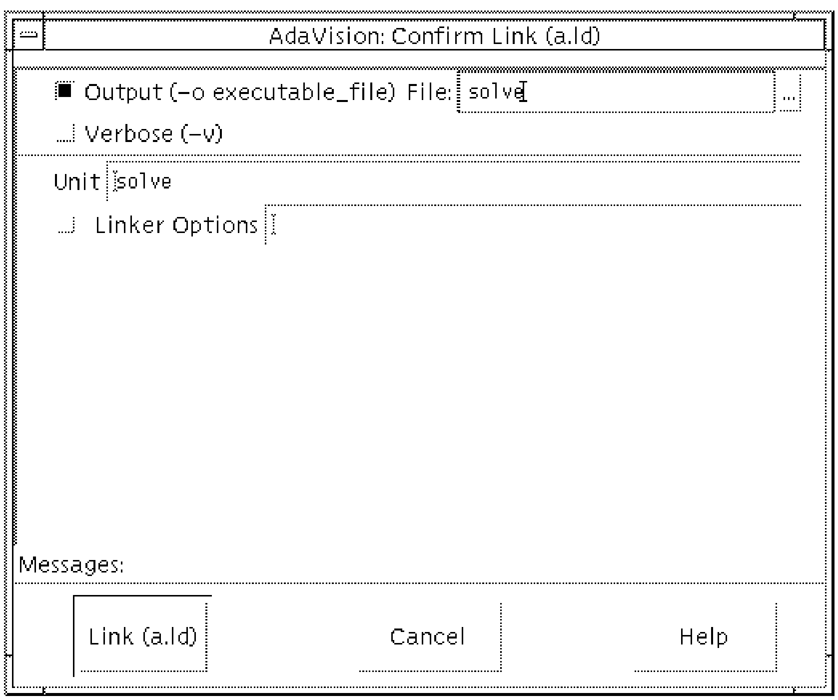
7. **Close the Job Information window, the Status of Jobs window, and the Library View window.**

All that remains before running `solve` is to link the executable.

1.9 Linking `solve`

1. **Select the body of the unit `solve` by clicking on its icon in the Unit View.**

2. **Choose Actions ➤ Link (or click on the Link button).**



3. **Select Output File and type `solve` in the text field to make the file name of the executable image more descriptive than the default `a.out`.**

4. **Confirm the link action by pressing Link in the confirmation window.**

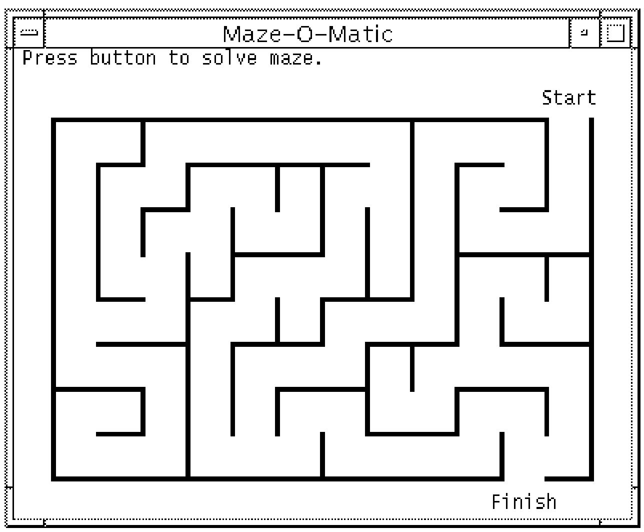
The link succeeds and the `solve` unit icon now has a Sun logo inside to indicate it is executable.

1.10 *Running* `solve` *From AdaVision*

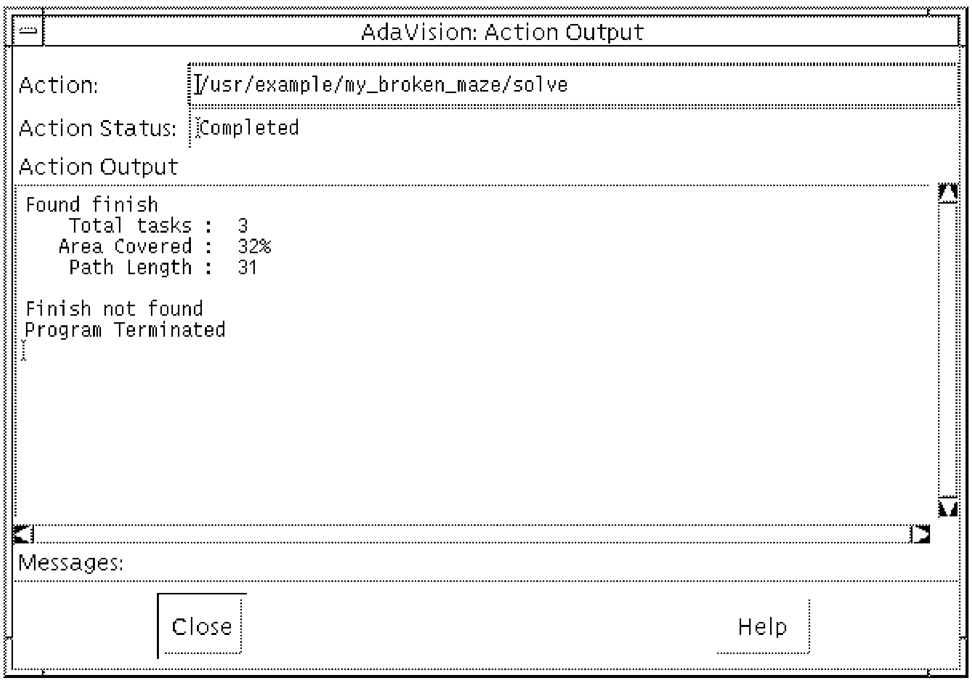
To start running `solve` from within AdaVision:

1. **With the** `solve` **executable still selected in the Unit View, choose Actions ➤ Run (or click on the Run button) and click Run in the Run action confirmation window.**

The `solve` program, called Maze-O-Matic for end users, is displayed on the screen.

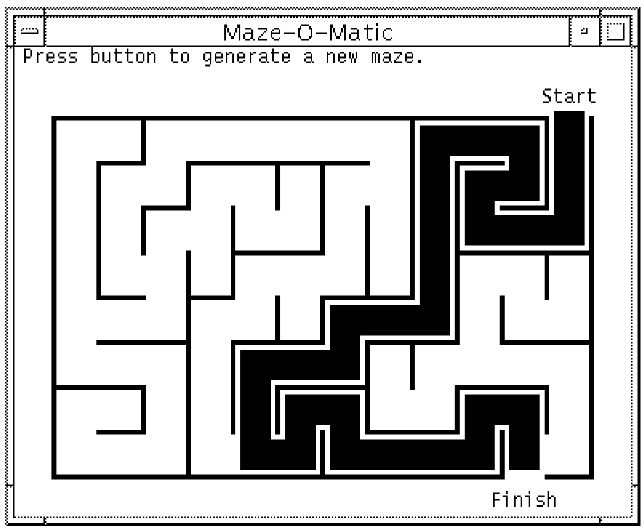


The Run action generates an Action Output window that contains details on the state of the action.



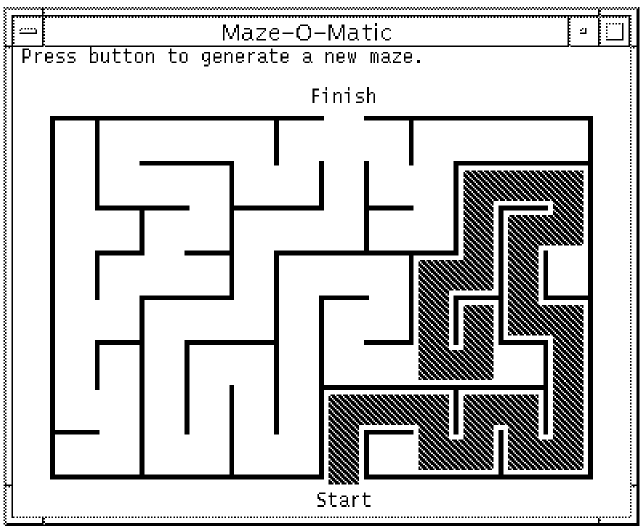
2. Put the cursor inside the maze display pane and click the mouse, as the message in the maze instructs users to do.

The first maze completes successfully.



3. **Generate a new maze by clicking on the maze window once, then try to solve the new maze by clicking on it again.**

   Maze-O-Matic fails to work this time, termintating in a blind maze pathway.



4. **Quit Maze-O-Matic and close the Action Output window.**

1.11 Examining `solve` *in AdaVision*

The main thing you know about `solve` is that it is a multitasking program that spawns tasks at each intersection in the maze, and that these tasks then follow all the pathways simultaneously to solve the maze.

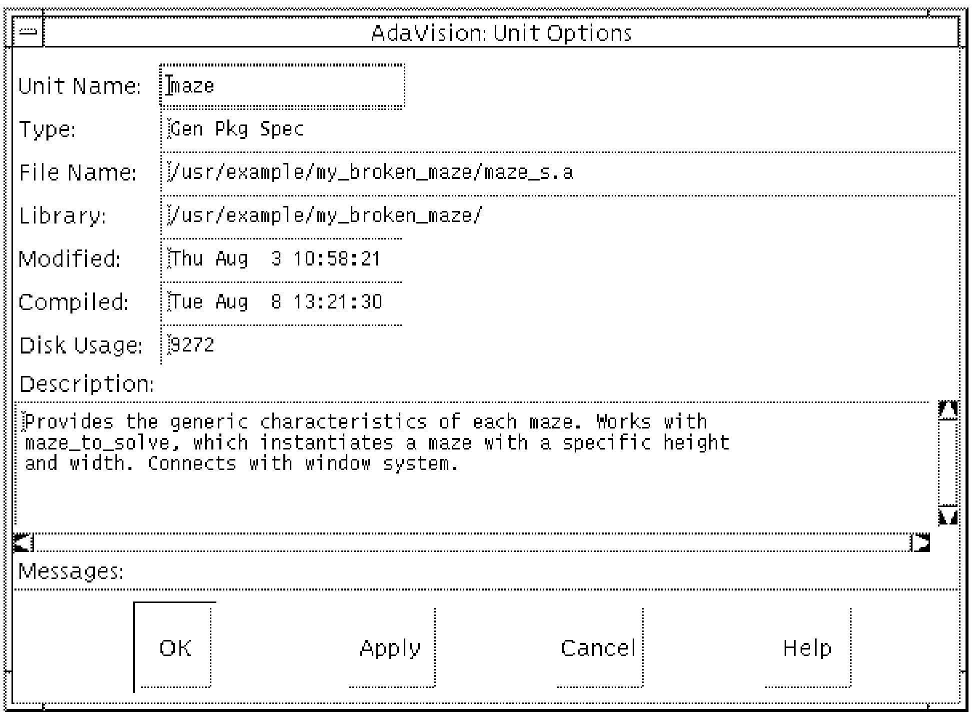
While watching the program fail, you noticed that it:

- Dead-ends
- Fails to make footprints on other pathways in each maze
- Seems to have trouble spawning tasks and sending them in each direction at an intersection

Before proceeding, you need to know more about how the program is assembled. What little documentation is available is either in comments in the source files or in the brief descriptions of each unit that a coworker wrote up early in the project.

The first thing to do is look quickly at the description for each unit provided by the previous programmer. To do this:

1. **Select each unit in turn and choose Options ➤ Unit to display the Options window for each unit.**

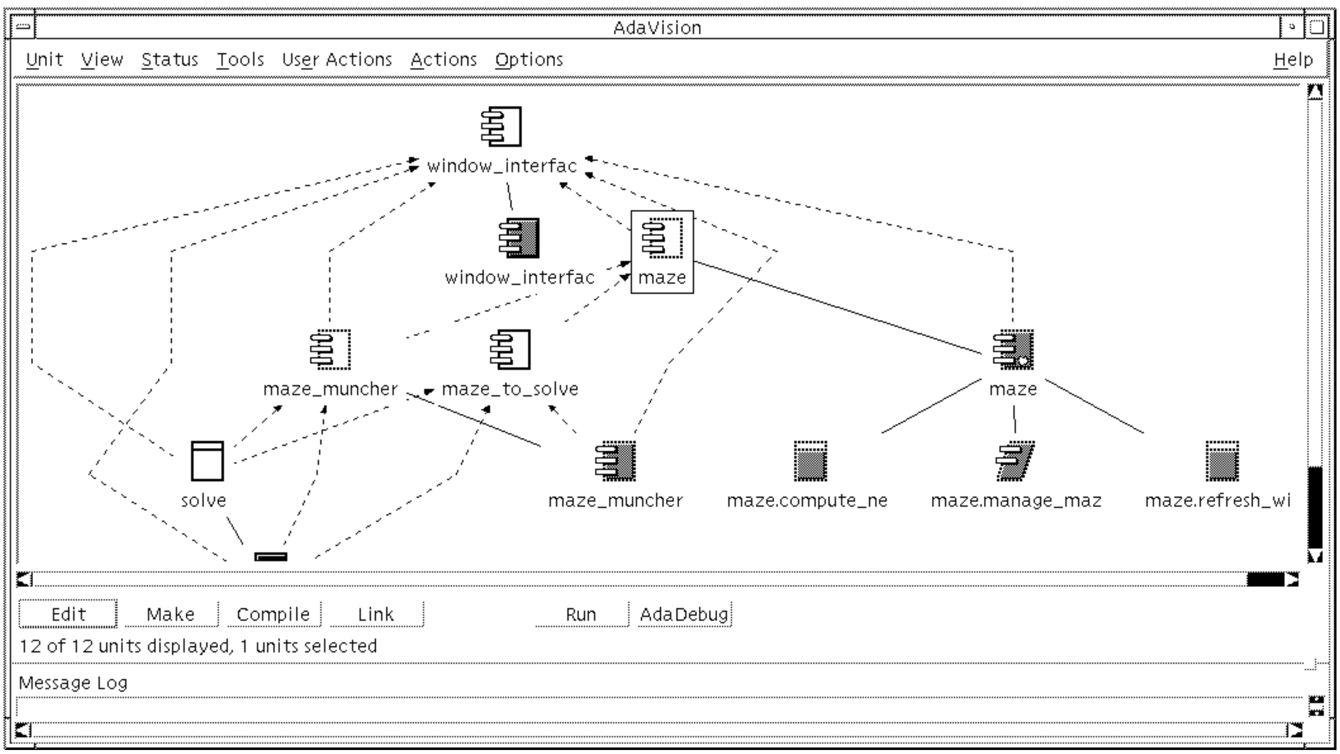


Now that you have a fair idea of how the program is assembled, it becomes important to see how the Ada units are themselves structured into specs, bodies, and subunits.

2. **Click OK to close the Unit Options window.**

3. From the Unit View, choose View ➤ Graph.

AdaVision opens a base window that graphs the interdependencies among the displayed units (in this case, all of the units in the `solve` program). WITH dependencies appear as dashed lines, and parent-child relationships appear as solid lines.



4. Choose View ➤ Icon to return to the icon view.

1.12 Explaining the Program's Behavior: Two Hypotheses

If you run through the program again, you can see that the program is not spawning tasks in all possible directions at each intersection, as it is supposed to do. All that white space should be gray because task munchers should have gone down each path, flushing the entire maze. Also, in the second maze, a task did not head out to the left at the first intersection.

There are two plausible explanations for the program's behavior:

- Maybe only one task is running and the others are not being spawned successfully.
- Maybe tasks are spawned successfully, but they are dying before they get anywhere.

You can use the Debugger tool to further examine the program.

Note – If you want to redo the first chapter, be sure to type `make clean` in a command line before starting over.

Debugging the `solve` Program 2

You are now ready to view and edit the source code. If you want to follow the AdaDebug section of the tutorial in more than one sitting (or if you miss a step that breaks the correct sequence), you can use the concise list of steps in Appendix A to return the program quickly to any particular place in the tutorial.

Note – If you skipped Chapter 1 of this tutorial, go back and perform Steps 1 and 2 from Section 1.2, "Getting Started." Then, execute the `make all` command at the command line before continuing with this chapter.

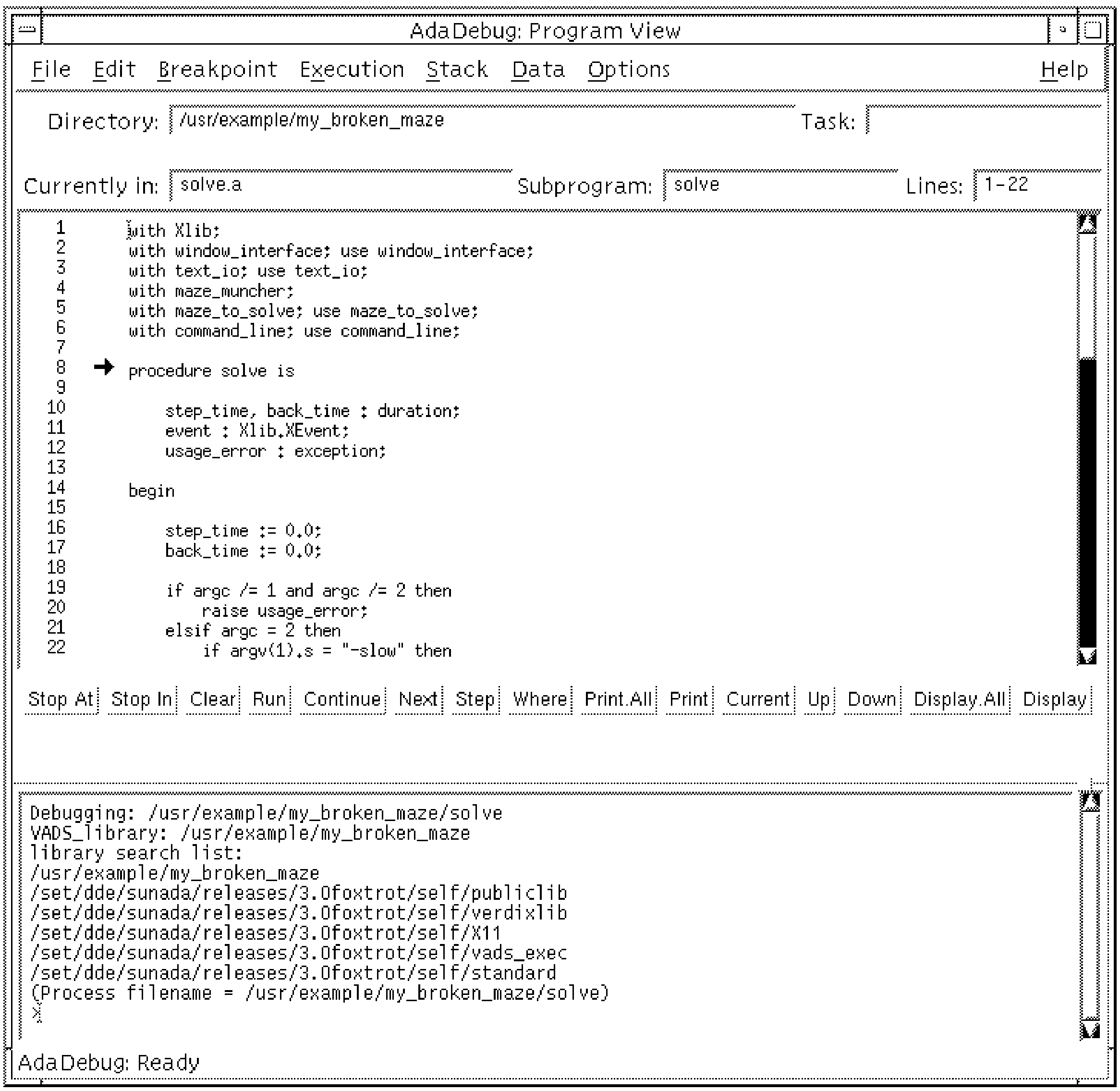
2.1 Starting AdaDebug From AdaVision

To start AdaDebug from within AdaVision:

♦ **Select the `solve` executable in the AdaVision Unit View and choose Tools ➤ Debug (or click on the AdaDebug button).**

Note – If AdaDebug is already running on the desktop, you can start a debugging session by choosing File ➤ Load Executable. If neither AdaVision nor the Debugger is running on your Desktop, you can type
`adadebug solve &`
in a Shell Tool window to start the Debugger.

You may want to close AdaVision to an icon for now.



At startup, AdaDebug displays the Program View window with the main program source code in the display pane. A small arrow marks the next line to be executed by the debugger—that is, the current position in the program.

2.2 Setting the First Breakpoint

You know that the program solves the first maze and therefore decide to find a place in the code where it passes the first maze but does not start the second one.

1. **Begin by scrolling halfway through the file to find parts of the code that might be relevant.**

Line 57 reads:

```
57      generate_new_maze
```

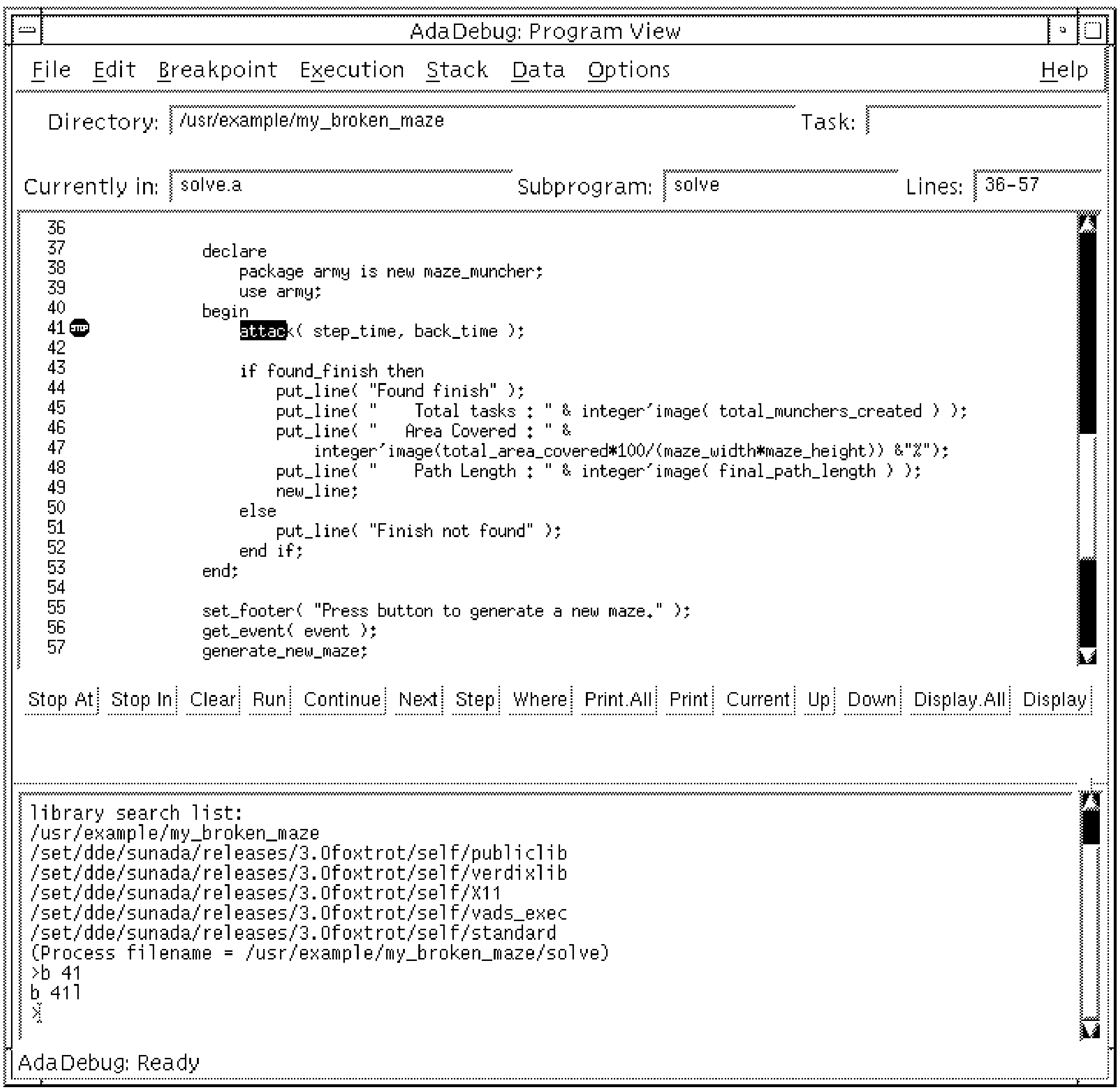
At first, this seems like a good place to put a breakpoint. But this statement probably comes too late to catch any of the action.

In the code that comes before this call to generate a new maze, line 41 is a call to the `attack()` procedure. From the description of `solve`, it is fairly obvious that the program uses `attack()` to launch the task munchers that solve the maze. A breakpoint at the call to the `attack()` procedure seems like a good idea.

2. **Double-click in line 41. The first word in the line is highlighted.**

3. Choose Breakpoint ➤ Stop At <*selected line*> (or click Stop At).

A stop sign glyph appears to the left of line 41, indicating that a breakpoint is set at that line.

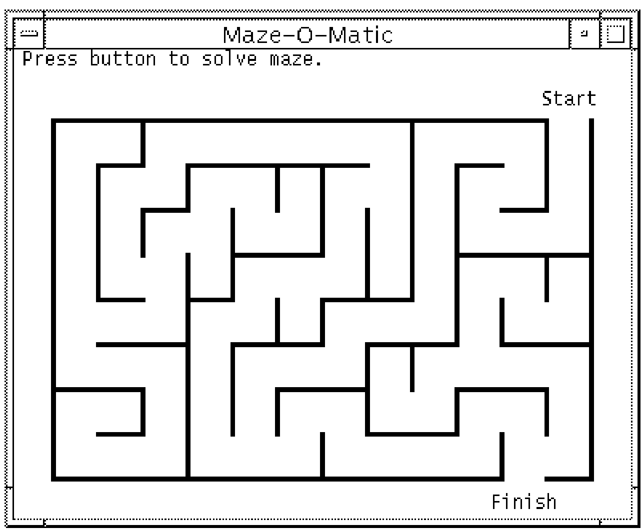


2.3 Executing the Program

Having set a breakpoint, start the program from the beginning.

1. Choose Execution ➤ Run (or click Run).

The Maze-O-Matic window opens with a message prompting the user to click the mouse button to solve the maze.



2. Click in the maze window to start the program solving the first maze.

The program runs until it hits the breakpoint at the call to `attack()`. The arrow indicating the next line to be executed points at line 41, where the breakpoint is set. Nothing has happened yet in the Maze-O-Matic window.

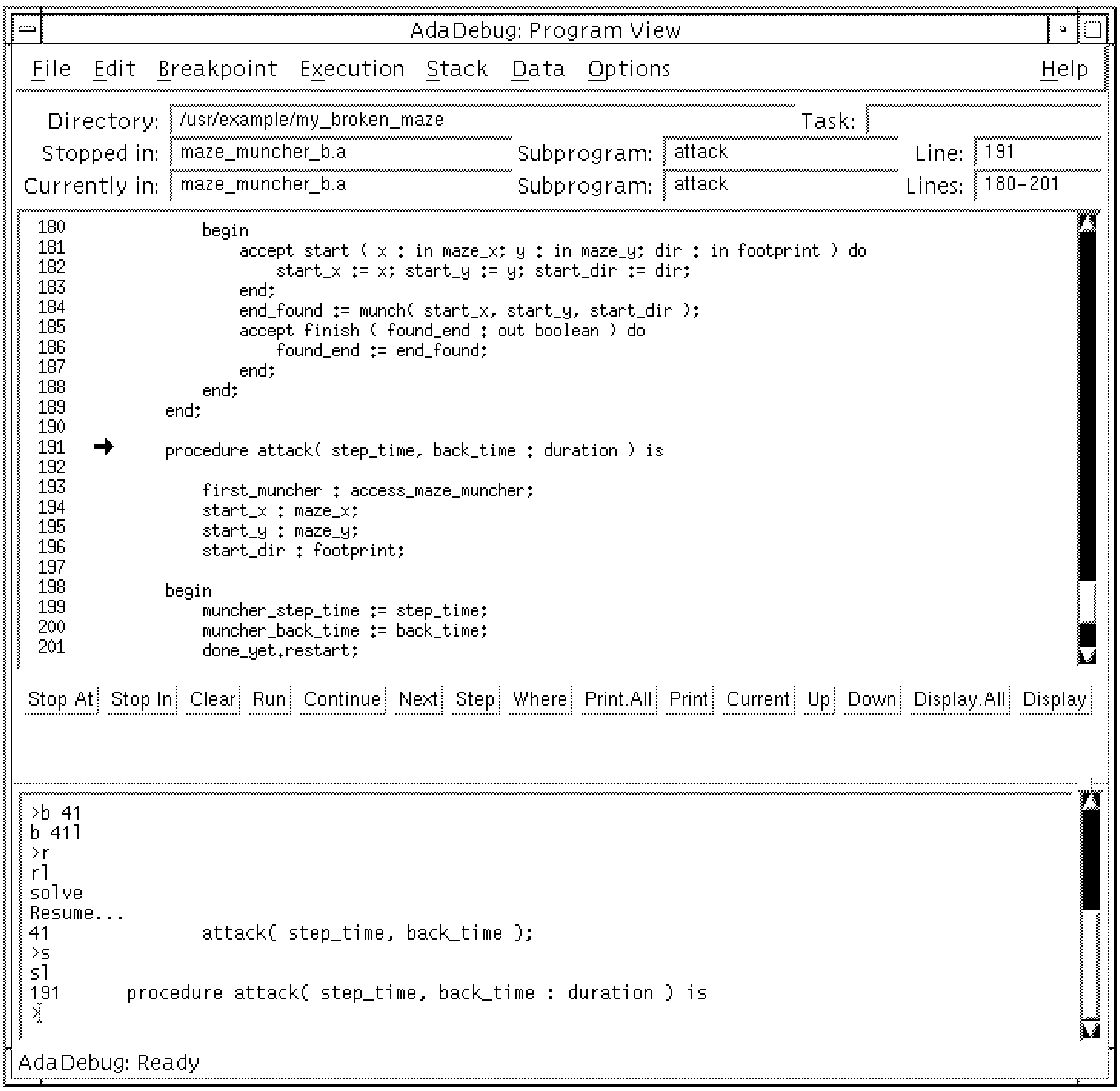
2.4 Stepping Into `attack()`

Recall that the program always solves the first maze, even though it does not work exactly as it is supposed to work because it doesn't send out munchers to explore the opposite path when it reaches an intersection. Work with the first maze for a while.

Step into the `attack()` procedure to see what happens when the program calls it.

1. **Choose Execution ➤ Step (or click Step) to step into the** `attack()` **procedure.**

The Program View window now displays the `attack()` procedure. AdaDebug positions the current line arrow at line 191, the first line of `attack()`.



At this point, assume that the program will behave properly and begin stepping through `attack()` line by line.

2. Choose Execution ➤ Next (or click Next).

3. **Repeat Next eight more times, advancing to line 206 and reading ahead a line or two before each step to analyze what is happening.**

With the current line arrow pointing at line 206, nothing has happened in the Maze-O-Matic window.

Line 206 reads:

```
206    first_muncher:=start_muncher(start_x,start_y,start_dir);
```

And the next line, 207, reads:

```
207    first_muncher.finish(found_finish);
```

Remember, the munchers' progress results in footprints on the maze. Don't allow the program to step over line 206, or the action involved in drawing the first footprint will be lost. Step into `start_muncher`.

4. **Choose Execution ➤ Step (or click Step) to step into the** `start_muncher` **function at line 21.**

AdaDebug scrolls the display to point at line 21, where `solve` declares the `start_muncher()` function. This is a short but important routine.

5. **Choose Execution ➤ Next (or click Next) four times until reaching line 26.**

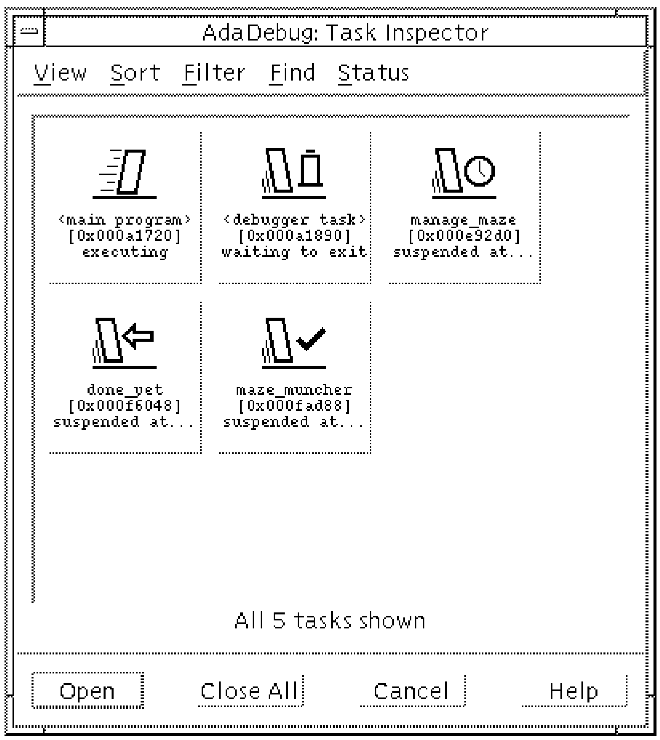
Line 25, the second line in `start_muncher()`, allocates a task of type `maze_muncher`. In stepping over line 25, notice that `solve` has just created a new task. Note also that the next line, 26, is a task rendezvous call:

```
26     new_muncher.start(x, y, dir);
```

Recall that the `maze_muncher` unit uses `attack()` to control the munchers that travel the maze. Now it should be clear that each muncher is a task.

2.5 Examining a Task

1. **Choose Execution ➤ Task Inspector to display each activated task in the Task Inspector window.**



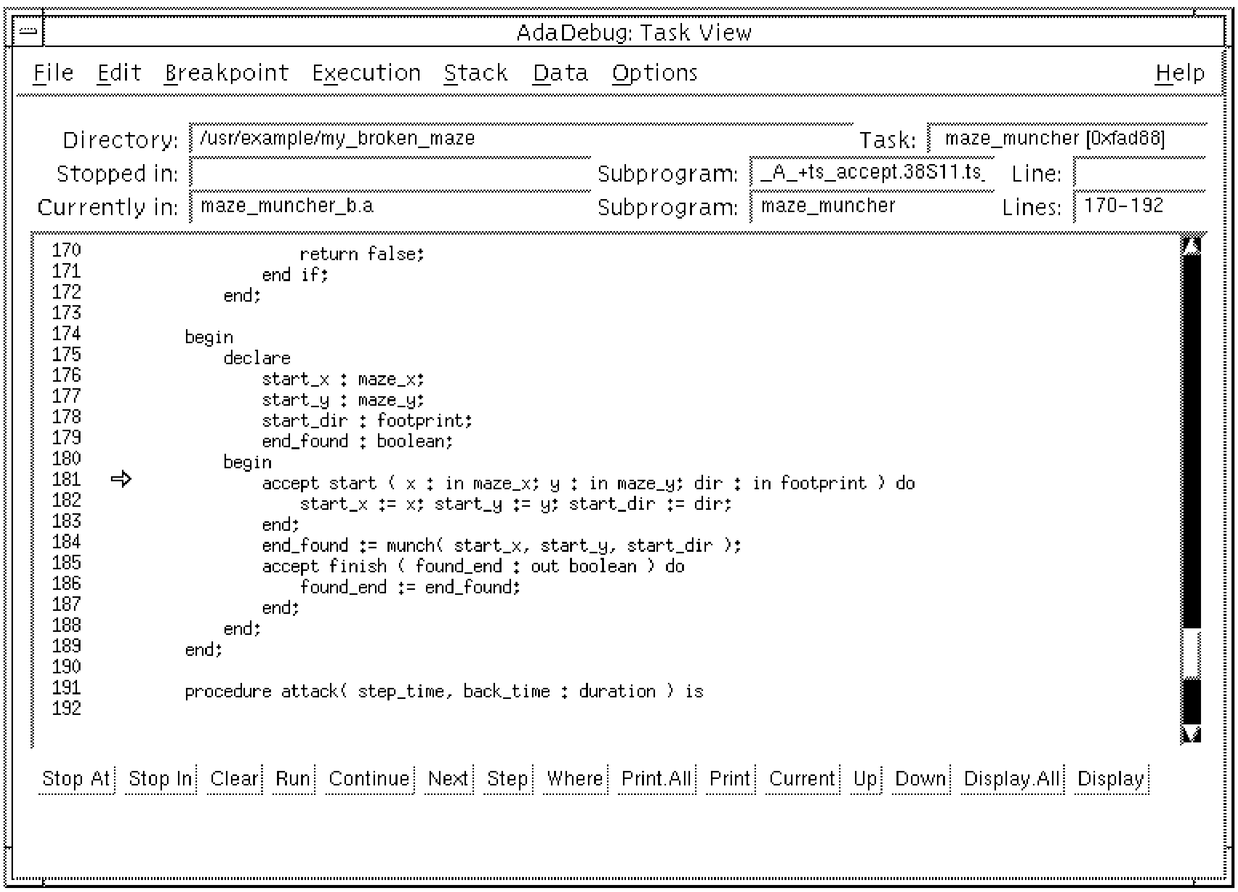
As expected, the icon for the new muncher task that `start_muncher` just created is visible. It is named `maze_muncher`.

From the Task Inspector, the task opens into a Task View window, where a task-specific breakpoint can be set at the accept statement for this muncher.

2. **Select the `maze_muncher` task icon in the Task Inspector and click Open to open the task in a Task View window.**

The Task View window looks similar to the Program View window.

Note – The important difference between the Task View window and the Program View window is functional. When you choose a menu item from within a Task View window, it applies only to the task identified in the Task View title bar.

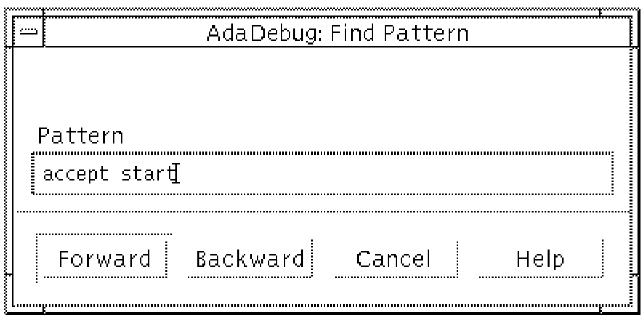

AdaDebug: Task View
File Edit Breakpoint Execution Stack Data Options Help
Directory: /usr/example/my_broken_maze
Task: maze_muncher [0xfad88]
Stopped in:
Subprogram: _A_+ts_accept.38S11.ts_
Line:
Currently in: maze_muncher_b.a
Subprogram: maze_muncher
Lines: 170-192
170 return false;
171 end if;
172 end;
173
174 begin
175 declare
176 start_x : maze_x;
177 start_y : maze_y;
178 start_dir : footprint;
179 end_found : boolean;
180 begin
181 accept start (x : in maze_x; y : in maze_y; dir : in footprint) do
182 start_x := x; start_y := y; start_dir := dir;
183 end;
184 end_found := munch(start_x, start_y, start_dir);
185 accept finish (found_end : out boolean) do
186 found_end := end_found;
187 end;
188 end;
189 end;
190
191 procedure attack(step_time, back_time : duration) is
192
Stop At
Stop In
Clear
Run
Continue
Next
Step
Where
Print.All
Print
Current
Up
Down
Display.All
Display

2.6 Setting a Breakpoint in the Task View

By setting a breakpoint in the Task View window, the program reaches the breakpoint only if this particular task attempts to execute this line of code.

Find the `accept start` statement using the search facility:

1. Choose Edit ➤ Find in the Task View.



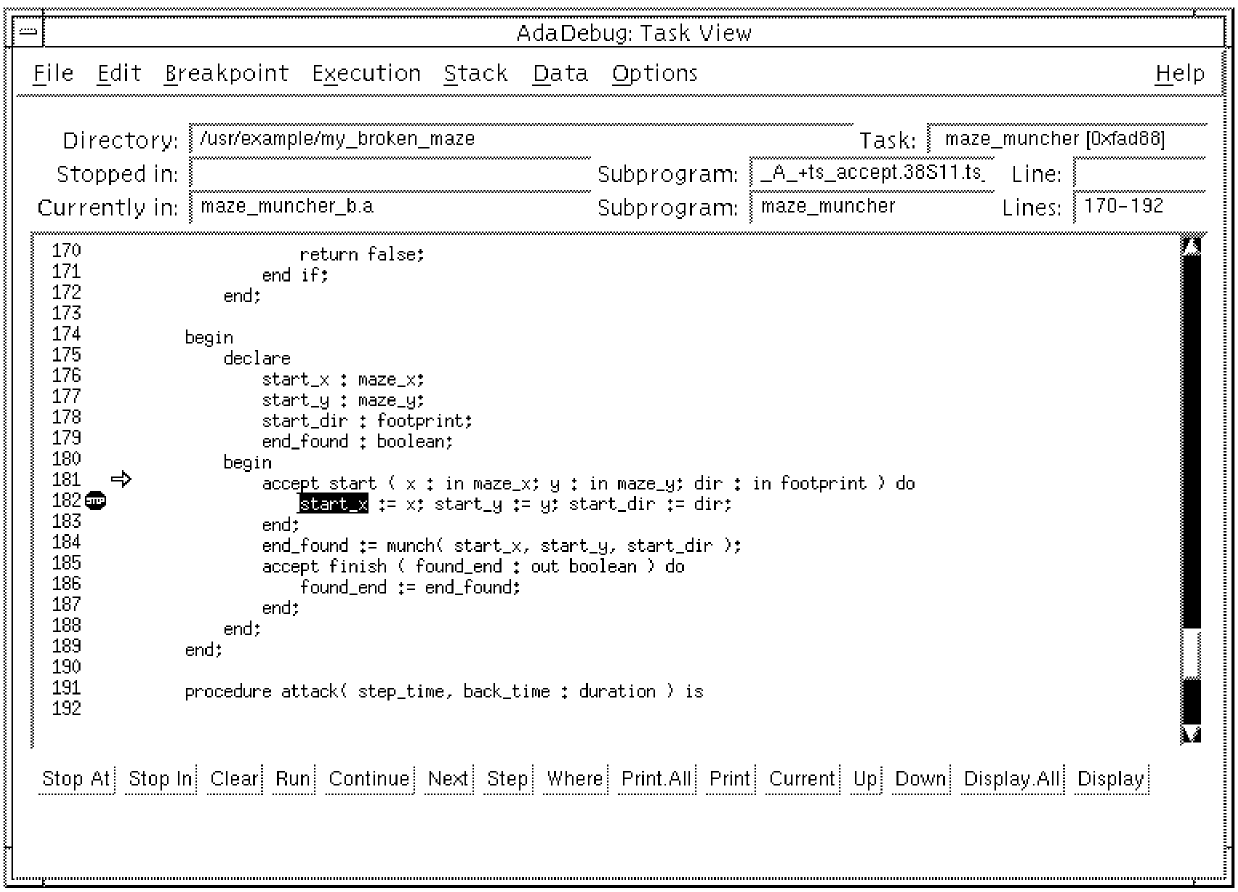
2. Type `accept start` **in the text field and click Forward.**

The code in the Task View pane highlights the `accept start` statement into view at line 181.

A breakpoint at line 181 is too early. The task is already suspended at the `accept start` rendezvous statement. The task-specific breakpoint goes on line 182.

3. Close the Find Pattern window.

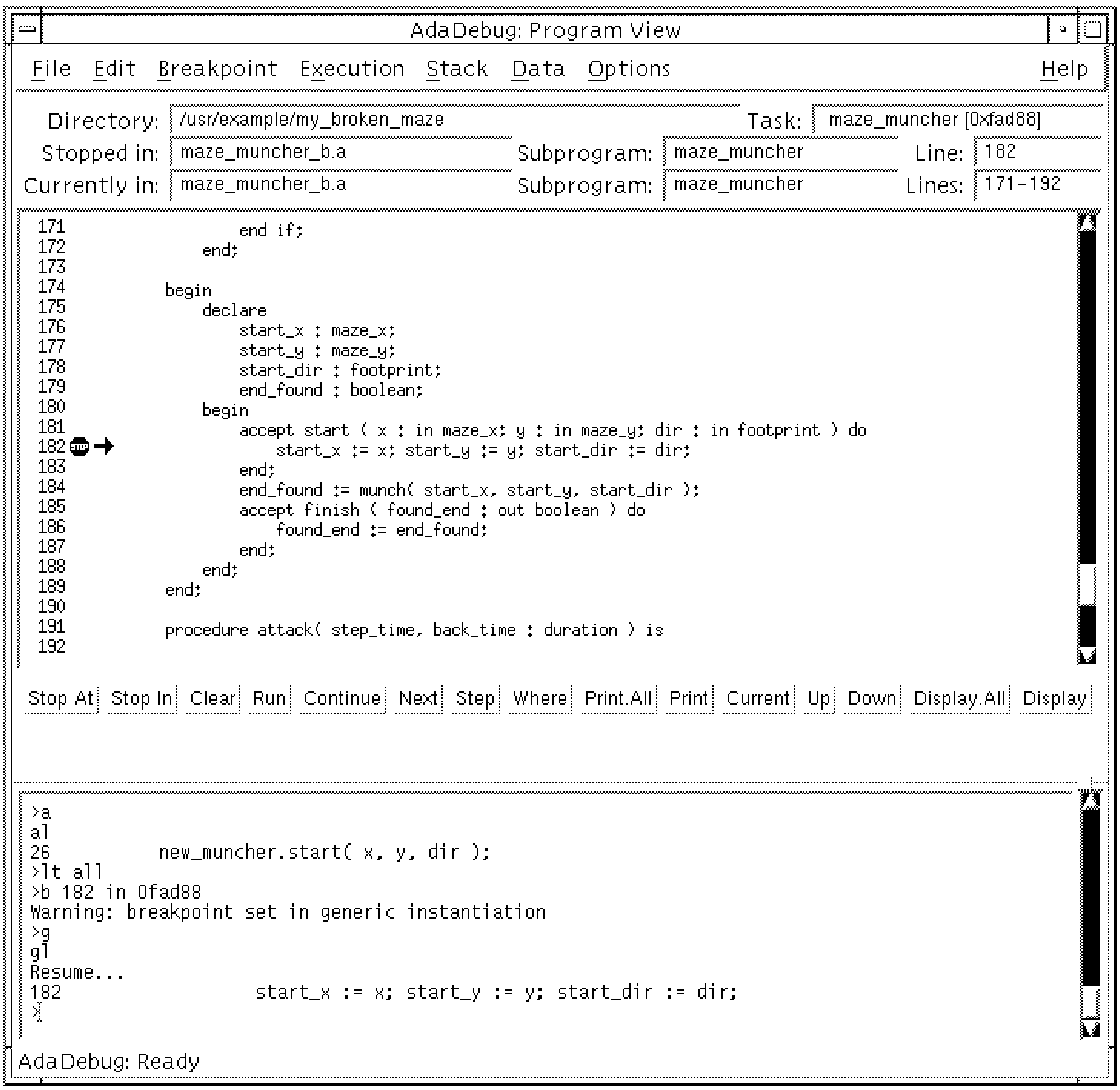
4. **Double-click on line 182 in the *Task View* window and choose Breakpoint ➤ Stop At <*selected line*> (or click Stop At).**



The hollow arrow at line 181 shows where the task suspended its execution. Don’t confuse the hollow arrow with the solid arrow, which shows the next statement to be executed when you continue the program.

5. **Close the Task View window, but leave the Task Inspector open for later.**

6. Choose Execution ➤ Continue (or click Continue) from the Program View.



The program runs until the task named `maze_muncher` hits this task-specific breakpoint. Still, nothing has happened in the Maze-O-Matic window.

Clear the breakpoint at line 182, since it has already served its purpose.

7. **Double-click on line on 182 in the Program View and choose Breakpoint ➤ Clear At <*selected line*> (or click Clear).**

2.7 *Stepping Into* `munch()`

By stepping into the `munch()` procedure at line 184, you can step through the entire process by which `solve` creates task munchers.

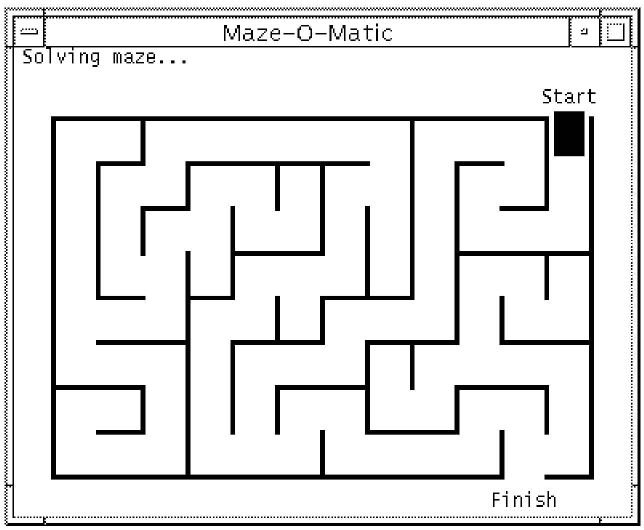
1. **Choose Execution ➤ Next (or click Next) twice to advance the current line pointer to line 184.**
2. **Choose Execution ➤ Step (or click on Step) at line 184 to step into the start of the `munch()` function at line 70.**
3. **Scroll or click Next a few times to advance through the code, noticing the loop from lines 106 to 116.**

Just after the loop, at line 123, is an if . . . then . . . else statement that seems to be significant.

4. **Double-click on line 123 and choose Breakpoint ➤ Stop At <*selected line*> (or click Stop At).**

5. Choose Execution ➤ Continue (or click Continue) to have the program advance to the breakpoint you just set at line 123.

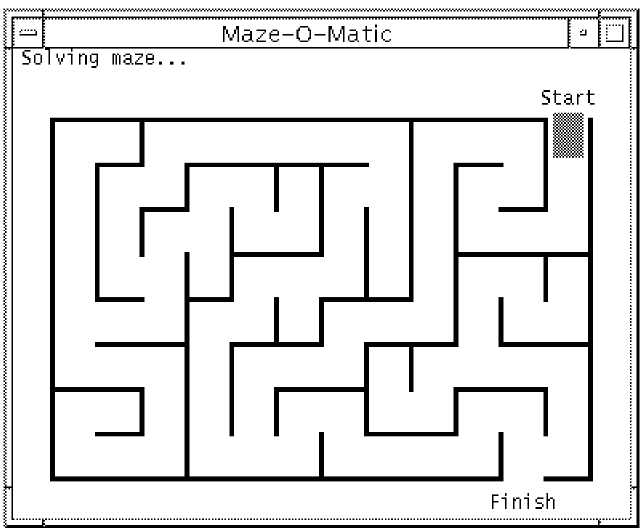
The program advances to the new breakpoint. In the Maze-O-Matic window, the program draws a single black footprint in the maze.



2.8 Stepping Through munch()

Step through munch() one line at a time to see what happens next.

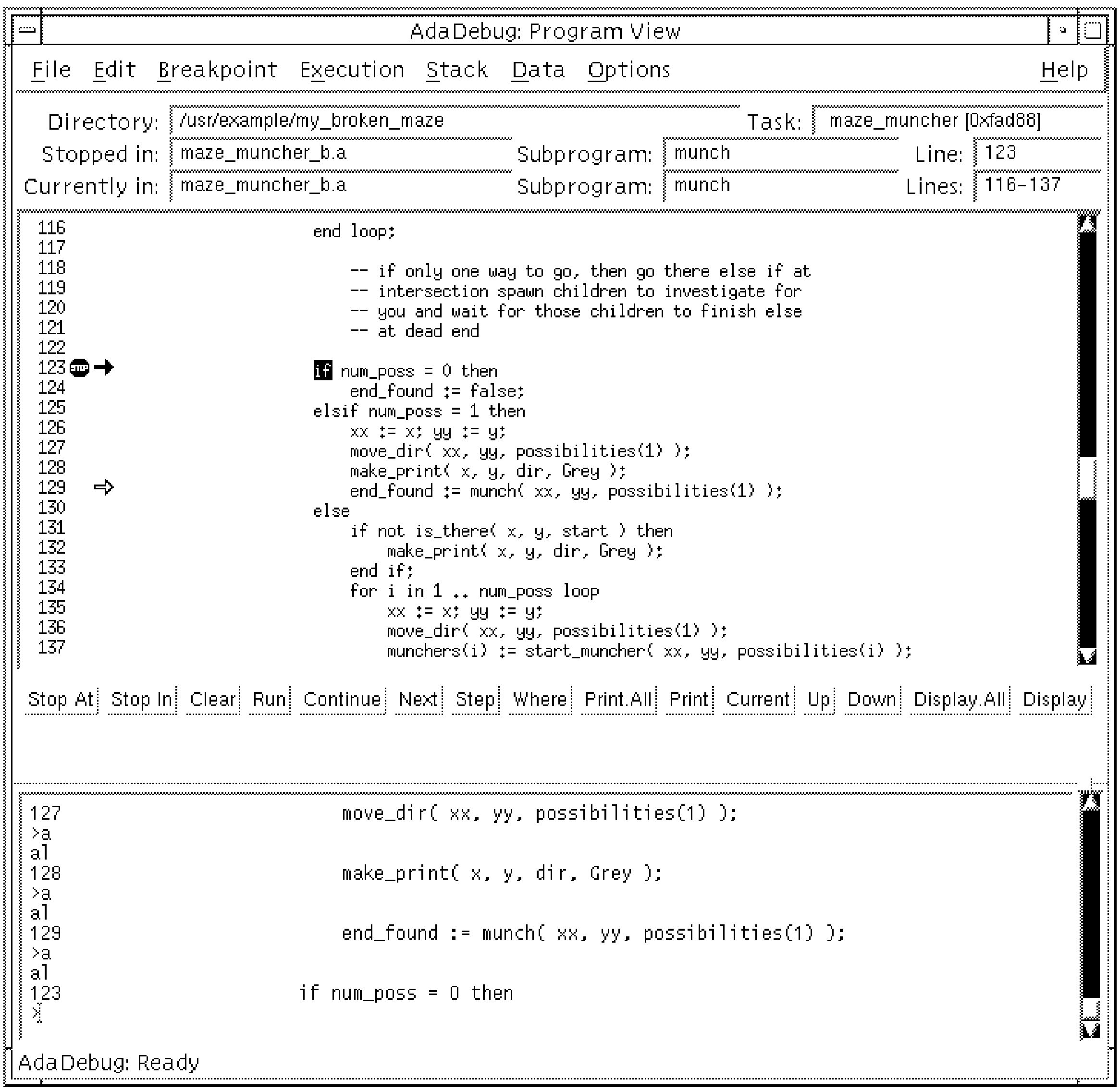
1. **Click Next five times. The fifth step executes the** make_print(x, y, dir Grey) **procedure (line 128), causing the first footprint to turn gray.**



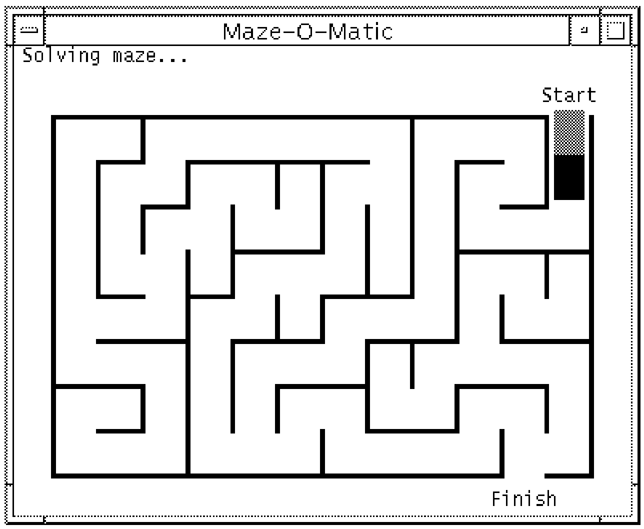
2. **Click Next again to execute line 129.**

Something unexpected happens: the program returns to line 123, even though the program is not in a loop. Also, the hollow arrow at line 129 indicated a different stack frame was executing.

.



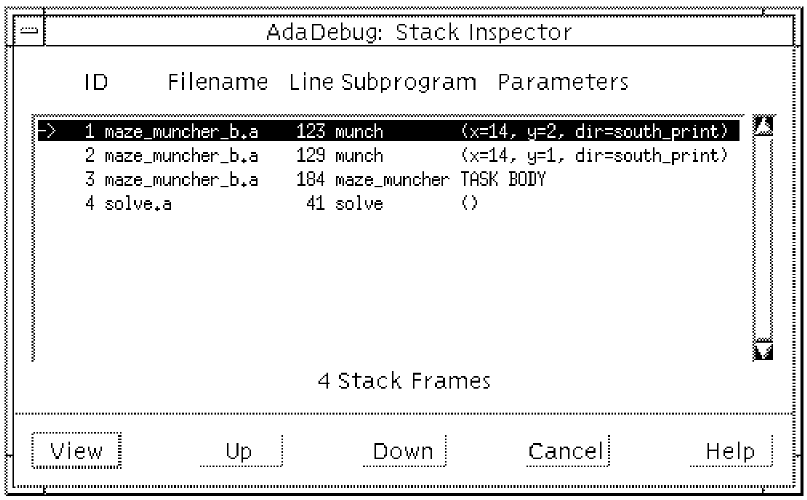
Also, `solve` draws another footprint in the maze.



`munch()` must be calling itself recursively at line 129. To check this hypothesis, bring up the Stack Inspector window.

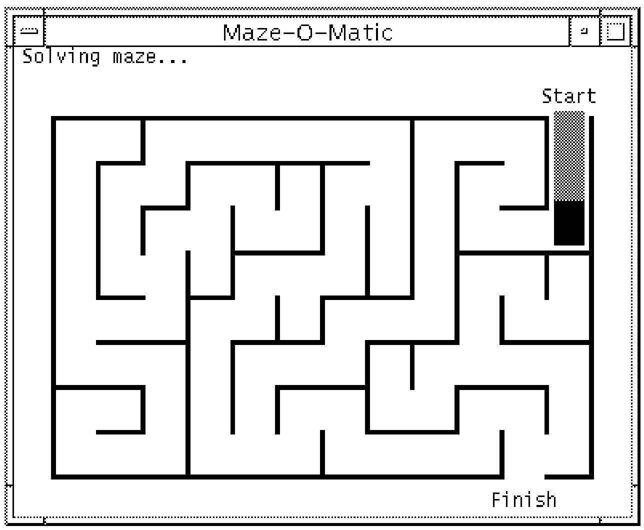
2.9 Stack Tracing

1. Choose Stack ➤ Inspector.



The Stack Inspector window display provides you with some key pieces of information. First, the top two entries on the stack are calls to `munch()`. Looking at the values of the parameters and comparing them to the location of the two footprints with respect to the maze—which is a 12 x 8 matrix—shows that the coordinates and the direction match perfectly.

2. **Click Next six times to step through the recursive lines of code again (lines 123 through 129, returning to 123) and see the third footprint appear in the maze.**



The new call also appears in the Stack Inspector.

3. **Select a word in line 123 and choose Breakpoint ➤ Clear At <*selected line*> (or click Clear) to remove the breakpoint at line 123.**

4. **Close the Stack Inspector window by clicking Cancel.**

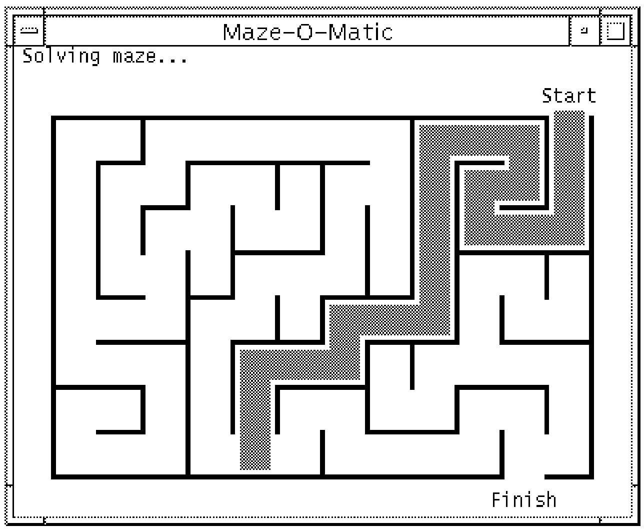
2.10 Setting a Breakpoint at `start_muncher()`

Maze footprints are not exploring all avenues (or "possibilities," as the code calls them) when coming to an intersection. To discover why, set the next breakpoint where the `start_muncher()` procedure begins (line 137).

1. **Double-click on a word in line 137 and choose Breakpoint ➤ Stop At <*selected line*> (or click Stop At).**

2. **Choose Execution ➤ Continue (or click Continue).**

The maze takes off this time, drawing footprints one after another until it reaches the first two-way intersection in the maze and stops.



`solve` must spawn two new maze muncher tasks here, sending one in each direction. The breakpoint set at the line containing `start_muncher()` has stopped the program just before it creates the new task munchers.

The maze fails here because when it reaches intersections it sends a muncher in one direction but not the other.

2.11 Evaluating Parameters

Evaluate the parameters of the `start_muncher()` procedure: `xx`, `yy`, and `possibilities(i)`.

1. **Drag the mouse to highlight the `xx` parameter in `start_muncher()` at line 137, then choose Data ➤ Evaluate <*selected expr*>.**

AdaDebug displays the value `6` in the message pane. Count six cells from the left. The `xx` coordinate is correct, but how is the `yy` coordinate?

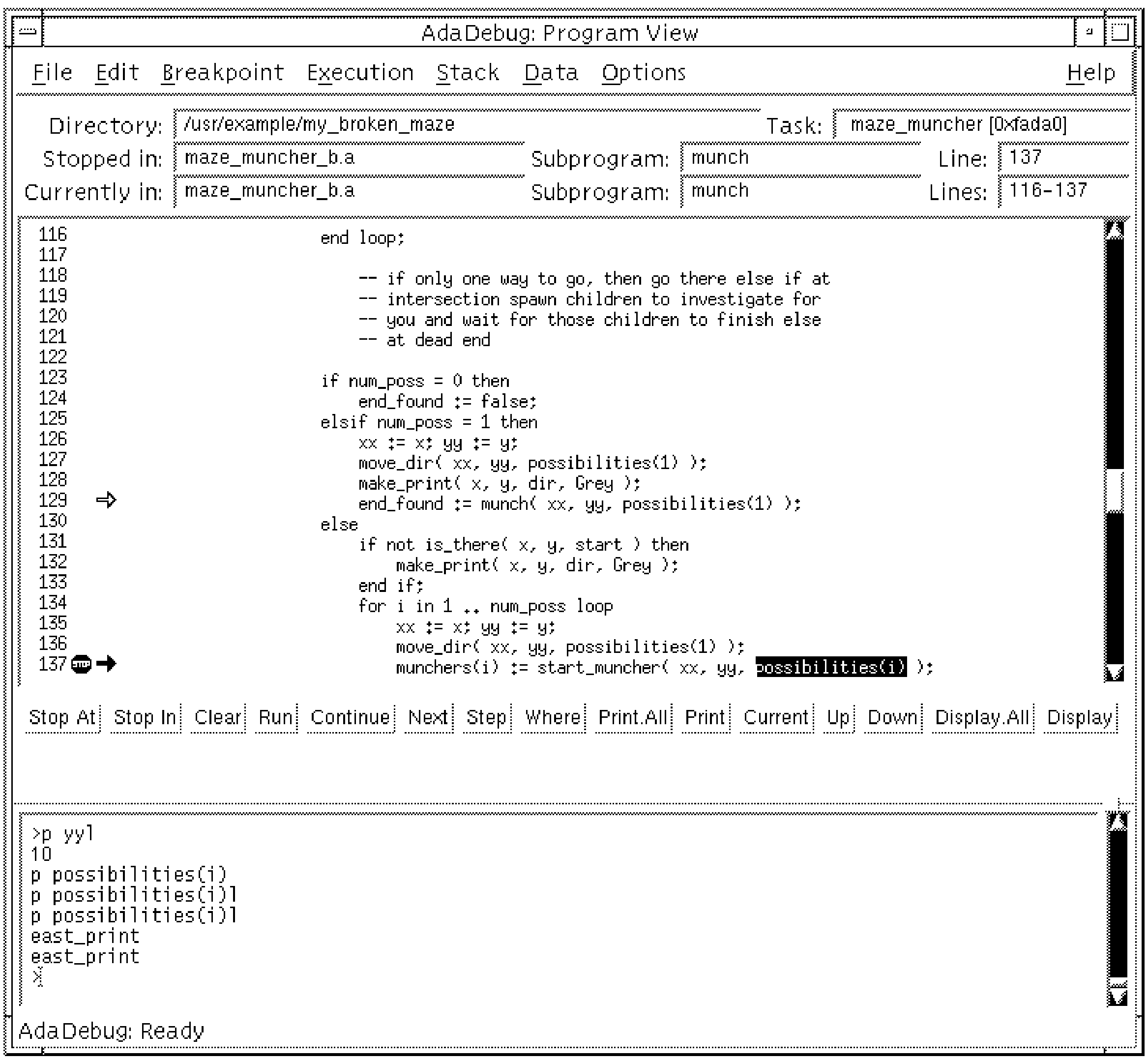
2. **Select the `yy` parameter, then choose Data ➤ Evaluate <*selected expr*>.**

The message pane shows that the value of `yy` is `8`. Eight is the bottom row in the matrix, so this value, too, is correct. What are the `possibilities(i)`?

3. **Highlight** `possibilities(i)` **and choose Data ➤ Evaluate <*selected expr*> again.**

   ```
   munchers(i) := start_muncher( xx, yy, possibilities(i) );
   ```

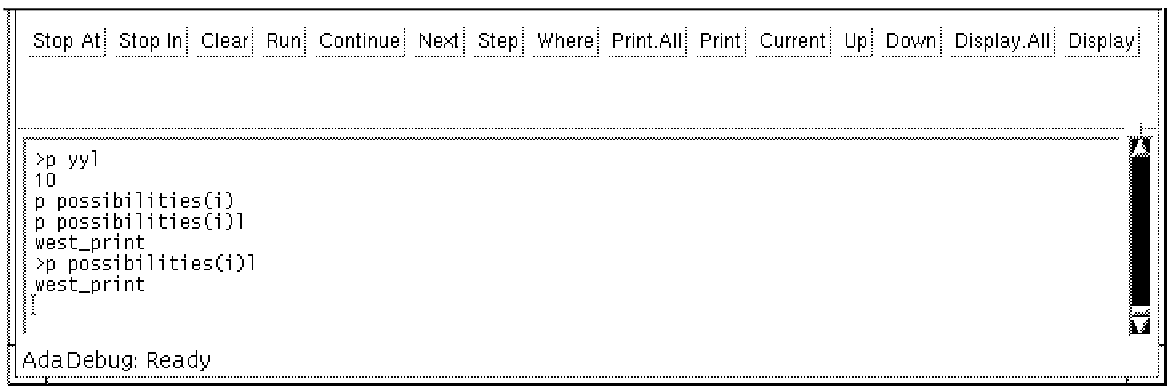
The message at the bottom of the window reports `east_print`. This value is also correct.



4. Choose Execution ➤ Continue (or click Continue).

Choosing Continue here at an intersection does not advance the maze. Instead, the program starts up a second maze muncher, and a second `maze_muncher` appears in the Task Inspector. This is the muncher that should go in the other direction, west. Test this by evaluating the arguments to `start_muncher()` for this second task.

5. Close the Task Inspector and repeat Step 1 through Step 4 to evaluate the `start_muncher()` parameters `xx`, `yy`, and `possibilities(i)`. The results are shown as follows:



The direction is not correct: `west_print` coordinates are the same for the first muncher. It appears that the second muncher is preparing to follow the first one. Why?

Look at the line above the `start_muncher()` call, to where the program calls `move_dir()`:

```
move_dir( xx, yy, possibilities(1) );
```

The parameter should be `possibilities(i)`, not `possibilities(1)`. There are four possible directions, not one. No wonder the task munchers travel in one direction when they come to an intersection: the `possibilities` variable in the `mov_dir` call was coded mistakenly as a constant.

♦ **Change `1` to `i`, and the program behaves correctly.**

2.12 Fixing Bugs From AdaVision

Shift back to AdaVision to edit and then re-make the library.

1. **Return to the AdaVision Unit View.**
2. **Double-click the icon for the** `maze_muncher` **body.**

AdaVision opens the body of the `maze_muncher` unit in your editor of choice.

3. **Go to line 136, which contains the call to** `mov_dir()`**, and edit the variable, changing** `1` **to** `i` **in the** `possibilities` **parameter.**
4. **Save the changes and quit the editor window.**
5. **Return to the AdaVision Unit View window and click in a blank area of the display pane to *deselect* the** `maze_muncher` **icon.**
6. **Choose Actions ➤ Make (or click Make) in the Unit View.**

AdaVision runs make on *all* of the units in the library. The job completes successfully.

7. **Select the** `solve` **executable by clicking it and then choose Actions ➤ Run (or click Run).**

In a moment Maze-O-Matic opens, along with a Program I/O window.

8. **Click in the Maze-O-Matic window to solve the maze.**
9. **After the program solves the first maze, click to generate a new maze, then click again to solve that maze.**

You have corrected the error and `solve` now solves each of the mazes correctly.

List of Steps for AdaDebug Tutorial A

This appendix contains a list of the steps in the AdaDebug portion (Chapter 2) of the tutorial. Having the steps in this format should make it easier to restart the AdaDebug tutorial session if you want to take the tutorial in more than one sitting or if you accidentally skip one of the steps.

1 Select the `solve` executable in the Unit View and choose Tools ➤ Debug (or click on the AdaDebug button).

2 Begin by scrolling halfway through the file to find parts of the code that might be relevant.

3 Double-click in line 41. The first word in the line is highlighted.

4 Choose Breakpoint ➤ Stop At <*selected line*> (or click Stop At).

5 Choose Execution ➤ Run (or click Run).

6 Click in the maze window to start the program solving the first maze.

7 Choose Execution ➤ Step (or click Step) to step into the `attack()` procedure.

8 Choose Execution ➤ Next (or click Next).

9 Repeat Next eight more times, advancing to line 206 and reading ahead a line or two before each step to analyze what is happening.

10 Choose Execution ➤ Step (or click Step) to step into the `start_muncher` function at line 21.

11 Choose Execution ➤ Next (or click Next) four times until reaching line 26.

12 Choose Execution ➤ Task Inspector to display each activated task in the Task Inspector window.

13 Select the maze_muncher task icon in the Task Inspector and click Open to open the task in a Task View window.

14 Choose Edit ➤ Find in the Task View.

15 Type `accept start` in the text field and click Forward.

16 Close the Find Pattern window.

17 Double-click on line 182 in the *Task View* window and choose Breakpoint ➤ Stop At <*selected line*> (or click Stop At).

18 Close the Task View window, but leave the Task Inspector open for later.

19 Choose Execution ➤ Continue (or click Continue) from the Program View.

20 Double-click on line 182 in the Program View and choose Breakpoint ➤ Clear At <*selected line*> (or click Clear).

21 Choose Execution ➤ Next (or click Next) *twice* to advance the current line pointer to line 184.

22 Choose Execution ➤ Step (or click Step) at line 184 to step into the start of the `munch()` function at line 70.

23 Scroll or click Next a few times to advance through the code, noticing the loop from lines 106 to 116.

24 Double-click on line 123 and choose Breakpoint ➤ Stop At <*selected line*> (or click Stop At).

25 Choose Execution ➤ Continue (or click Continue) to have the program advance to the breakpoint you just set at line 123.

26 Click Next five times. The fifth step executes the `make_print(x, y, dir Grey)` procedure (line 128), causing the first footprint to turn gray.

27	Click Next again to execute line 129.
28	Choose Stack ➤ Inspector.
29	Click Next six times to step through the recursive lines of code again (lines 123 through 129, returning to 123) and see the third footprint appear in the maze.
30	Select a word in line 123 and choose Breakpoint ➤ Clear At <*selected line*> (or click Clear) to remove the breakpoint at line 123.
31	Close the Stack Inspector window by clicking Cancel.
32	Double-click on a word in line 137 and choose Breakpoint ➤ Stop At <*selected line*> (or click Stop At).
33	Choose Execution ➤ Continue (or click Continue).
34	Drag the mouse to highlight the `xx` parameter in `start_muncher()` at line 137, then choose Data ➤ Evaluate <*selected expr*>.
35	Select the `yy` parameter, then choose Data ➤ Evaluate <*selected expr*>.
36	Select `possibilities(i)` and choose Data ➤ Evaluate <*selected expr*> again.
37	Choose Execution ➤ Continue (or click Continue).
38	Close the Task Inspector and repeat the last four steps to evaluate the `start_muncher()` parameters `xx`, `yy`, and `possibilities(i)`.
39	Return to the AdaVision Unit View.
40	Double-click the icon for the `maze_muncher` body.
41	Go to line 136, which contains the call to `mov_dir()`, and edit the variable, changing `1` to `i` in the `possibilities` parameter.
42	Save the changes and quit the editor window.
43	Return to the AdaVision Unit View window and click in a blank area of the display pane to *deselect* the `maze_muncher` icon.
44	Choose Actions ➤ Make (or click Make) in the Unit View.
45	Select the `solve` executable by clicking it and then choose Actions ➤ Run (or click Run).
46	Click in the Maze-O-Matic window to solve the maze.
47	After the program solves the first maze, click to generate a new maze, then click again to solve that maze.

Adobe PostScript