

Stitch Language Final Reportd

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Introduction

Most "modern" programming languages trace their origins back decades to before the advent of cheap, general purpose multicore CPUs. They were designed for a distinctly mono-threaded environment. While libraries and enhancements to mainstay languages such as C/C++ and Java have added multithreading capabilities, it remains in many ways bolted on kludge. While newer frameworks such as Node.js provide more integral support for asynchronous operations, they lack the depth of support and power of a fully compiled language. With Stitch, we aim to build a language that has the power and flexibility of a fully compiled C style language, while having native threading support for modern multithreaded applications. Our goal is to create a translator from Stitch to C.

Stitch is inspired by C, which has a very well known syntax, and has been one of the most widely used languages since it was released over forty years ago. Stitch is a general purpose language that supports all standard mathematical and logical operations. Like C, Stitch is strongly typed, and whitespace does not matter. In addition to the standard C primitive types (`int`, `double`, `char`, etc.)

Stitch is able to provide an easy to use, clear paradigm for multithreaded operations by strictly limiting when and how they can be invoked. This is done through the `stitch` loop. The body of this loop is automatically split into multiple threads, and the program will not continue until all threads have returned. Using a simple loop paradigm, similar to well know control structures like `while` and `for` loops, allows for an easy learning curve, and clear easy to read code. It also allows the compiler to easily see what code needs to be run in a threaded manner, and to efficiently generate the threaded code.

The underlying method by which Stitch runs multithreaded code is C's `pthread` library. The Stitch compiler will wrap the body of the `stitch` loop in a function. This function will be executed in parallel using `pthreads`. Variable scoping inside the threads is also handled by the compiler. Each threads is passed a C `struct` that contains all non-local variables needed by the block of code that is being multithreaded. This prevents clobbering issues without needing to resort to `mutex` locks. The only exceptions to this rule are accumulators, which are very limited in scope, and arrays, which can be sliced and piecewise accessed by different threads concurrently.

Language Tutorial

Running The Stitch Compiler:

When inside the ocaml folder, type *makeallinordertogeneratethestitchexecutable*. Running *./singer filename.stch* from the home directory will output a C program called *filename.stch.c* which gets compiled in *singer* with the appropriate C libraries and runtime headers into an executable of the same file name. *Singer* needs to be in the home directory in order to access the compiler executable and runtime headers correctly, if it needs to be moved then those directory accesses need to be updated.

Hello World

This is the popular "hello world" program written in Stitch. As can be seen below, it's almost identical to how it would be written in C, except without the `#include` statement and the syntax of the `print` function.

```
1 int main()  
2 {  
3     print("hello world");  
4     return 0;  
5 }
```

Matrix multiplication

If you want to use the multithreaded feature of Stitch, then simply use the stitch loop. Matrix multiplication is shown using the stitch loop below.

```
1 int main() {
2
3     int a[5][5] = { {1, 2, 3, 4, 5},
4                     {1, 2, 3, 4, 5},
5                     {1, 2, 3, 4, 5},
6                     {1, 2, 3, 4, 5},
7                     {1, 2, 3, 4, 5} };
8
9     int b[5][5] = { {1, 1, 1, 1, 1},
10                    {2, 2, 2, 2, 2},
11                    {3, 3, 3, 3, 3},
12                    {4, 4, 4, 4, 4},
13                    {5, 5, 5, 5, 5} };
14
15     int c[5][5];
16
17     int i = 0;
18     int j = 0;
19     int k = 0;
20
21     stitch i from 0 to 5 by 1: {
22
23         for(j = 0; j < 5; j = j + 1) {
24
25             for(k = 0; k < 5; k = k + 1) {
26
27                 c[i][j] = c[i][j] + a[i][k] * b[k][j];
28             }
29         }
30     }
31
32     for(j = 0; j < 5; j = j + 1) {
33
34         for(k = 0; k < 5; k = k + 1) {
35
36             print(c[j][k]);
37         }
38     }
39
40
41     return 0;
42 }
```

Language Reference Manual

Project Plan

Planning

We arranged weekly meetings with our language advisor Professor Edwards to discuss progress and issues that we countered. The immediate feedbacks we received from him were extremely helpful in the development of the language, especially when we were heading in the wrong directions. We had weekly meetings as well where all of us got together and worked on the project. During the meetings we split up the work, often two people working together on the same thing. Initially this worked really well since all of us were new with OCaml. Later, we divided up the work on an individual level such as implementing some functionality or writing some specific tests.

Style Guide

While programming our compiler we tried to follow these general guidelines:

- Ocaml style guidelines, such as indentation and formatting
- Tried to keep lines limited to 80 characters, if this wasn't possible due to unreadability, then we used 120 characters as the hard limit.
- Unlike Ocaml, we named variables in all lowercase and used underscores as a delimiter
- Used 4-space indentation for each program

Project Timeline

September 30 Proposal submitted

October 26 LRM submitted, scanner and parser with 1 shift/reduce error

November 16 Working scanner, parser, ast without arrays/stitch loops,
'Hello, Word' works

November 30 Finished semantic analyzer and cast

December 8 Finished c code generator with arrays added

December 14 Stitch loops working

December 21 Final Presentation

December 22 Code cleanup and Final Report submitted

Team Roles and Responsibilities

Rashedul Haydar	-	Manager
Tim Waterman	-	Language Guru
Dan Cole	-	System Architect
Megan Skrypek	-	Tester

While we had assigned roles, the responsibilities became much more fluid as the project progressed. During the initial planning phase we all discussed the structure and components of the language. Later on, we also worked together on the semantic analyzer, C generator, and the variety of tests used for the test suite.

Software Development Environment

- Version Control
 - Git
- Languages
 - OCaml (4.02.3) for parser, scanner, ast, semantic analysis
 - GCC for compiling generated C code
 - bash for test suite and singer
 - Python (2.7.5) for image curve generator
 - L^AT_EX for reports and documentation
- Text Editors
 - VIM
 - Sublime

Project Log

commit 14fcbbf36913eeba32454705951f590629df1ae1

Merge: f86f952 cd73bf1

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Mon Dec 21 12:27:34 2015 -0500

Merge branch 'master' of https://github.com/danhcole/4115_lang

commit f86f952f4ed913c92bc2b3d96d028ec7d1b554e7

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Mon Dec 21 12:27:29 2015 -0500

updated demo and presentation

commit cd73bf1546f50a0d761cd73c237e5adc6cd58935

Author: Tim Waterman <watermantium@gmail.com>

Date: Mon Dec 21 12:14:34 2015 -0500

Getting everything up pre-demo

commit 7726285bd6845f42de94c180d981660829932ac7

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Mon Dec 21 12:11:17 2015 -0500

updated presentation and demo

commit 219855f53fdf111f06eb251c678126fe991525fe

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Mon Dec 21 12:08:27 2015 -0500

updated presntation

commit e34dfe37af0d6b8e38d138b08e95f0495c3ced2f

Author: Rashedul Haydar <rh2712@columbia.edu>

Date: Mon Dec 21 11:09:20 2015 -0500

generated C for matrix multiplication added

commit e28346bb1af89c7959e2ea6309c3d4922651b9fc
Author: Rashedul Haydar <rh2712@columbia.edu>
Date: Mon Dec 21 10:56:32 2015 -0500

added matrix multiplication code

commit 6b9558e962acaa2f7a2ceb2dc585a72fce937bcb
Author: Tim Waterman <watermantium@gmail.com>
Date: Mon Dec 21 02:13:42 2015 -0500

Got demo to work with no C code cheats

commit 833ab002702eb5b56b652087165fb424dbae01cb
Author: Tim Waterman <watermantium@gmail.com>
Date: Mon Dec 21 01:27:49 2015 -0500

Starting testing with + accumulators

commit b8434f0eb623b9ffee29834955d6df9bd966c057
Author: Tim Waterman <watermantium@gmail.com>
Date: Mon Dec 21 00:14:15 2015 -0500

Stitch loop scoping issues worked out

commit 5c465f254dd3266f7dbe482ae6c451ccc9524c67
Author: Tim Waterman <watermantium@gmail.com>
Date: Sun Dec 20 23:57:31 2015 -0500

Made a better matrix mult test; updated sems

commit 6d19c76c540b35ba8814c9f3b703fa7d1d21a485
Author: Tim Waterman <watermantium@gmail.com>
Date: Sun Dec 20 21:50:28 2015 -0500

Added matmult output

commit 55d411d2608ceb6180e82de2e2401e7c34a48a90
Author: Tim Waterman <watermantium@gmail.com>
Date: Sun Dec 20 21:48:56 2015 -0500

Matrix multiplication test working

commit 7bd1175b3e6aa95bc47918a6811abbdea525ce94
Author: Tim Waterman <watermantium@gmail.com>
Date: Sun Dec 20 21:34:36 2015 -0500

Working on scoping issues

commit b1ba4625bbd4613eefc6ed4871e364a22cf7e29c
Merge: a978103 5a49906
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Dec 20 20:35:05 2015 -0500

Merge branch 'master' of https://github.com/danhcole/4115_lang

commit a9781034f1f1dd44de3ac97fe08fcf570818e847
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Dec 20 20:35:00 2015 -0500

added open_r and open_w

commit 5a49906dd846b14931a3e2c4aef86a73a58b0590
Author: Tim Waterman <watermantium@gmail.com>
Date: Sun Dec 20 20:32:14 2015 -0500

Finished matrix init -> stitch

commit c909820ba855fce2ca8a62a94dd186aa51d80197
Merge: 62cbf0a eca869c
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Dec 20 20:19:10 2015 -0500

Merge branch 'master' of https://github.com/danhcole/4115_lang

commit eca869cb0f88e9615b4e4cdad106c259a07fd181
Author: Tim Waterman <watermantium@gmail.com>
Date: Sun Dec 20 20:19:04 2015 -0500

Fixed 1D array init passing

commit 62cbf0a8d1c68cbbd8a7c67a1ce79ce00330a8c1
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Dec 20 20:19:02 2015 -0500

minor fix

commit 6455582db726d6f5dd7e2dc7df0a96c0031e9b53
Merge: 3d2ceff c16ede4
Author: Tim Waterman <watermantium@gmail.com>
Date: Sun Dec 20 19:57:53 2015 -0500

Merge branch 'master' of https://github.com/danhcole/4115_lang

commit 3d2ceffe122c54c3b87f5d878060b7644319a2cb
Author: Tim Waterman <watermantium@gmail.com>
Date: Sun Dec 20 19:57:51 2015 -0500

Finished stch_stmt checking

commit c16ede42f887a33020826c38f19451e1a7a8e96c
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Dec 20 19:56:27 2015 -0500

fixed paren issues

commit 1d273b474db7be10ec9c9ec3095e752ab28149a3
Merge: 4c6e669 8bd704e
Author: Tim Waterman <watermantium@gmail.com>
Date: Sun Dec 20 19:50:10 2015 -0500

Merge branch 'master' of https://github.com/danhcole/4115_lang

commit 4c6e669fa31ea9667d8a96b9670393b6c4e63fed
Author: Tim Waterman <watermantium@gmail.com>
Date: Sun Dec 20 19:50:08 2015 -0500

Added some more generator testing

commit 8bd704ed2da598867247fe681028b4bc72469083

Author: ms4985 <ms4985@columbia.edu>

Date: Sun Dec 20 19:43:46 2015 -0500

removed func3

commit 39eafcbec26b5abdf473b24a59bc6f7e56ed34bc

Merge: 78c76df 03244dd

Author: ms4985 <ms4985@columbia.edu>

Date: Sun Dec 20 19:42:43 2015 -0500

Merge branch 'master' of https://github.com/danhcole/4115_lang

commit 78c76dfd0801089d8f41cb25fb7708bd5d824ffb

Merge: 38d630a d30b9bf

Author: ms4985 <ms4985@columbia.edu>

Date: Sun Dec 20 19:42:36 2015 -0500

removed fib1

commit 03244dde2357d2cf0763b0c043d3ae3f7d54e9ec

Merge: 02836f8 d30b9bf

Author: Tim Waterman <watermantium@gmail.com>

Date: Sun Dec 20 19:41:43 2015 -0500

Merge branch 'master' of https://github.com/danhcole/4115_lang

commit 02836f8476fb79c41b6b85fba37f56e69919eae5

Author: Tim Waterman <watermantium@gmail.com>

Date: Sun Dec 20 19:41:41 2015 -0500

Fixed array passing bug

commit 38d630a36e0cbbce22473bd3a30475b78f4e98c5

Author: ms4985 <ms4985@columbia.edu>

Date: Sun Dec 20 19:41:21 2015 -0500

added tests

```
commit d30b9bf0e270d8143e2113eaeafb791ebbd8ef2c
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Dec 20 19:39:52 2015 -0500
```

```
    minor fix on 4
```

```
commit f515cf5f229418bef8d9530c1f65ef907ad88c38
Merge: 7fb08e9 200acf2
Author: Tim Waterman <watermantium@gmail.com>
Date: Sun Dec 20 19:27:28 2015 -0500
```

```
    Merge branch 'master' of https://github.com/danhcole/4115
    _lang
```

```
commit 7fb08e934101b3837ee3d105ac06d42357ae54a9
Author: Tim Waterman <watermantium@gmail.com>
Date: Sun Dec 20 19:27:18 2015 -0500
```

```
    2D arrays are working
```

```
commit 200acf257512624f312e6bd58b5b74ccf6a4d1ee
Merge: c36a877 aaaa5ce
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Dec 20 19:07:28 2015 -0500
```

```
    Merge branch 'master' of https://github.com/danhcole/4115
    _lang
```

```
commit c36a8772a17c1a1774704f8b9b2aa472199d955a
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Dec 20 19:07:21 2015 -0500
```

```
    recursion wont work
```

```
commit aaaa5ce4829084dcf6751e96cfd8360031d7a5e2
Author: Rashedul Haydar <rh2712@columbia.edu>
Date: Sun Dec 20 18:38:27 2015 -0500
```

```
    added _ntests/array3.stch, array4.stch, and matrixinit2.stch
```

```
commit 9957b7448d9e6fa3427d38785ee8a6a7da5b6634
```

Author: Rashedul Haydar <rh2712@columbia.edu>

Date: Sun Dec 20 17:47:41 2015 -0500

added _tests/fib1.stch

commit 9847733e91ccd9d62bd444f8085ba6821f5b057a

Merge: 588cc44 515be64

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Sun Dec 20 17:43:42 2015 -0500

Merge branch 'master' of https://github.com/danhcole/4115_lang

commit 588cc44363e5e2809436a3b4baf4dfa90efe1f39

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Sun Dec 20 17:43:39 2015 -0500

fixed recursion

commit 515be640f660365dd4ef70a62865a9f9bb9e7322

Author: Tim Waterman <watermantium@gmail.com>

Date: Sun Dec 20 17:43:14 2015 -0500

Can print locals in stitch loops

commit 0fcd77f0c164c463a99f1166662419b806c35141

Merge: 89b2f31 aceffe8

Author: Rashedul Haydar <rh2712@columbia.edu>

Date: Sun Dec 20 17:36:47 2015 -0500

Merge branch 'master' of https://github.com/danhcole/4115_lang

commit 89b2f31208a2116d9b3af94c7da2537a77580f42

Author: Rashedul Haydar <rh2712@columbia.edu>

Date: Sun Dec 20 17:36:34 2015 -0500

added _/tests/func4 and func5.stch

commit aceffe8260737f1a83e5ce8c40f0efda6fe3fbe1

Merge: 02d3734 3c88e1c

Author: Tim Waterman <watermantium@gmail.com>

Date: Sun Dec 20 17:34:58 2015 -0500

Merge branch 'master' of https://github.com/danhcole/4115_lang

commit 02d37343356e0b50624e7996a9b83e2d3d961eda

Author: Tim Waterman <watermantium@gmail.com>

Date: Sun Dec 20 17:34:51 2015 -0500

More code gen

commit 3c88e1c76fa14e81cc087364f249c83e50143ace

Author: ms4985 <ms4985@columbia.edu>

Date: Sun Dec 20 17:34:19 2015 -0500

renamed gcd added stitch4 output txt

commit 8c3fbe3a7588c1715967ac2e278e3273988016f9

Merge: 5f94a5a fa7c23e

Author: Tim Waterman <watermantium@gmail.com>

Date: Sun Dec 20 17:23:19 2015 -0500

Fixing the merge

commit 5f94a5a12f071674e2943f908bbc0d6f2ef3cf55

Author: Tim Waterman <watermantium@gmail.com>

Date: Sun Dec 20 17:21:18 2015 -0500

Stitch statement parsing overhaul

commit fa7c23ed6dbfc50cca96c6bc445591c2fd7d9f43

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Sun Dec 20 16:58:46 2015 -0500

fixed .gitignore; char can now cast to int

commit 2e19c6d01c184a93898a82205a152202a2018bdd

Author: ms4985 <ms4985@columbia.edu>

Date: Sun Dec 20 16:55:05 2015 -0500

```

    fixed escaped characters

commit 50a5d3ee12a1a96f4d5db00ea87fa9e26017f428
Author: Rashedul Haydar <rh2712@columbia.edu>
Date:    Sun Dec 20 16:49:34 2015 -0500

    updated all tests to have correct return statements

commit 0354d0c3b716d48a1d5d6eea3f619d12e726c6ea
Merge: 7413e98 3fe7525
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date:    Sun Dec 20 16:33:15 2015 -0500

    Merge branch 'master' of https://github.com/danhcole/4115
    _lang

commit 7413e982270eb9db48be5ca875d06a15445df65b
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date:    Sun Dec 20 16:32:57 2015 -0500

    check for return on non-void function

commit 3fe7525d89f8244769ddcc90b9679dc962286068
Author: Rashedul Haydar <rh2712@columbia.edu>
Date:    Sun Dec 20 16:01:57 2015 -0500

    added _ntests/vardecl1.stch, cant identifier starting with _
    or a number

commit 1446057a4c0c33c04434dd7ca02b9257908a0a92
Merge: 29c3e59 1895079
Author: Tim Waterman <watermantium@gmail.com>
Date:    Sun Dec 20 15:33:05 2015 -0500

    Merge branch 'master' of https://github.com/danhcole/4115
    _lang

commit 29c3e594d2e8672ea9c39be374bb5732efdd314b
Author: Tim Waterman <watermantium@gmail.com>
Date:    Sun Dec 20 15:32:59 2015 -0500

```

```

    Fixed issue with var being removed too late from stitch

commit 1895079fa4b0a460c0d2166d24d01f3984784322
Author: Rashedul Haydar <rh2712@columbia.edu>
Date:    Sun Dec 20 15:25:49 2015 -0500

    added _tests/for1.stch

commit 350b17670a0b795902fc008094bc429d8aadf3b3
Merge: c79809b 1c46608
Author: Tim Waterman <watermantium@gmail.com>
Date:    Sun Dec 20 15:15:51 2015 -0500

    Merge branch 'master' of https://github.com/danhcole/4115
    _lang

commit c79809b7070dc507bd5c00756504e8cddecf12562
Author: Tim Waterman <watermantium@gmail.com>
Date:    Sun Dec 20 15:15:46 2015 -0500

    Adding gen stuff

commit 1c46608678604b7a6c09626205e00d62ee22f28c
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date:    Sun Dec 20 15:05:06 2015 -0500

    fixed function ordering problem

commit ccae33c4a21f924abac64ed695b8e6298581147f
Author: Tim Waterman <watermantium@gmail.com>
Date:    Sun Dec 20 14:59:01 2015 -0500

    Working on stitch loop verification

commit c447d69eb709f5becdfff2f0d500e609603df306
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date:    Sun Dec 20 14:39:08 2015 -0500

    updated presentation and demo

commit 492a1ce0c48c369b9681892acd891d6bb950395e

```

Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Dec 20 13:56:02 2015 -0500

added presentation pdf

commit 655acdd240fe5ef42ebb6b6f3859f9f9807d0b6a
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Dec 20 13:55:24 2015 -0500

updated file2 test

commit 3954666f247f91a72988b0b63b457b63a66dbce9
Merge: 6a93ff4 2a5a23a
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Dec 20 13:54:58 2015 -0500

merge conflict

commit 6a93ff45d27458df206a0dea2cb3cbfe64a61820
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Dec 20 13:53:42 2015 -0500

updated presnetation, file tests

commit 2a5a23a7d8781a1aced8576bfac4da22477cfae0
Author: ms4985 <ms4985@columbia.edu>
Date: Sun Dec 20 02:18:58 2015 -0500

added more tests

commit 0d603b1e8406269ede1fc9a6ea4d6b714a4fa53d
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sat Dec 19 23:06:32 2015 -0500

file IO works

commit 2557e441e0b3a4cc0c92b1d6a08ca9cadfb19c8a
Author: Rashedul Haydar <rh2712@columbia.edu>
Date: Sat Dec 19 21:26:09 2015 -0500

added _ntests/arith3.stch, checks that you cant add chars to

```

    ints. Added _ntests/func2.stch, funcs w/o return type cause
    error.

commit 0cd0268a41ddbccc67a8f5bb21ffc17ef5f168fc3
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sat Dec 19 19:14:51 2015 -0500

    updated gitignore

commit e2b2651405022319038790b7ad8ef7e4fa22db72
Merge: 58aa1b4 443c22f
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sat Dec 19 19:13:18 2015 -0500

    Merge branch 'master' of https://github.com/danhcole/4115
    _lang

commit 58aa1b46b935835ab04af99604a6dc27c602fe35
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sat Dec 19 19:13:15 2015 -0500

    added FILE type

commit 443c22fd1528c3b2999c3d0a55d94f12f474443d
Author: Tim Waterman <watermantium@gmail.com>
Date: Sat Dec 19 19:08:05 2015 -0500

    More things now get screened before the struct

commit aae955dc54a06202de85586105c8ec2938e24a8e
Merge: eff5c5e d82e06d
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sat Dec 19 18:43:23 2015 -0500

    Merge branch 'master' of https://github.com/danhcole/4115
    _lang

commit eff5c5ea368de4d4899219c3aa1b13a52c74bb02
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sat Dec 19 18:43:05 2015 -0500

```

```
    added 2nd image for presentation , added new if test

commit d82e06d6b78ffba3105b7e9d97e94d9b18eb5e48
Author: Tim Waterman <watermantium@gmail.com>
Date:   Sat Dec 19 18:42:36 2015 -0500

    Local stitch variables should not be put inside the struct
    now

commit 97eb3628befb3c8785eaf214599c6554fec22d84
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date:   Sat Dec 19 18:14:55 2015 -0500

    added presentation files

commit 067fe06aebdbd31d572c7e9a9471a21dfe4b2c91
Author: Rashedul Haydar <rh2712@columbia.edu>
Date:   Sat Dec 19 17:21:07 2015 -0500

    no more CONST and NULL in our language , also added global
    variable negative test

commit 66b262cfb5e01506bc9a449168e25e623b254d75
Author: Rashedul Haydar <rh2712@columbia.edu>
Date:   Sat Dec 19 16:39:59 2015 -0500

    break works , tested in _tests/break1.stch

commit 3736edbef0dc5ff3df06cf3931f17a9ee63056f0
Author: Tim Waterman <watermantium@gmail.com>
Date:   Sat Dec 19 16:08:16 2015 -0500

    Closer to getting array passing

commit 8f9e8967ffe7a06afa88f83b89ca0d90453f793a
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date:   Sat Dec 19 15:50:30 2015 -0500

    fixed unmatched accumulator tokens

commit 83bd3d36ae7130ec9160026054692aea835c8c2f
```

Author: Rashedul Haydar <rh2712@columbia.edu>

Date: Sat Dec 19 15:49:03 2015 -0500

added mod operator to ops1.stch, checked logical operators in
ops2.stch

commit 32662a7565735324058e8c84c7b2ed6405d0d3df

Merge: a5c3d93 7280502

Author: Tim Waterman <watermantium@gmail.com>

Date: Sat Dec 19 15:31:00 2015 -0500

Merging changes

commit a5c3d9353644b6884ab83be67ab67a370004ff81

Author: Tim Waterman <watermantium@gmail.com>

Date: Sat Dec 19 15:30:51 2015 -0500

Arrays are passing through

commit 7280502f0656cc75d20a6793279e7ff3e722897b

Merge: 40f096c a51ed05

Author: ms4985 <ms4985@columbia.edu>

Date: Sat Dec 19 15:24:34 2015 -0500

Merge branch 'master' of https://github.com/danhcole/4115_lang

commit 40f096ce70eae7a48b09365befa0659c2d428d65

Author: ms4985 <ms4985@columbia.edu>

Date: Sat Dec 19 15:24:24 2015 -0500

added negative print test

commit a51ed052e8f8ddc8c70f0c7523e9e0464d4727c5

Author: Rashedul Haydar <rh2712@columbia.edu>

Date: Sat Dec 19 15:21:23 2015 -0500

added _ntests/float1.stch, fails with multiple decimals in
floating points

commit 60e63537836e38c965420a8279f50bfa699b3f80

Author: Tim Waterman <watermantium@gmail.com>
Date: Sat Dec 19 14:22:24 2015 -0500

Passing arrays into multithreaded apps working 50%

commit dc56ccfb9de14951ef1a494f96db0088c21d75bf
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Fri Dec 18 18:24:25 2015 -0500

added accumulator types intap, intam floatap floatam

commit df57730b475a7471e135f494c4a9afd1cc3b8ec5
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Fri Dec 18 14:32:14 2015 -0500

fixed a testing issue

commit 11079547757834808d3e19b46d78deb6ae0b7877
Merge: b738f24 9fcef18
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Fri Dec 18 13:44:47 2015 -0500

fixed merge conflict in stitch3_out.txt

commit b738f24919d8724e864fa1f58955760b32668df7
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Fri Dec 18 13:43:47 2015 -0500

potential merge conflict

commit 9fcef180124171ce21c9d27bf58f191538457163
Author: Tim Waterman <watermantium@gmail.com>
Date: Fri Dec 18 11:09:03 2015 -0500

Passing variables into stitch

commit 3d587d1264a84e7a586ce82829da6d95dcb2bad8
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Fri Dec 18 00:21:10 2015 -0500

fixed ordering on stitch2func matching

commit 96864c17443d2f972286b0a3724af83ffcd965bd
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Dec 17 23:48:53 2015 -0500

really added tests

commit 95cfc40432d3caf3e740a466bf44427c9b54b5ae
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Dec 17 23:46:55 2015 -0500

nested stitch loops work; added stitch tests 3 - 6

commit 2900c7f1c23a728b60e616407df48721046b868a
Author: Tim Waterman <watermantium@gmail.com>
Date: Thu Dec 17 23:17:24 2015 -0500

Stitch test 2 output fixed

commit a3537de8df1f2357baa55e2d8157d733785d79bf
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Dec 17 23:16:59 2015 -0500

fixed invalid return, fixed non-block stitch issues

commit 1aa8fd9f41f3b8cfc60d4d0716404e6b3bfa80aa
Author: Tim Waterman <watermantium@gmail.com>
Date: Thu Dec 17 23:10:00 2015 -0500

Working on multiple stitch loops

commit 081dc99c0659dd4a6f652a32d0e57f5bc6918f95
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Dec 17 23:09:40 2015 -0500

updated stitch2_out

commit 24a32f26e74a09b81f22ad720380f362d98200a1
Merge: f7318f8 93e2ac7
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Dec 17 23:03:58 2015 -0500

merge fix

commit f7318f8d4fd5ef755a7d7e7c753c5a0a861ee2a2
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Dec 17 23:02:52 2015 -0500

updated tests

commit 93e2ac70401a32852dbf28a6c4aa45e2ba4508db
Author: Tim Waterman <watermantium@gmail.com>
Date: Thu Dec 17 23:02:27 2015 -0500

Added multiple threadpools

commit ec977e821cfb62b6fb0bd8eae89fc4b289637494
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Dec 17 22:45:44 2015 -0500

removed struct/access; cleaned up old code

commit 503f05282e3f4493873eccbb92a2277b35046d97
Author: Tim Waterman <watermantium@gmail.com>
Date: Thu Dec 17 22:37:57 2015 -0500

Fixed stitch loops with fnames

commit 847bb3dc7381561e48c479054c71257c41b266e3
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Dec 17 22:34:10 2015 -0500

stch func naming works

commit d12ff2fa167e3016acb45fa3d5cf6377fd27bab6
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Dec 17 22:25:49 2015 -0500

updating stch func gen

commit d4acce8abd070fe0795ca20a08ecea821828dab6
Author: Tim Waterman <watermantium@gmail.com>

Date: Thu Dec 17 22:24:53 2015 -0500

Reworked structs to access stitch variables

commit 5408089ef6734ef9c569f425aa10f316a1b54045

Author: Tim Waterman <watermantium@gmail.com>

Date: Wed Dec 16 14:08:58 2015 -0700

Its going through syntactically, need to get variables passed in from headers

commit 64e35c5bfd99f33d705cd78041d642907d736c9d

Author: Tim Waterman <watermantium@gmail.com>

Date: Wed Dec 16 13:51:47 2015 -0700

Changing names correctly sometimes. Still not general enough

commit 747815f55365df192317f9c8a91e4697001cf050

Author: Tim Waterman <watermantium@gmail.com>

Date: Tue Dec 15 10:35:39 2015 -0500

Adjusted the variables in the generated for loops to be general

commit fc59e0265f8298ab26ba60417a6db8edca7acb95

Author: Tim Waterman <watermantium@gmail.com>

Date: Tue Dec 15 10:26:29 2015 -0500

Added thread blocking. Im an idiot

commit 5faf89299826880b76d63d469365b98e1a370395

Author: Tim Waterman <watermantium@gmail.com>

Date: Mon Dec 14 23:59:11 2015 -0500

Done for tonight

commit 91111abcda95102d45379e3d55fce9ba2d9b3f89

Author: Tim Waterman <watermantium@gmail.com>

Date: Mon Dec 14 23:50:07 2015 -0500

Still working on accessing passed in vars

```
commit ed3d01241778a94fcc5fb2912f542c84030f7fce
Author: Tim Waterman <watermantium@gmail.com>
Date: Mon Dec 14 23:29:43 2015 -0500
```

Need to figure out how to change the names of the variables in the stitch loops statement list

```
commit a051d852d2ab208436e673a6ec66e1a2e8f2a3af
Author: Tim Waterman <watermantium@gmail.com>
Date: Mon Dec 14 22:46:43 2015 -0500
```

Started to get threaded stitch working. Threadcount is a little wonky

```
commit 4b5101dbf24f5099115cf3a9a34b610f20818e02
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Dec 13 19:04:34 2015 -0500
```

stitch body now turns into a function, still need to get the nameing down

```
commit d523668973ee4357d92582fe0aa1abf91f3f8991
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sat Dec 12 20:50:04 2015 -0500
```

redid the way that stitch funcs are passed, still need to generate the functions in the c_gen

```
commit 06ff138f3564f568a93df0d64a531eabb7542268
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Sat Dec 12 14:20:03 2015 -0500
```

Update README.md

```
commit d45dd0e7e39b0075f69b07dfac6e04547537ad11
Author: Tim Waterman <watermantium@gmail.com>
Date: Fri Dec 11 23:44:27 2015 -0500
```

Started stitch->for code generation

```
commit 77bd9795055f04e9afc69cbd2b7f99577716da07
Merge: 05e6fbb bce1cd4
Author: Tim Waterman <watermantium@gmail.com>
Date:   Fri Dec 11 21:43:51 2015 -0500
```

Merging with dans changes

```
commit 05e6fbb5b5b9300a1abcd9b06e7100b22b1f83be
Author: Tim Waterman <watermantium@gmail.com>
Date:   Fri Dec 11 21:43:48 2015 -0500
```

Started work on for loop generation

```
commit bce1cd4399d50deff099affeee6f48fba0719002
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date:   Fri Dec 11 21:21:47 2015 -0500
```

little to no progress on the stch funcs

```
commit 4ed3f45d1f620971673d20dcfab4ac7545eece87
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date:   Fri Dec 11 20:20:06 2015 -0500
```

still working on stitch funcs

```
commit a23221534f8b6f860e571e88a4793dff2df32f70
Merge: 1ed3d07 1dff7ec
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date:   Fri Dec 11 17:23:56 2015 -0500
```

Merge branch 'master' of https://github.com/danhcole/4115_lang

```
commit 1ed3d07b8e35de80116f300f5d6f2c9fb57c3571
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date:   Fri Dec 11 17:23:53 2015 -0500
```

added stch_funcs

```
commit 1dff7ec6565c32c511260eb196435f15968e7d29
Author: Tim Waterman <watermantium@gmail.com>
```

Date: Fri Dec 11 11:53:23 2015 -0500

Finished matrix init. Need to remove debug statements later

commit 9c032762654796bff9347609ac1f218cb6ad8f47

Merge: a905ad3 952e6d6

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Thu Dec 10 19:47:33 2015 -0500

Merge branch 'master' of https://github.com/danhcole/4115_lang

commit a905ad3de0802fe63588b511849e7475713dfa96

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Thu Dec 10 19:47:28 2015 -0500

updated some tests, fixed list rev issue

commit 952e6d66e6601f9263c9cc39d1a95c190cca605d

Author: Tim Waterman <watermantium@gmail.com>

Date: Thu Dec 10 19:46:54 2015 -0500

Matrix init working 90%. Working on typechecking

commit 7163ee62b65f8b609cb7ad5face70e4bc61a5d38

Author: Rashedul Haydar <rh2712@columbia.edu>

Date: Thu Dec 10 19:43:00 2015 -0500

added negate2 and negate3.stch

commit 148ca6dc15be4eb4eae58d011e4c78d2e4105729

Author: ms4985 <ms4985@columbia.edu>

Date: Thu Dec 10 19:41:23 2015 -0500

fixed recl test

commit 3e1db6e827105d913f01ef45877adc34db0f83f8

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Thu Dec 10 19:24:40 2015 -0500

removed microc binary

commit ab1a394db56d434412ecd96343a0c8a30b2b4564
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Dec 10 19:23:47 2015 -0500

fixed snafu

commit 744381b513e3ba3fa008c3e99bb76901fed54b68
Author: ms4985 <ms4985@columbia.edu>
Date: Thu Dec 10 19:16:44 2015 -0500

added stitch and rec tests

commit a052841944b13bebaa4b6cd148d9efc5cbd409f8
Author: Rashedul Haydar <rh2712@columbia.edu>
Date: Thu Dec 10 19:16:01 2015 -0500

added more tests

commit 4c9136b74b462cffa92ad6245ae75e5c0e9d20ca
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Dec 10 19:12:56 2015 -0500

working on stitch loops

commit f3cca0c68daf4fe582005673f22ca4c393c45cd4
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Dec 10 18:42:04 2015 -0500

updated stitch test

commit bb69889b8a08cb305318f24ab411627cb6bdc818
Merge: 4fc0380 9d063bc
Author: ms4985 <ms4985@columbia.edu>
Date: Thu Dec 10 18:39:12 2015 -0500

Merge branch 'master' of https://github.com/danhcole/4115_lang

commit 4fc038006a974131c958da7ac365a53c4e54aa7c
Author: ms4985 <ms4985@columbia.edu>

Date: Thu Dec 10 18:39:00 2015 -0500

added stitch loop test

commit 9d063bc7cbea95c3489fd2e65f78f4fb26105509

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Thu Dec 10 18:38:29 2015 -0500

stitch loops redone in cast/analyzer/generator

commit e42e03b0b7c0c8e89400d1f2ecbd35d9b415da56

Merge: 4a3e470 20b60c4

Author: Tim Waterman <watermantium@gmail.com>

Date: Thu Dec 10 16:50:20 2015 -0500

"Merging with the syntax changes"

commit 4a3e4705a2f8cb2eb032cb79fe769ce545e03ebf

Author: Tim Waterman <watermantium@gmail.com>

Date: Thu Dec 10 16:49:59 2015 -0500

Added matrix checking. Now only init is missing

commit 20b60c4d0df664954390b5fda8bb422fada8255e

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Thu Dec 10 14:18:26 2015 -0500

fix minor formatting

commit a449e53de6a31c9e6cf93e14dc00732152145260

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Thu Dec 10 14:11:11 2015 -0500

fix conflict

commit a0e0636fcffbb966df1f9ef0f8019a9e97da48a7

Merge: f85e09e 209b7ed

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Thu Dec 10 14:08:03 2015 -0500

Merge branch 'master' of <https://github.com/danhcole/4115>


```

_lang

commit f85e09eeeb95251cfda76330ac68dd55a716df6a
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Dec 10 14:07:13 2015 -0500

    bit of code cleanup in the sem-an, make it a bit more
    readable

commit 209b7edfb790ec5b8e94cfe3e40b6c121f2e8906
Author: Tim Waterman <watermantium@gmail.com>
Date: Thu Dec 10 13:47:37 2015 -0500

    Array assignment in . 1D arrays should work 100% now

commit 121ba6810a11910ca7f1ca581c9f45773ad98edb
Merge: d55cb3b 0948ea2
Author: Tim Waterman <watermantium@gmail.com>
Date: Thu Dec 10 13:16:10 2015 -0500

    Fixed merging issues

commit d55cb3b258de506e980ff64067fa72bb39726d1e
Author: Tim Waterman <watermantium@gmail.com>
Date: Thu Dec 10 13:12:07 2015 -0500

    Fixing matching issue with arrays; error messages not
    accurate

commit 0948ea2b5805d2856e43f584aa6df84dd89d124c
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Wed Dec 9 18:09:11 2015 -0500

    questions about matching

commit 10cd1cb8fba3f2dfcbed3e071a71e9d21d096bf6
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Wed Dec 9 17:17:09 2015 -0500

    test suite now echos total number of tests and how many
    passed

```

commit 68326e9c504acff661b2ad5bb384d5b3bc4b2d2e
Merge: cd26dcf ae9e8b6
Author: Tim Waterman <watermantium@gmail.com>
Date: Wed Dec 9 16:21:40 2015 -0500

Pushing the negative array tests after merge

commit cd26dcf1753f24f1ba0ce9216aee5f0bc43bf0ce
Author: Tim Waterman <watermantium@gmail.com>
Date: Wed Dec 9 16:21:30 2015 -0500

Pushing array negative tests

commit ae9e8b6eba22a76202dfcc73b03e546af22ad511
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Tue Dec 8 18:47:54 2015 -0500

minor commenting

commit 28ec92af50354d748234b76847a993123e5a9e6a
Author: Tim Waterman <watermantium@gmail.com>
Date: Tue Dec 8 16:35:29 2015 -0500

Added size checking for array init

commit a88a2a4d696ee1ec8464ab4bec5a80056c8a451a
Author: Tim Waterman <watermantium@gmail.com>
Date: Tue Dec 8 15:55:32 2015 -0500

Array initialization working

commit b116aa4bd0ee75feec5a11df97bbe1ddd93c0112
Merge: e052491 aadd3b9
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Tue Dec 8 14:14:47 2015 -0500

Merge branch 'master' of https://github.com/danhcole/4115_lang

commit e052491cdb41118329d8f028314fb300d3c2c5de

Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Tue Dec 8 14:14:40 2015 -0500

added exit() + tests; added commenting tests

commit aadd3b987c848a1fc97d17524376ff6d3519bed6
Author: Tim Waterman <watermantium@gmail.com>
Date: Tue Dec 8 14:05:32 2015 -0500

Added array indexing to the print statement

commit 17e1a695296b3dd1cb19110b1a1d4a81678a3f64
Author: Tim Waterman <watermantium@gmail.com>
Date: Tue Dec 8 13:57:00 2015 -0500

Added in array indexing expressions. Need to add them to
print

commit 93272f2330e441ac28906db16dab3067503dacd6
Author: Tim Waterman <watermantium@gmail.com>
Date: Mon Dec 7 23:04:52 2015 -0500

Added more array items. Working on 1D array init

commit 05ca28f77603d036ed9b4adf9023c473926e9fff
Author: Tim Waterman <watermantium@gmail.com>
Date: Mon Dec 7 21:18:18 2015 -0500

Added two dimension array decls, working all the way through

commit 39a8a4d403c7083a6049569b97a7f7ae9ae4dd88
Merge: 73bc7ff 3527842
Author: Tim Waterman <watermantium@gmail.com>
Date: Mon Dec 7 19:06:26 2015 -0500

Merge branch 'master' of https://github.com/danhcole/4115_lang

commit 73bc7ff3374bf6492fd0cc24ce4f342e03ac1914
Author: Tim Waterman <watermantium@gmail.com>
Date: Mon Dec 7 19:06:15 2015 -0500

```

    One dimensional array declarations working, parse->print

commit 3527842aa87c50070f6b76ddafc6768e548479e7
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date:   Mon Dec 7 17:17:26 2015 -0500

    file cleanup for negative tests

commit 9b083ee0ff021608921800c4a355de2f901db6dc
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date:   Mon Dec 7 17:17:12 2015 -0500

    updated negative tests

commit 6470897bd762270847c1f1768906851d6d57b5f8
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date:   Mon Dec 7 17:03:00 2015 -0500

    test suite works with negative testing (goes in _ntests);
    updated headers

commit 8f0482eb4b19acd7a8a4c8e6e758a2541703a7b4
Author: Daniel Cole <dhc2131@columbia.edu>
Date:   Mon Dec 7 16:24:01 2015 -0500

    Update README.md

commit 5ca219aa8fa3b010b76f13087198ee7baf54a2ae
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date:   Sun Dec 6 17:28:30 2015 -0500

    error() added Stitch. Added hello2 test to confirm this

commit cf3e7898576149a1d37a52f30a36cc898e13a460
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date:   Sun Dec 6 17:08:57 2015 -0500

    print works

commit bbd481ecf6e544fb3d6796b30f75ef1c6dc22f93

```

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Sun Dec 6 16:35:05 2015 -0500

print works for int, float, char, string, id; does not work
for other expr

commit 6f52d3db9df12d425aeb0a7686579766afbde676

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Sat Dec 5 17:37:09 2015 -0500

print works for ints now, updated all tests accordingly

commit 8049b3dc74d171068c6b6c79cafaf272c7013caf

Author: Tim Waterman <watermantium@gmail.com>

Date: Fri Dec 4 22:02:46 2015 -0500

Quick fix for if statements. Need to rethink how we print

commit d8cb215629af8f4eb180de00cfb578b91f9ebd0d

Author: Tim Waterman <watermantium@gmail.com>

Date: Fri Dec 4 21:41:55 2015 -0500

Fixed the stitch compiler chain, started adding print

commit 25791cdb3d156e9bc3e21b729222013338243af5

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Fri Dec 4 13:49:11 2015 -0500

working on c_call - find_func_sig working (?)

commit d514d8c32ea80308150b8391a8c3d9d1a2be49c0

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Fri Dec 4 13:41:01 2015 -0500

working on c_call - find_func_sig

commit 8dfea1a4056bce6cfa0077746ce7a0cd9cc048ae

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Fri Dec 4 13:34:03 2015 -0500

working on c_call - need to finish func args

commit c6afbb284ad07a4782191f0ee2d6a57776e7a0ce
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Fri Dec 4 11:47:27 2015 -0500

added better error for check_assign2, tweaked cleanup of test suite

commit 01a92d5332fd6be8b381c92124d059797149c379
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Fri Dec 4 01:40:21 2015 -0500

fixed assign

commit 0d18e5f2dc10a4b42bc9be3a04bbd306cbaeee42
Author: Tim Waterman <watermantium@gmail.com>
Date: Thu Dec 3 21:27:09 2015 -0500

Debugging variable issues

commit b41f84754f9e2e01e7ccf665bf95488a7692ae30
Author: Tim Waterman <watermantium@gmail.com>
Date: Thu Dec 3 20:51:12 2015 -0500

For loops correctly accept expr_opt

commit c07013b4c847fdc45bca258c705c3fb517d1c495
Author: Tim Waterman <watermantium@gmail.com>
Date: Thu Dec 3 20:49:53 2015 -0500

Added testing file

commit 2cdd1126be26fd365d05714654f86f9c8b04ad47
Author: Tim Waterman <watermantium@gmail.com>
Date: Thu Dec 3 20:38:05 2015 -0500

Generator issues, but everything seems to compile

commit 308b52d1d7fe1fd1c8c85d53786d07ff0b151928
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Dec 3 20:27:00 2015 -0500

```

    fixed gen

commit 479c8701c4df07f1f37653b9d5013ef21b2c2fa5
Author: Tim Waterman <watermantium@gmail.com>
Date: Thu Dec 3 20:15:58 2015 -0500

    Started the C code generation file

commit 9a6bcf3ecd6ea00a525d4dd2bbff7411896e1a16
Merge: e6246b0 95fde55
Author: Tim Waterman <watermantium@gmail.com>
Date: Thu Dec 3 19:53:26 2015 -0500

    Fixed merge bullshit

commit e6246b0ed9654c03d8617998a22b81f6b9f97877
Author: Tim Waterman <watermantium@gmail.com>
Date: Thu Dec 3 19:51:26 2015 -0500

    Stitch thing working

commit 95fde554d5d23170047438a8f47c2abb8340db65
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Dec 3 19:49:55 2015 -0500

    sm-an works again

commit cdb0b1ac080b6b897e0c89f335f18195c543576b
Author: Tim Waterman <watermantium@gmail.com>
Date: Thu Dec 3 19:36:34 2015 -0500

    Makefile and compiler edit

commit 7f15f7f49eef9ef9d18ae1eb0e82ea2fdad05a7d
Author: Rashedul Haydar <rh2712@columbia.edu>
Date: Thu Dec 3 19:35:03 2015 -0500

    added check_for

commit 61f94774363231958a4dd178850459c9a0348f27

```

Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Dec 3 19:31:19 2015 -0500

working on program

commit 93ea0d82be4bb0d166e65b30b108a98b91633070
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Dec 3 18:39:29 2015 -0500

making progress

commit ebfa2ec2e5af5e9ad9956b2fa564fb6dd5d3d508
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Dec 3 18:21:14 2015 -0500

w

commit 67e40f8420c6d7f8df9cff3f0763d905713d371d
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Dec 3 17:49:37 2015 -0500

w

commit a07af01a4af200d1773db6ba89bad67b1eae974c
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Dec 3 17:40:53 2015 -0500

fixed

commit 86db74aff9b3f8ce04b91284c85e3150ad368362
Merge: d7f53b2 07a24c3
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Dec 3 17:25:06 2015 -0500

Merge branch 'master' of https://github.com/danhcole/4115_lang

commit d7f53b2e53407b5cea1a5ddbf94e457d7ad3bea5
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Dec 3 17:24:58 2015 -0500

working on sm

commit 07a24c353a57e3e50d5cc91e356faa2408a2bdc2
Author: Tim Waterman <watermantium@gmail.com>
Date: Thu Dec 3 16:49:28 2015 -0500

Checked if expressions, while semantic checking done

commit 09a146ab66b698bcedab996f2481847d5beeb315
Author: Tim Waterman <watermantium@gmail.com>
Date: Thu Dec 3 16:33:34 2015 -0500

If semantic checking checks for int type expr

commit a367ac78d4acbd95110ad958d4fa8d41180055cf
Author: Tim Waterman <watermantium@gmail.com>
Date: Wed Dec 2 20:05:25 2015 -0500

Semantic checker compiling with the pieces we have, a lot has
been commented out

commit c68b1dfa5fb2bf8e469f1c6f6b0ec972aedd2f3
Author: Tim Waterman <watermantium@gmail.com>
Date: Wed Dec 2 19:11:00 2015 -0500

Fixed optional error

commit 19d4e043bfae7acee69c090495e91220219bc6bf
Merge: af3a9ec ca26c84
Author: Tim Waterman <watermantium@gmail.com>
Date: Wed Dec 2 17:57:32 2015 -0500

Merge branch 'master' of https://github.com/danhcole/4115_lang

commit af3a9ec4dbb6806eba0b31d7063d677efa905844
Author: Tim Waterman <watermantium@gmail.com>
Date: Wed Dec 2 17:57:23 2015 -0500

Fixed compile stuff

```
commit ca26c84fd8e274c1db816d3db9330c39a52b473c
Merge: f8be026 83f1175
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date:   Wed Dec 2 17:48:48 2015 -0500
```

```
    Merge branch 'master' of https://github.com/danhcole/4115
    _lang
```

```
commit f8be0264b1d229d54bd13b82deb87814179af5c7
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date:   Wed Dec 2 17:48:40 2015 -0500
```

```
    updated makefile
```

```
commit 83f1175e536b841796b971324361aa78659fc6ac
Merge: 53282cb 153fff7
Author: ms4985 <ms4985@columbia.edu>
Date:   Wed Dec 2 16:13:04 2015 -0500
```

```
    Merge branch 'master' of https://github.com/danhcole/4115
    _lang
```

```
commit 53282cb6ab31b0a1ae299be89a8c8b160f8fe299
Author: ms4985 <ms4985@columbia.edu>
Date:   Wed Dec 2 16:12:58 2015 -0500
```

```
    fixed up sem tests
```

```
commit 153fff71062d4532dd8d2dade9aad2d58401fc34
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date:   Wed Dec 2 16:10:39 2015 -0500
```

```
    updated comments
```

```
commit 3accl1a9c8200480e57791b250e92c44de5a0e42a
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date:   Wed Dec 2 15:02:22 2015 -0500
```

```
    commented sem_an, still need to do check_for, fix
    check_var_decl
```

commit 50f444b4ee818db79e5af2f86d10c33fc219b1a2
Author: Tim Waterman <watermantium@gmail.com>
Date: Wed Dec 2 14:37:09 2015 -0500

Added back access operator and struct keyword

commit 24723bb66ce7c484bbd1d3eec2c582d1e76ff049
Author: Tim Waterman <watermantium@gmail.com>
Date: Tue Dec 1 23:39:09 2015 -0500

Arrays now can assign individual elements

commit 87bdbbe5804eb72d1c4d4f0a6cb00dbf21e9f92c
Author: Tim Waterman <watermantium@gmail.com>
Date: Tue Dec 1 23:10:06 2015 -0500

Initial array declaration passing parser tests

commit a6f399113c32bac2915678d66ea64a3f5d878973
Author: Tim Waterman <watermantium@gmail.com>
Date: Tue Dec 1 12:55:27 2015 -0500

Fixed pretty printing of chars from ast

commit 53166bf86b82e5994464cfc71b9ff1a69e52c094
Author: ms4985 <ms4985@columbia.edu>
Date: Tue Dec 1 11:05:06 2015 -0500

added the actual semantic checks to test

commit b44f18dd7fa5e2c32d5fede5298f184de76f9ab4
Author: ms4985 <ms4985@columbia.edu>
Date: Tue Dec 1 10:59:14 2015 -0500

added simple semantic analysis tests

commit 07a81ef1ecfb6d069966a363d0dbcba5dd35b9c4
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Mon Nov 30 12:11:38 2015 -0500

semantic analyzer compiles, still need gen code

commit 5e1fba16104839ac3964bbf7cb73198416e61192
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Mon Nov 30 12:04:15 2015 -0500

finished sm-an

commit 2aefc5892f392b9d6833fbd1932ac183f03e6423
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Nov 29 17:08:26 2015 -0500

need to still add init_env and chck_program

commit c1d8dff46a438722f3d181b29451d32b899a7713
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Nov 29 16:46:31 2015 -0500

working on sem-an

commit 3df7000bffe087e4d01d21b3b7dd4dd19ed00965
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Tue Nov 24 13:20:22 2015 -0500

working on sem-an

commit 135caf8726134865d43f8ed6a65ebdcad98b313e
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Tue Nov 24 13:05:15 2015 -0500

started on semantic analysis

commit bd34b67afac6cf13c42b59d984e32bb1deab2bd4
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Nov 22 20:21:05 2015 -0500

created cast, added type dataType refactored the ast for
consistency

commit 79b9ebc687898a82a6f012cd69d9e65632251bec
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Nov 22 19:21:01 2015 -0500

```

    started on env and complier

commit 2eb53e0ac96e5fc98d4a7728c7247578b730b7ad
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Nov 19 18:06:00 2015 -0500

    updated .gitignore, added makefile for stch_headers library

commit 34301c36c591a75e5ee0ae8c7682d13091966a9d
Author: Tim Waterman <watermantium@gmail.com>
Date: Thu Nov 19 18:04:48 2015 -0500

    Added new loop tests

commit 7bb3f01fb70b60d35bb1d748605e20737757b1cf
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Nov 19 17:57:16 2015 -0500

    added function test 6 - check for empty return

commit b491f3d154bda7dbf9d91620a46491ee8c12f9e3
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Nov 19 17:56:10 2015 -0500

    fixed some stuff

commit 8171503e3921b3e15907bf06770c9bf47f0ad811
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Nov 19 13:41:46 2015 -0500

    removed gen code diffing from test suite

commit 2fbbb1d5a434528ff40a6205f50ef1d616a53901
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Thu Nov 19 13:14:49 2015 -0500

    Update README.md

commit bf76fbf0e0040e5ae8e3dbb170d3b2e3f9a8a9d8
Author: Tim Waterman <watermantium@gmail.com>

```

Date: Tue Nov 17 21:20:24 2015 -0500

Fixed shift/reduce error caused by stitch loop. All tests
still work

commit c2892cf56d57fe0aca1aaaa17a69766431094100

Author: Rashedul Haydar <rhaydar8@gmail.com>

Date: Tue Nov 17 15:46:25 2015 -0500

updated meeting notes

commit 33fa100ab44678da625a69ea7c9acb64cfefdc4d

Author: Daniel Cole <dhc2131@columbia.edu>

Date: Tue Nov 17 15:07:03 2015 -0500

Update meetingNotes.md

commit 4c46e088822371df43782b93cd61bacf62a02c5a

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Tue Nov 17 12:01:17 2015 -0500

added two new tests

commit b5d767afb03ba0b1d3e058b49e528a1f9d7b7aab

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Sun Nov 15 21:40:38 2015 -0500

added fucn1 targets

commit efc6214ac58989d432b07dc0b42a950321ad25bf

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Sun Nov 15 21:35:15 2015 -0500

fixed newline issue , removed .dSYM

commit 876191de3d0b7a13324b69c837228ac13289cde0

Author: Tim Waterman <watermantium@gmail.com>

Date: Sun Nov 15 21:30:47 2015 -0500

AST changes to allow vdecls

```
commit 6edbc79588c29679de29a66d52a2ea9ae9ceb71d
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Nov 15 21:29:58 2015 -0500
```

```
updated gitignore
```

```
commit a656e75075fea22e29fbc0855eb76f9caa6ce17f
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Nov 15 21:25:02 2015 -0500
```

```
tester now recompiles everything
```

```
commit 856235421ca473adb5e661a6ffbea7565b862aa7
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Nov 15 21:15:15 2015 -0500
```

```
added new tests (spoiler, we pass)
```

```
commit 7cfbd96c49b9a5b7d7e06e45f40cbbf2123ee99e
Author: Tim Waterman <watermantium@gmail.com>
Date: Sun Nov 15 20:48:02 2015 -0500
```

```
Changed ast to use printf
```

```
commit 1740d751c0d627fb4018e5887b1d7d7f3eb1849a
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Nov 15 20:45:22 2015 -0500
```

```
added dummy files for _log and _bin
```

```
commit 892ca104b7aacf09a887b6d892666e9e0cf1d0cb
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Nov 15 20:27:58 2015 -0500
```

```
fixed int x = 3 error
```

```
commit 27f59871b4707649cb1b6deee7c9ccc421c781b7
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sat Nov 14 00:07:56 2015 -0500
```

```
test suite now works, also folded in color, etc. from parse
```

tester

commit e9cf2179c20fafba171fe9cc4389213cf41c2370
Author: Tim Waterman <watermantium@gmail.com>
Date: Fri Nov 13 12:16:20 2015 -0500

Fixed tester cases, shift reduce still happening

commit 7fb2182fa4c9569011cfade64c772468633cb984
Author: Tim Waterman <watermantium@gmail.com>
Date: Fri Nov 13 00:19:56 2015 -0500

Made ptest more extendable with functions

commit 000a738da56f1e36a2b1fa686672388d86370d9f
Author: Tim Waterman <watermantium@gmail.com>
Date: Thu Nov 12 23:42:58 2015 -0500

Colorized output of ptest suite

commit 682a5728a1d43a323c2900ecbfc990ba34edccd6
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Nov 12 22:50:04 2015 -0500

fixed 8 SR errors

commit 490aa2fdb761d84878860fc2056e84f7d37ff937
Author: Tim Waterman <watermantium@gmail.com>
Date: Thu Nov 12 22:43:02 2015 -0500

Ptests report what they are; while/stitch added

commit d24d0d3645b6fa931632aabd38e5b89473ed35d8
Author: ms4985 <ms4985@columbia.edu>
Date: Thu Nov 12 22:18:06 2015 -0500

added test doc

commit c6dee2286fb8c13976c8d4c7c342a762811a9b5d
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Nov 12 22:17:41 2015 -0500


```
hello , world

commit ef6c05f24695a445c963fd69a6f9ca89848a4eb6
Author: Tim Waterman <watermantium@gmail.com>
Date: Thu Nov 12 22:02:01 2015 -0500

Parser test script updated

commit 71d238926bffe47ecf9d150e01ac641de54fad5c
Author: Tim Waterman <watermantium@gmail.com>
Date: Thu Nov 12 21:55:39 2015 -0500

Stitch includes headers

commit f4bf3f3c98f8526dbb90b8c8a924059df688f941
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Nov 12 21:48:51 2015 -0500

functions working

commit a9a66840ce6149982bbfc426a2444bb3430fc506
Merge: 80823a2 a41a639
Author: ms4985 <ms4985@columbia.edu>
Date: Thu Nov 12 21:45:24 2015 -0500

Merge branch 'master' of https://github.com/danhcole/4115
_lang

commit 80823a268592ff0e7ef847970d3fd349e7f9eca6
Author: ms4985 <ms4985@columbia.edu>
Date: Thu Nov 12 21:45:10 2015 -0500

added more tests

commit a41a639f64cd7ce4928e429964cdd38bc2875bd2
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Nov 12 21:28:45 2015 -0500

minor fix
```

commit 2788f4c6905199da5809b05604683aead1f52021

Author: ms4985 <ms4985@columbia.edu>

Date: Thu Nov 12 21:28:13 2015 -0500

added test suite for parser

commit a7c5865238d584ddfa294f3e74a949e71bae8c52

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Thu Nov 12 20:48:20 2015 -0500

working on functions

commit 7e594a1be51209e15a2036e42d675c57abeaadcd

Merge: 337987d 453f44c

Author: Tim Waterman <watermantium@gmail.com>

Date: Thu Nov 12 20:47:42 2015 -0500

Fixed stitch.ml issue

commit 337987de8088fb08547c57def1e1a38a4445acec

Author: Tim Waterman <watermantium@gmail.com>

Date: Thu Nov 12 20:45:13 2015 -0500

Stitch.ml taking in filename

commit 453f44c460ce2284d3bbb6746969955484a8de44

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Thu Nov 12 19:30:40 2015 -0500

unordered vdecl statments works

commit c611d232489da46e7980218d78a36d28d3a82786

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Thu Nov 12 19:05:52 2015 -0500

restructured vdecls

commit d7a3b80647b4b5ee1f8422d2df0c0619842556bd

Author: Daniel Cole <takeitfromthedan@gmail.com>

Date: Thu Nov 12 18:14:18 2015 -0500

```
    added stitch to pretty print

commit 372687d8979d718aa95c77d80043ca6167bc15dc
Author: Rashedul Haydar <rhaydar8@gmail.com>
Date:   Tue Nov 10 19:09:15 2015 -0500

    fixed formatting

commit ed6e4eb55757b017f2314121e009a6b463e05127
Author: Rashedul Haydar <rhaydar8@gmail.com>
Date:   Tue Nov 10 19:08:04 2015 -0500

    added notes from 11/10 meeting

commit cd71c4551c3dcca992c8a558a43e3fc41aa24e57
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date:   Tue Nov 10 16:15:16 2015 -0500

    compiler compiles (with nothing in it_
    )

commit 6d743a00b1cbf24b92b34eaddef8c9cd6d69a2c3
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date:   Tue Nov 10 15:37:34 2015 -0500

    2 more errors fixed

commit 6dba4d67453ecb49007b733ad32ae9412fe3698e
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date:   Tue Nov 10 15:21:01 2015 -0500

    updated

commit 31538c38a2cd5f4537ff694a536f0f4173f4d0eb
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date:   Tue Nov 10 13:44:33 2015 -0500

    fixed some issues

commit 68c76a75ffef4e3ba3ac323f3b44c2b23a38c76e
Author: Daniel Cole <takeitfromthedan@gmail.com>
```

```
Date: Tue Nov 10 12:28:33 2015 -0500

added Makefile

commit d4b388634339bf16d57a8819d4e803545fb5db20
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Tue Nov 10 11:43:35 2015 -0500

test update 2

commit 87a91772064c8e9c6b0ebf32bd65ddd22ee14b44
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Tue Nov 10 11:42:21 2015 -0500

test update 1

commit 7adba58bdd0c1a33c393b8b8636759ab57e7d0f1
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Tue Nov 10 01:47:55 2015 -0500

updated test script

commit a26d8ff170dbf9f72e9930afe0920464f4505be4
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Tue Nov 10 01:42:58 2015 -0500

test suite added

commit 23eb1db66e5506a86aaebc06a0b94b2b909d2b18
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Tue Nov 10 01:40:37 2015 -0500

tests

commit 450976a82bf9a87cb4686f4827f8fc4d6197d8aa
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Mon Nov 9 18:06:59 2015 -0500

Delete hello1_target.c

commit 85e07a535c066c960b7da02da713c58b11574e25
```

Author: Daniel Cole <dhc2131@columbia.edu>
Date: Mon Nov 9 18:06:45 2015 -0500

Delete stch_headers.h

commit 3615729f345a3aa9049607c163c6021dc038740b
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Mon Nov 9 18:05:53 2015 -0500

started work on testing

commit 736cb3ac8ed69d787e37299afdbdafce2eec822e
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Mon Nov 9 17:07:46 2015 -0500

hw test target

commit 78e30de0b28a2dec1a323eee367b006436cf50b4
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Mon Nov 9 15:52:21 2015 -0500

Update stch_compiler.ml

commit 387cf5404148befd486af3268fd9ce394376c4c5
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Mon Nov 9 15:22:54 2015 -0500

Create stch_compiler.ml

commit 997ff10affded68449ea05e3cedbeb290ea17acc
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Mon Nov 9 15:21:47 2015 -0500

Create hello2.stch

commit ac2ab8a9a9cf0b094acf5e897812d75fefdd6d30
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Mon Nov 9 15:16:28 2015 -0500

Create hello1.stch

```
commit 3baf3d29959ee88b8bb4afa3542c351947e17965
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Mon Nov 9 10:54:22 2015 -0500
```

```
stch c headers and func defs added
```

```
commit c86292b09b0ddc5ba33a71cd86471c4a318ecfa2
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Sun Nov 8 20:06:36 2015 -0500
```

```
Update stch_headers.h
```

```
commit d23f256f266c4573c5f9bc83bc4ad0416b76c20f
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Sun Nov 8 20:01:46 2015 -0500
```

```
runtime questions for 4/10
```

```
commit 6b47151d175862256a05adf28b96b690a706a13e
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Thu Nov 5 17:47:35 2015 -0500
```

```
Update stch_headers.h
```

```
commit 47eea775ef5cd9719b20b540683f9cffe16173b
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Thu Nov 5 13:16:49 2015 -0500
```

```
Started work on header
```

```
This header file will be auto-included at the beginning of
any c file generated by the Stitch compiler.
```

```
It should include all includes, defines, and structs needed
by every Stitch-C program. Program specific functions will be
generated separately.
```

```
commit bad6110bf902b80c6d6dab96e9361b3a422edd31
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Thu Nov 5 12:13:16 2015 -0500
```

```
removed bitwise , unary operators

commit a7ae8c95120edee5c1a3fec12c7ffb9d57ea9606
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Thu Nov 5 12:12:01 2015 -0500

removed bitwise , unary operators

commit 2568ef7fd2a282c838dc9605768a21a04510d1f1
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Thu Nov 5 12:08:32 2015 -0500

removed bitwise , unary operators

commit 3febda5584311329ff4ce362a669b3e513a34cd5
Author: Rashedul Haydar <rhaydar8@gmail.com>
Date: Wed Nov 4 21:43:15 2015 -0500

added my notes from meeting

commit 279aade3ad61b3cb653b32e5b98b92e5ca6f2058
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Tue Nov 3 15:23:42 2015 -0500

Update meetingNotes.md

commit 29e5576bae82533f51bcb7939d5e901f503beeb8
Author: Rashedul Haydar <rh2712@columbia.edu>
Date: Sun Nov 1 15:39:23 2015 -0500

arrays work without any shift/reduce errors

commit 30551c08218c896be4888779dec8455f7e716122
Author: Rashedul Haydar <rh2712@columbia.edu>
Date: Sun Nov 1 14:51:48 2015 -0500

fixed typos in arrays

commit c1f2800dd4f252149b00288c921c8001775dbcd7
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Sun Nov 1 14:46:50 2015 -0500
```

```

    started to add arrays

commit 10725757d0c9b2e95172eac8f86fbd58b6c0ef52
Author: ms4985 <ms4985@columbia.edu>
Date: Thu Oct 29 19:36:02 2015 -0400

    took out Call from ast

commit 54c7cd249afffb534054d1115ad9569c7eddaa8
Author: Rashedul Haydar <rh2712@columbia.edu>
Date: Thu Oct 29 19:10:10 2015 -0400

    fixed parser, no more shift/reduce errors. need to add arrays
    still.

commit 633eb9c0ea5b060e4dd6e1c724148f39d811370b
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Oct 29 18:50:49 2015 -0400

    updated typenames, updated gitignore, added singer

commit ff2e47bf4b1be678470743b896eafacff701d0a8
Merge: f04092d 53193cf
Author: Rashedul Haydar <rh2712@columbia.edu>
Date: Thu Oct 29 18:43:20 2015 -0400

    Merge branch 'master' of http://github.com/danhcole/4115_lang

commit f04092d2d0feb89c8ecb6fe910ba5b3d51d70eb2
Author: Rashedul Haydar <rh2712@columbia.edu>
Date: Thu Oct 29 18:42:47 2015 -0400

    got rid of ftype

commit 53193cf3451f67dedc5d2fa74150ddc9dd73f433
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Thu Oct 29 12:52:43 2015 -0400

    Create testDoc.md

```


commit 700b222ad81847077ae826d37ae73fa846c97584
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Thu Oct 29 12:27:32 2015 -0400

updated meeting times , added link to LRM

commit afaada4a0582941f3997cd30c996616e7515f81a
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Oct 29 12:24:59 2015 -0400

fixed gitignore , started basic compiler toolchain

commit ef0afdbc41a3fac03b12d60fdcf00721247efb97
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Wed Oct 28 18:09:16 2015 -0400

added .gitignore , trying to keep things clean

commit 79b78ad499571f143162585822d321307965a471
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Tue Oct 27 17:11:03 2015 -0400

Update meetingNotes.md

commit 3c0d24d7c9a0be915a8ec0c0a1bd4f6f5702a959
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Tue Oct 27 14:14:01 2015 -0400

fixed dotproduct

commit b969752af73c8f4f775615c75be026381f13eb2c
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Tue Oct 27 13:03:53 2015 -0400

dotproduct updated

commit 311db285615ede90022bd1da46c685d6c74510d7
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Tue Oct 27 11:57:14 2015 -0400

removed .* operator

commit 0f4f13a52d9a05594e2403db0f54f5deada242e7

Merge: 6ee4639 313a484

Author: Tim Waterman <watermantium@gmail.com>

Date: Mon Oct 26 14:03:45 2015 -0400

Merge branch 'master' of https://github.com/danhcole/4115_lang

commit 6ee4639e42850fdd4d23f866123e48f0c4c227df

Author: Tim Waterman <watermantium@gmail.com>

Date: Mon Oct 26 14:03:01 2015 -0400

Fixed myAdd, working on matrix mult

commit 313a4846a39797db7f10fb758665416f029c29c8

Author: Rashedul Haydar <rh2712@columbia.edu>

Date: Sun Oct 25 16:57:29 2015 -0400

most of the parser is done, have 4 shift/reduce errors

commit cec57449b85e151ac636ce3d91cc114b1290e2b0

Author: ms4985 <ms4985@columbia.edu>

Date: Sun Oct 25 16:48:54 2015 -0400

backtracked

commit 29e73d01c4d40260d8799672a57ea411d15a8c9a

Author: ms4985 <ms4985@columbia.edu>

Date: Sun Oct 25 16:46:47 2015 -0400

assign now takes a vdecl

commit 3ac86e93cbb8bbf670cebbbc8f20add795b066151

Author: ms4985 <ms4985@columbia.edu>

Date: Sun Oct 25 16:36:15 2015 -0400

added a vdecl struct to account for multiple typenames

commit f8932cf5aa574b393f11f22a8784f028ddd86b01

Author: ms4985 <ms4985@columbia.edu>

Date: Sun Oct 25 16:00:05 2015 -0400

added stitch stmt

commit 24be4c050448c6e1c3149884483d1457bc44f6e5

Author: ms4985 <ms4985@columbia.edu>

Date: Sun Oct 25 15:38:44 2015 -0400

minor fix

commit 02441f86411db60084a486b1f8aa22a40a93ef90

Author: ms4985 <ms4985@columbia.edu>

Date: Sun Oct 25 15:37:09 2015 -0400

minor fix

commit ddfcd2f74fb474922dd7fbb90dde18a55f037da4

Author: ms4985 <ms4985@columbia.edu>

Date: Sun Oct 25 15:36:33 2015 -0400

fixed unary types

commit db2373159a068a8f3175cd8e16127de19a4c2732

Author: ms4985 <ms4985@columbia.edu>

Date: Sun Oct 25 15:29:31 2015 -0400

added data types and fixed fn names

commit ce4ebcb7a3c699e7a4396707dc4b7609890920e2

Author: ms4985 <ms4985@columbia.edu>

Date: Sun Oct 25 14:47:55 2015 -0400

added stitch ops

commit e4778813c18a3a4dcfc6729cf6d3695519d9347f

Author: Rashedul Haydar <rh2712@columbia.edu>

Date: Sun Oct 25 14:19:03 2015 -0400

added all associative operators

commit 353fa76c5504261f3eb526528e3e1173ebfbde7f

Author: Rashedul Haydar <rhaydar8@gmail.com>
Date: Sun Oct 25 13:51:47 2015 -0400

updated parser

commit 186cf5ccc8d56277996cc438e599d84a218ed3e9
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Oct 25 13:20:03 2015 -0400

actually save the updated scanner first...

commit 06fecf11ab9e99ecc1a918dc07bc44975545211e
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Oct 25 13:19:13 2015 -0400

updated scanner

commit 4cd70880397079e114f45268e920d021621c8643
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sat Oct 24 17:31:53 2015 -0400

minor scanner fix

commit 25ba2f17e58d1733dc6dcd274d18276c557ed694
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Sat Oct 24 17:25:02 2015 -0400

Update README.md

commit a5a2637934fa321c1cc7ead3489eaf6ff5daaca3
Author: Tim Waterman <watermantium@gmail.com>
Date: Sat Oct 24 13:28:02 2015 -0400

Adding N to each element - finished

commit 0d507d027e00a643f846030c150c5673d3769769
Author: Tim Waterman <watermantium@gmail.com>
Date: Sat Oct 24 12:57:02 2015 -0400

Pthread skeleton working

```
commit e906286b4ce487ee70979398308967083254cfba
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sat Oct 24 12:21:46 2015 -0400
```

updated scanner

```
commit 2c3592b23232c5ac1e6e369d98cace990ecf9aa7
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Fri Oct 23 19:50:00 2015 -0400
```

Update dotproduct.stch

```
commit af945319fb88f0158beb1da35b902f7b23d7cb56
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Fri Oct 23 19:46:46 2015 -0400
```

Update dotproduct.stch

```
commit 7d705960d1fe7c9c208f5969ab35a72dd6cf194c
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Fri Oct 23 19:45:12 2015 -0400
```

Create dotproduct.stch

```
commit 09c1e8527116e18d64f6db1545948cdeae90dc3
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Fri Oct 23 19:28:15 2015 -0400
```

Update ideas.md

```
commit c83c68aec8a2565f0b5ada270bcacc21c87e0a50
Merge: edbe1d9 308e8b5
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Fri Oct 23 18:01:54 2015 -0400
```

Merge branch 'master' of https://github.com/danhcole/4115_lang

```
commit edbe1d939afbb7c1a7350c7c5b4e70794d584a14
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Fri Oct 23 18:01:46 2015 -0400
```

```
scanner mostly done, parser started

commit 308e8b521e95b896cc172b621e0ec776a3d5921a
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Thu Oct 22 18:17:55 2015 -0400

Update ideas.md

commit 4e97fbf8cd985882cacfd187ac9cd89dadeca68f
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Thu Oct 22 12:48:32 2015 -0400

Update ideas.md

commit 74380b1db70f1ac201a4defd9970df7b7fb7b5b5
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Thu Oct 22 12:36:40 2015 -0400

Create ideas.md

commit ddf5d1e7fd533e11d0de8bf86cd7ff120fbf1f87
Author: Tim Waterman <watermantium@gmail.com>
Date: Wed Oct 21 17:04:20 2015 -0400

Added microc sample code

commit ef9f52ca748e31aedef7cb00b69c27f1566d96c0b
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Tue Oct 20 15:34:04 2015 -0400

Update meetingNotes.md

commit c1a12e6d4897d9d6b115897ce809c1490f2e4187
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Sun Oct 18 16:04:56 2015 -0400

Update TODO.md

commit 83422c57deb7b0f60b9ee1b6c70c104590a2bc36
Author: Daniel Cole <dhc2131@columbia.edu>
```

Date: Sun Oct 18 16:03:38 2015 -0400

Rename TODO to TODO.md

commit ffe0d8f1291fed06c4a2c13f45b0186d5ec956d9

Author: Daniel Cole <dhc2131@columbia.edu>

Date: Sun Oct 18 16:03:21 2015 -0400

10/20

commit 1d46f16bf292decf7f4a1a0175863557880a1fe3

Author: Daniel Cole <dhc2131@columbia.edu>

Date: Sun Oct 18 15:55:04 2015 -0400

questions for 10/20

commit 21154b8fc5419395982feb757cd854945c85f80a

Author: Tim Waterman <watermantium@gmail.com>

Date: Sun Oct 18 15:45:36 2015 -0400

Examples changed

commit 57c0774b562cae68ce2f3ada374ac46fb4415c60

Author: Daniel Cole <dhc2131@columbia.edu>

Date: Sun Oct 18 15:44:13 2015 -0400

Update examples.stch

commit 49217d102ca937c72e7ace9e915c16a5affb2501

Author: Daniel Cole <dhc2131@columbia.edu>

Date: Sun Oct 18 15:07:01 2015 -0400

Create examples.stch

commit 117b5f74a9449bd7a7475330a508bb9d6278b69e

Author: Daniel Cole <dhc2131@columbia.edu>

Date: Sun Oct 18 15:02:24 2015 -0400

Update LoopExample.stch

commit 0931cc4540a6940cd9eb78e4b6a8ef497f190de1

Author: Daniel Cole <dhc2131@columbia.edu>
Date: Fri Oct 16 00:16:23 2015 -0400

Update LoopExample.stch

commit 9a681ac387d7e8bc22cb499d5c847537f76651f6
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Fri Oct 16 00:05:35 2015 -0400

Update meetingNotes.md

commit 69795aec00cccf4cb233ae3763959a945bf7e682
Author: Tim Waterman <watermantium@gmail.com>
Date: Thu Oct 15 22:48:25 2015 -0400

Some early thoughts on syntax stuff

commit ccb5b7c49431e859085a857bd0ad6e7cc75f2e0d
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Thu Oct 15 17:23:26 2015 -0400

Update meetingNotes.md

commit a4ddfb53c3ec166017acbc2046707e5c1d423f39
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Thu Oct 15 17:22:19 2015 -0400

cleaned up notes, reorg.

commit 337e1fc431a6d35c40877fc4870a39ab63825a99
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Thu Oct 15 10:18:30 2015 -0400

Update MeetingNotes.txt

commit 5f9c8b7e5eeb4eadd07ef9adae9adaf9b0c85dc4
Author: Rashedul Haydar <rh2712@columbia.edu>
Date: Wed Oct 14 20:46:55 2015 -0400

converted to txt file, rtf was being weird

commit 23d0ffc8bae17563caedde534f5000a6aa677049
Author: Rashedul Haydar <rh2712@columbia.edu>
Date: Wed Oct 14 20:41:21 2015 -0400

added ReferenceManual folder

commit e8080df7a4f04e2f1c815d793e6af917697fce7f
Author: Rashedul Haydar <rh2712@columbia.edu>
Date: Wed Oct 14 20:38:26 2015 -0400

added MeetingNotes.txt

commit 8437e3700a5150c23251534466f2fcd9a17fccd1
Author: Rashedul Haydar <rh2712@columbia.edu>
Date: Wed Oct 14 20:35:46 2015 -0400

added MeetingNotes.rtf

commit 2b813a4768920b48f359dcfed3783c8f9cfd0729
Author: Tim Waterman <watermantium@gmail.com>
Date: Mon Oct 12 00:25:18 2015 -0400

Started matrix mult. Pthread structure is done. Need to
finish later

commit d536c21195dfd58aec354876d08fa33c469f8b88
Author: Rashedul Haydar <rhaydar8@gmail.com>
Date: Sun Oct 11 21:24:26 2015 -0400

Updated First step section

commit d9e2dd310598b609ae5b671838e7201575e431c3
Author: ms4985 <ms4985@columbia.edu>
Date: Thu Oct 8 18:31:02 2015 -0400

Create openMP_example_link

commit cd0e4e90156605fd5823f613e808c8ab21425fa3
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Tue Oct 6 14:52:46 2015 -0400

Create meetingNotes.md

commit 28c98405da3a936dc96c30cb28ae1695a7ce265a
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Wed Sep 30 15:49:06 2015 -0400

remade pdf

commit 096049cfc34a57a32fb1e15c5dda0dbe1050c23f
Author: Rashedul Haydar <rhaydar8@gmail.com>
Date: Wed Sep 30 15:44:49 2015 -0400

Corrected typos

commit 2a108e23e604dc41ea2503829faf1893e680958b
Author: Rashedul Haydar <rhaydar8@gmail.com>
Date: Wed Sep 30 15:43:38 2015 -0400

Corrected typo and added roles

commit 3af13488ec582d1d724f881e3fa2880850f7e505
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Mon Sep 28 08:41:56 2015 -0400

updated pdf

commit 5cd818cf0dc19a72e27a3313ce775f56968290f2
Author: Tim Waterman <watermantium@gmail.com>
Date: Sun Sep 27 23:24:55 2015 -0400

Ex3 edited

commit bb8f808bd5b0f476e1367b25cac299a8ec765f85
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Sep 27 17:13:15 2015 -0400

fixed examples, need example program

commit fd87df4bae7efa64a7559c26b64c4eeae810e2db
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Sep 27 12:39:23 2015 -0400

minor changes

commit b2b4242a0aca8edb1b53aa81270aa0595c3cc385
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Sep 27 12:13:58 2015 -0400

added para RE async keyword

commit 92a02644f4372f4e83d60e3b5814b2069a9ff94d
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Sep 27 12:01:27 2015 -0400

added code example

commit ae8de78c1fd46f0e97b330a8d2b0ffbfa94732eb
Merge: 1dc3887 10c6456
Author: Tim Waterman <watermantium@gmail.com>
Date: Sun Sep 27 11:52:01 2015 -0400

Merge branch 'master' of https://github.com/danhcole/4115_lang

commit 1dc3887de4b592953bd64898d30061ae630d86f9
Author: Tim Waterman <watermantium@gmail.com>
Date: Sun Sep 27 11:51:49 2015 -0400

Code snippet added

commit 10c64566f531bf806d9f08c51054fb95d5737a61
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sun Sep 27 11:51:47 2015 -0400

small changes to .tex

commit f9c5317d8450c748a4cf81ca45cfd28f1a3f1d28
Author: Rashedul Haydar <rhaydar8@gmail.com>
Date: Sat Sep 26 21:52:32 2015 -0400

Fixed typos

commit 6da5e19dfaab76bbd201fb71df4558cf991fa18b
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Sat Sep 26 21:42:24 2015 -0400

added rough draft of the proposal language

commit e13d614a71d90849f35c1ba97f016a8781adc514
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Wed Sep 16 14:41:38 2015 -0400

Markdown is hard

commit 813e51459a7a552d72a5e584887e1b93f9199eb6
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Tue Sep 15 12:58:54 2015 -0400

1st meeting time

commit 30e38166da5a57f2c946d66312df0bb68760033c
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Tue Sep 15 11:52:48 2015 -0400

updated w/ links to last semesters projects

commit 9ea75aaf3e11cdbef823e997ade807c76afe94c
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Tue Sep 15 09:49:18 2015 -0400

minor update to readme

commit 62b7ea6a2e751c08874c7212167b3a6287b173c5
Author: Daniel Cole <takeitfromthedan@gmail.com>
Date: Tue Sep 15 09:46:55 2015 -0400

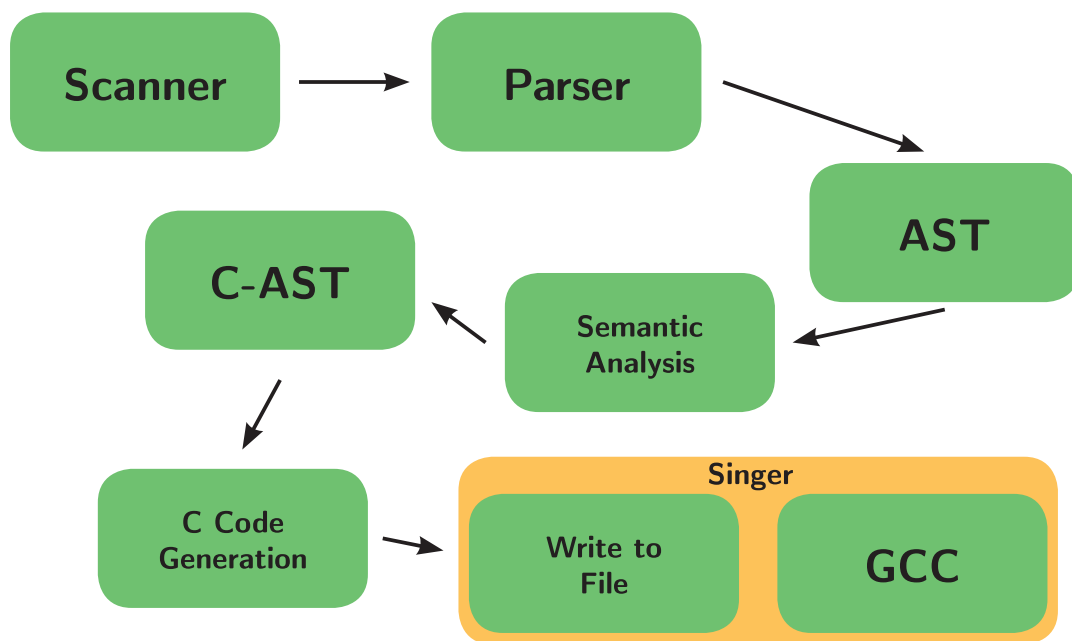
added link to class page

commit e63c1d0b41a77938f668162dc8ba785e47458a62
Author: Daniel Cole <dhc2131@columbia.edu>
Date: Tue Sep 15 09:25:17 2015 -0400

Initial commit

Architectural Design

Block Diagram



Interface Description

Scanner

`stch_scanner.mll`

The scanner is written in OCamlLex. It takes input from the source file, and tokenizes it into keywords, identifiers, and literals. It scans over and removes both single line and multi-line comments, as well as all whitespace not in string literals. Any token that is not a keyword, or does not meet the criteria for an identifier or literal will throw a scanner error.

Parser/AST

`stch_parser.mly`

`stch_ast.ml`

The parser is written in OCamlYacc. It takes the tokens from the scanner, and using the grammar defined in the parser and the datatypes defined in the AST, generates an abstract syntax tree. The rules in the parser insure that code that passes this step is syntactically correct, although not necessarily semantically correct. Any error at this stage will throw a syntax error. The AST file also contains pretty printing functions for all datatypes defined therein.

Semantic Checking/CAST

`stch_ast.mll`

`stch_semantic.ml`

`stch.cast.mli`

Stitch first runs the AST through the semantic analyzer. This pass insures that the code is semantically valid. The output of the semantic analyzer is another AST, a C language AST. The major difference here is that the CAST carries with it a Stitch Environment, which has, most importantly, a list of declared functions, and a symbol table, which contains all declared identifiers and their type. Stitches symbol table also contains information on the expression that the identifier references, which is used in the C code generation to build pthread related code.

Code Generation

`c_generator.ml`

The CAST, which as already been semantically analyzed is now pretty printed. The bulk of the work to add multithreading is done here. The C generator performs multiple passes on the CAST. First any non-`main` functions are printed. Then any `stitch` loops are analyzed, and their statements are turned into a function. Finally, `main` is printed. This insures proper scoping of functions, and that all functions declared before `main` can be called in any `Stitch` block. To convert `stitch` loops to multithreaded `pthread` code, the C generator first takes the body of the loop and transforms it into a function. The generator also builds a custom `struct` for each `stitch` loop, that contains all in-scope, non-local variables that the loop will need access too. It then generates the `pthread` specific code, as well as a `for` loop that creates and runs the threads. The function containing the code body, as well as the structure containing all needed variables is passed into the `pthread`.

Test Plan

GCD

```
1 int gcd(int a, int b) {  
2     while (a != b) {  
3         if (a > b) {  
4             a = a - b;  
5         }  
6         else {  
7             b = b - a;  
8         }  
9     }  
10    return a;  
11 }  
12  
13 int main() {  
14     int x = 1;  
15     int y = 10;  
16  
17     int z = gcd(x,y);  
18  
19     print(z);  
20  
21     return 0;  
22 }
```

Listing 1: Stitch

GCD

```
1 #include "stch_headers.h"
2
3
4 int gcd(int b, int a)
5 {
6     while ((a != b)) {
7         if ((a > b))
8         {
9             a = (a - b);
10        }
11        else
12        {
13            b = (b - a);
14        }
15    }
16    return a;
17 }
18
19
20
21
22
23 int main()
24 {
25     int x = 1;
26     int y = 10;
27     int z = gcd(x, y);
28     printf("%d\n", z);
29     return 0;
30 }
```

Listing 2: C

Stitch loop Matrix Multiplication

```
1 int main() {
2
3     int i = 0;
4     int test = 6;
5
6     int a[6][6];
7     int k = 0;
8     int j = 0;
9
10    for(k = 0; k < 6; k = k + 1) {
11        for(j = 0; j < 6; j = j + 1) {
12            a[k][j] = 0;
13        }
14    }
15
16    stitch i from 0 to 6 by 1: {
17
18        int j;
19        for(j = 0; j < 6; j = j + 1) {
20            a[i][j] = a[i][j] + 10;
21        }
22    }
23
24    for(j = 0; j < 6; j = j + 1) {
25        for(k = 0; k < 6; k = k + 1) {
26            print(a[j][k]);
27        }
28    }
29
30    return 0;
31
32 }
```

Listing 3: Stitch

Stitch loop Matrix Multiplication

```
1 #include "stch_headers.h"
2
3
4
5 struct stch_rangeInfo_0 {
6     int begin;
7     int end;
8     int stepSize;
9     int k;
10    int (* a)[6];
11    int test;
12
13
14 };
15
16 void *_0 (void *vars) {
17     int i = 0;
18     for(i = ((struct stch_rangeInfo_0 *)vars)->begin; i < ((struct
        stch_rangeInfo_0 *)vars)->end; i++) {
19     {
20     int j;
21     for (j = 0 ; j < 6 ; j = j + 1) {
22     ((struct stch_rangeInfo_0 *)vars)->a[i][j] = ((struct stch_rangeInfo_0 *)vars
        )->a[i][j] + 10;
23     }
24     }
25
26     }
27     return (void*)0;
28 }
29
30 int main()
31 {
32     int i = 0;
33     int test = 6;
34     int a[6][6];
35     int k = 0;
36     int j = 0;
37     for (k = 0 ; (k < 6) ; k = (k + 1)) {
38     for (j = 0 ; (j < 6) ; j = (j + 1)) {
39     a[k][j] = 0;
40     }
41     }
42
43     pthread_t *threadpool_0 = malloc(NUMTHREADS * sizeof(pthread_t));
44     struct stch_rangeInfo_0 *info_0 = malloc(sizeof(struct stch_rangeInfo_0) *
```

```

    NUMTHREADS);
45 int thread_0 = 0;
46 for(i = 0; i < 6; i = i+6/NUMTHREADS) {
47     info_0[thread_0].begin = i;
48     info_0[thread_0].k = k;
49     info_0[thread_0].a = a;
50     info_0[thread_0].test = test;
51
52     if((i + 2*(6/NUMTHREADS)) > 6) {
53         info_0[thread_0].end = 6;
54         i = 6;
55     }
56     else {
57         info_0[thread_0].end = i + 6/NUMTHREADS;
58     }
59     int e = pthread_create(&threadpool_0[thread_0], NULL, _0, &info_0[thread_0]);
60     if (e != 0) {
61         perror("Cannot create thread!");
62         free(threadpool_0); //error, free the threadpool
63         exit(1);
64     }
65     thread_0++;
66 }
67
68 //loop and wait for all the threads to finish
69 for(i = 0; i < NUMTHREADS; i++) {
70     pthread_join(threadpool_0[i], NULL);
71 }
72 //now we loop and resolve any accumulators
73 for(i = 0; i < NUMTHREADS; i++) {
74
75 }
76
77 for (j = 0 ; (j < 6) ; j = (j + 1)) {
78     for (k = 0 ; (k < 6) ; k = (k + 1)) {
79         printf("%d\n", a[j][k]);
80     }
81 }
82 return 0;
83 }

```

Listing 4: C

Test Suite Log

Full test code supplied in appendix

```
*****  
* Positive Tests *  
*****  
Starting Test ./_tests/accum1.stch
```

COMPILE SUCCESSFUL!

DIFFing Output

TEST SCESSFUL!

Starting Test ./_tests/arith1.stch

COMPILE SUCCESSFUL!

DIFFing Output

TEST SCESSFUL!

Starting Test ./_tests/arith2.stch

COMPILE SUCCESSFUL!

DIFFing Output

TEST SCESSFUL!

Starting Test ./_tests/array1.stch

COMPILE SUCCESSFUL!

DIFFinG Output

TEST Sccessful!

Starting Test ./_tests/arrayassign.stch

COMPILE SUCCESSFUL!

DIFFinG Output

TEST Sccessful!

Starting Test ./_tests/break1.stch

COMPILE SUCCESSFUL!

DIFFinG Output

TEST Sccessful!

Starting Test ./_tests/collatz.stch

COMPILE SUCCESSFUL!

DIFFinG Output

TEST Sccessful!

Starting Test ./_tests/collatz2.stch

COMPILE SUCCESSFUL!

DIFFing Output

TEST Sccessful!

Starting Test ./_tests/comment1.stch

COMPILE SUCCESSFUL!

DIFFing Output

TEST Sccessful!

Starting Test ./_tests/comment3.stch

COMPILE SUCCESSFUL!

DIFFing Output

TEST Sccessful!

Starting Test ./_tests/escape.stch

COMPILE SUCCESSFUL!

DIFFing Output

TEST Sccessful!

Starting Test ./_tests/exit1.stch

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test ./_tests/file1.stch

COMPILE SUCCESSFUL!

DIFing Output

TEST SUCCESSFUL!

Starting Test ./_tests/file2.stch

COMPILE SUCCESSFUL!

DIFing Output

TEST SUCCESSFUL!

Starting Test ./_tests/for1.stch

COMPILE SUCCESSFUL!

DIFing Output

TEST SUCCESSFUL!

Starting Test ./_tests/func1.stch

COMPILE SUCCESSFUL!

DIFing Output

TEST SUCCESSFUL!

Starting Test ./_tests/func2.stch

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test ./_tests/func4.stch

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test ./_tests/func5.stch

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test ./_tests/gcd.stch

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test ./_tests/hello1.stch

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test ./_tests/hello2.stch

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test ./_tests/if1.stch

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test ./_tests/if2.stch

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test `./_tests/if3.stch`

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test `./_tests/main.stch`

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test `./_tests/matmult.stch`

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test `./_tests/matrix1.stch`

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test `./_tests/matrixinit.stch`

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test `./_tests/matrixstitch.stch`

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test `./_tests/negate.stch`

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test `./_tests/ops1.stch`

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test ./_tests/ops2.stch

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test ./_tests/sem2.stch

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test ./_tests/stitch1.stch

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test ./_tests/stitch2.stch

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test ./_tests/stitch3.stch

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test ./_tests/stitch4.stch

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test ./_tests/stitch5.stch

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test ./_tests/stitch6.stch

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

Starting Test ./_tests/stitch7.stch

COMPILE SUCCESSFUL!

DIFFing Output

TEST SUCCESSFUL!

* Negative Tests *

Starting Negative Test ./_ntests/arith3.stch

TEST SUCCESSFUL!

Starting Negative Test ./_ntests/array2.stch

TEST SUCCESSFUL!

Starting Negative Test ./_ntests/array3.stch

TEST SUCCESSFUL!

Starting Negative Test ./_ntests/array4.stch

TEST SUCCESSFUL!

Starting Negative Test ./_ntests/arrayinit1.stch

TEST SUCCESSFUL!

Starting Negative Test ./_ntests/arrayinit2.stch

TEST SUCCESSFUL!

Starting Negative Test ./_ntests/char1.stch

TEST SUCCESSFUL!

Starting Negative Test ./_ntests/comment2.stch

TEST SUCCESSFUL!

Starting Negative Test ./_ntests/comment4.stch

TEST SUCCESSFUL!

Starting Negative Test ./_ntests/error.stch

TEST SUCCESSFUL!

Starting Negative Test ./_ntests/exit2.stch

TEST SUCCESSFUL!

Starting Negative Test ./_ntests/file1.stch

TEST SUCCESSFUL!

Starting Negative Test ./_ntests/float1.stch

TEST SCESSFUL!

Starting Negative Test ./_ntests/func1.stch

TEST SCESSFUL!

Starting Negative Test ./_ntests/func2.stch

TEST SCESSFUL!

Starting Negative Test ./_ntests/globalvar1.stch

TEST SCESSFUL!

Starting Negative Test ./_ntests/if1.stch

TEST SCESSFUL!

Starting Negative Test ./_ntests/if2.stch

TEST SCESSFUL!

Starting Negative Test ./_ntests/matrixinit.stch

TEST SCESSFUL!

Starting Negative Test ./_ntests/matrixinit2.stch

TEST SCESSFUL!

Starting Negative Test ./_ntests/negate2.stch

TEST SCESSFUL!

Starting Negative Test ./_ntests/negate3.stch

TEST SCESSFUL!

Starting Negative Test ./_ntests/print.stch

TEST SCESSFUL!

Starting Negative Test ./_ntests/sem1.stch

TEST SCESSFUL!

Starting Negative Test ./_ntests/sem3.stch

TEST SCESSFUL!

Starting Negative Test ./_ntests/stitch1.stch

TEST SCESSFUL!

Starting Negative Test ./_ntests/stitch4.stch

TEST SUCCESSFUL!

Starting Negative Test ./_ntests/unfunc.stch

TEST SUCCESSFUL!

Starting Negative Test ./_ntests/vardecl1.stch

TEST SUCCESSFUL!

Starting Negative Test ./_ntests/void1.stch

TEST SUCCESSFUL!

Passed 71 / 71 tests

Test Description

We started with a basic hello world program and then started adding cases such as basic arithmetic, comparison and logical operations, conditionals, comments, functions etc. Once we were able to get the basics passing the test suite, we moved on to semantic checking, arrays (1D and 2D), file I/O, and stitch loops. We added negative tests for certain features for a more comprehensive testing suite.

Positive Tests

- Basic arithmetic
- Comparison ops
- Logical ops, negate
- Conditional statements
 - Nested variable declarations
 - Nested conditional statements
- Comments- single and multiple lines
- Functions- single, multiple, gcd
- Break, exit
- Type checking
- 1D arrays, initializing and assigning
- 2D arrays (matrices), initializing and assigning
- File I/O
- Stitch Loops
- Matrix multiplication
- Escaped characters
- Accumulators

Negative Tests

- Arithmetic with mismatched types
- Type checking with void
- Negate with floats, chars
- Global variables
- Comments
- Functions
 - Initializing variables as arguments
 - No return type
 - Declaring functions inside functions
 - Calling undeclared functions
- Arrays
 - Initializing, accessing, size parameter as expression
- Matrices
 - Initializing, accessing
- Print/error with wrong type
- File I/O
- Invalid conditionals
- Stitch Loops
 - Undeclared iterator variable
 - No curly braces around statement block

Test Automation

The test suite `stch_testSuite.sh` first makes the compiler, then iterates through each test in the positive tests folder, calling the tool chain `?Singer?. ?Singer?` runs the compiler on the test program, generating the `c` code, and compiling the `c` program with the appropriate runtime headers and `c` libraries. The test suite then checks if the file compiled, and prints the appropriate response to the screen and the log. It compares the difference between the output generated by the executable and the expected output, and prints the result to the screen and to the log. The negative tests are iterated through in a similar way, however the test only passes if the compilation fails. Finally, the test suite cleans up all the target programs, generated output, and executables.

Tests were added by all members of our team as they were needed. The test script is located in the appendix.

Lessons Larned

Rashedul Haydar

For a semester long project it's very important to try to get at least parts of the project done each week. Thankfully, we planned enough to have progress each week on the project. Having the weekly meetings with our advisor really pushed us to get something done every week. Even with the incremental progress, the last two weeks of the project was still crazy.

Megan Skrypek

I learned how important planning and communication is in tackling a large project like this. Having weekly meetings to work on components of the project as well as discuss future plans really helped us manage our time. Working on key components as a team really helped every member understanding the overall flow of the project, instead of only handling individual components. Some advice for future teams would be to start as early as possible, if you get stuck in the beginning it is very difficult to finish on time since each piece of the compiler builds on one another.

Daniel Cole

First and foremost, this was an amazing learning opportunity. Beyond learning the PLT related topics of compiler design, I learned group management, how to work on large scale, long term projects, how to integrate code written by multiple people, and how to partition tasks. One of the big challenges was the long scale of the project. Keeping everything moving, and everyone motivated when the deadline was far away was not always easy. The periodic milestones, as well as the weekly checkins help immensely.

Because so much of our language focused on the C code generation, when we got to that point, (from the end of November on), it became much harder to split up the work, as most work at this point was dependent on previous work, and had to be completed in sequence. For instance, matrices needed arrays done first, and the Stitch loop bodies needed the Stitch functions done first. Along with other classwork, this was the biggest issue we had with balancing the workload.

I'd also like to confirm pretty much everything you said at the beginning of the semester, especially regarding OCaml. It wasn't until around the time I finished up the semantic analyzer that I fully appreciated why you had us work in this language. While it won't be my first choice for most projects going forwards, for this type of thing, it is 100% the best language I can imagine.

Tim Waterman

Code