

Program Adjustment

Josh Branchaud and Eric Rizzi
CSE 990 - 4/23/13

Manual Code Search

code to find the maximum number in an array



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Right now, to **get the maximum**, I am looping through the **Array**, and resetting a variable to the **value** if it is greater than the existing **value**: ...

Manual Code Search



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What is the best way to get the minimum or maximum value from an Array

Let's say I have an Array of numbers: [2,3,3,4,2,2,5,6,7,2]

10

What is the best way to find the minimum or maximum value in that Array?

Right now, to get the maximum, I am looping through the Array, and resetting a variable to the value if it is greater than the existing value:

```
var myArray:Array /* of Number */ = [2,3,3,4,2,2,5,6,7,2];  
  
var maxValue:Number = 0;  
  
for each (var num:Number in myArray)  
{  
    if (num > maxValue)  
        maxValue = num;  
}
```

code to find the maximum n

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Right now, to get the maximum, I am looping through the Array, and resetting a variable to the value if it is greater than the existing value: ...

Automated Code Search

User-Defined Specifications

Preconditions:

- Given an array of integers, arr
- `arr.length() > 1`

Postconditions:

- For each n in arr, `ret >= n`

Magic Black Box

Source Code Database

```
var myArray:Array /* of Number */ = [2,3,3,4,2,2,5,6,  
var maxValue:Number = 0;  
for each (var num:Number in myArray)  
{  
    if (num > maxValue)  
        maxValue = num;  
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Automated Code Search

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}
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Problem

We have a program that almost does what we want it to (almost correct).

Solution(s):

- Manually Fix/Adjust Program
- Automatically Fix/Adjust Program?

Project Overview

- Trace Generation
- Trace Differentiation
- Fault Localization
- Pre/Post Condition Generation
- Synthesis

```
foo(x, y): precondition: (x != 0)
    int a = 1;
    if(x>0)
        if(y<=0)
            a = -1;
    else
        if(y>=0)
            a = -1;
    if(a <= 0)
        if(y<0)
            y = y * -1;
        else
            if(x<0)
                x = x * - 1;
    if(x<0)
        x = x * -1; y = y * -1;
    x = x + y;
    return x; postcondition: (return > 0)
```


Project Demo

Evaluation and Expectations

Evaluation with control systems:

- Traffic Collision Avoidance System (TCAS)
- Wheel Brake System (WBS)
- Elevator control system

Characteristics:

- Restricted to integers and booleans
- Lots of conditional control flow
- No looping
- 1 Step Mutations

Future Work

- Glue all the pieces of the project together
- Consider generating subsets of traces rather than an exhaustive list
- Consider weighting traces before fault localization
- Generate more succinct constraints for the synthesis
- Add more complex grammars to the synthesis

Concluding Remarks

Program Adjustment is possible by building off of existing approaches (Logozzo and SemFix) using:

- Statistical Fault Localization
- Localized Specification Construction
- Program Synthesis

References

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Comments and Questions