Data Structure Visualization

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Introduction

Is there an easy way to visualize data structures and their operations?

The main data structures we learn about are:
-Arrays
-Linked Lists
-Stacks
-Queues
-Hashes
-Trees
-Graphs

Data Structure Visualization is an app that helps students visualize operations for each data structure.

Visualizing how data moves around in a data structure is essential to understanding how to implement a particular algorithm.

The idea came about when I was thinking back to learning about each data structure and the difficulty I was having understanding them.

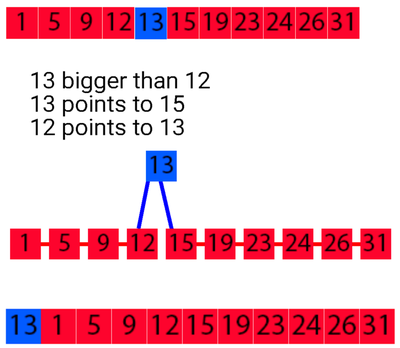
Methodology

I used Android Studios to create a an app for the android operating system.

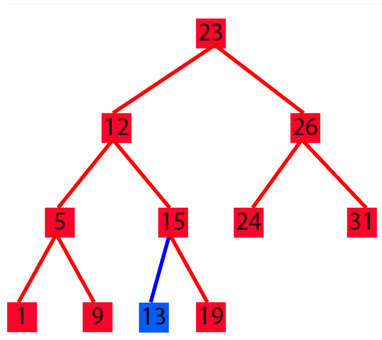
For each data structure animation I created a view class, where all the animation takes place on a canvas within the onDraw method.

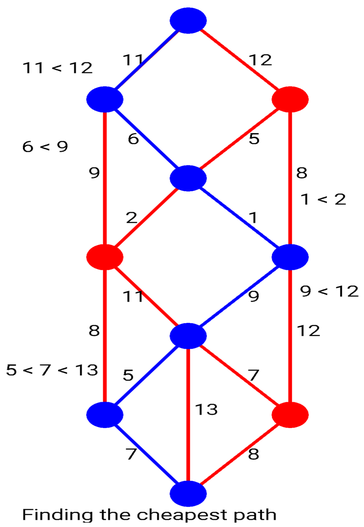
```
15  public class AnimationActivityGraph extends View {
16      Activity myActivity;
17      Paint redPaintBrushFill, bluePaintBrushFill, blackPaintBrushFill, white;
18      Paint redPaintBrushStroke, bluePaintBrushStroke;
19      int x,y,y_dir;
20      final MediaPlayer mp1, mp2;
21      Boolean mp1b,mp2b;
22
23      public AnimationActivityGraph(Context context,Activity activity) {
24          super(context);
25          myActivity = activity;
26          setBackgroundResource(R.drawable.white);
27          x = 10;
28          y = 5;
29          y_dir = 0;
30          mp1 = MediaPlayer.create(context, R.raw.song11);
31          mp2 = MediaPlayer.create(context, R.raw.chimes);
32          mp1b = mp2b = true;
33
34      }
35
36      @Override
37      protected void onDraw(Canvas canvas) {
38          super.onDraw(canvas);
39          redPaintBrushFill = new Paint();
40          redPaintBrushFill.setColor(Color.RED);
41          redPaintBrushFill.setStyle(Paint.Style.FILL);
42          redPaintBrushFill.setTextSize(60);
```

Results

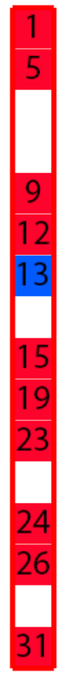


cannot insert in order





Finding the cheapest path



Data Structure Visualization

Format	SORT	INSERT
	SEARCH	DELETE
	SMALL LIST, BIG LIST	
Array		
	110156 , 8989167	184010 , 60369166
	8958 , 209531	12813 , 3750
Linked List		
	158698 , 9820521	10000 , 195677
	3763073 , 345417	4115 , 193021
Stack		
	408281 , 14918386	293386 , 7170000
	45885 , 249115	15261 , 227604
Queue		
	234844 , 5823177	497969 , 9494167
	13646 , 142240	17292 , 283646
Hash		
	106406 , 6046094	199531 , 6460521
	5052 , 1458	7136 , 1719
Tree		
	64479 , 606563	132917 , 8695729
	9010 , 1666	9531 , 2083

Conclusion

This project was a valuable experience for me for a few reasons:

-It was a great review of the core data structures I learned
-It taught me many things about app development
-It prepared me for technical job interview questions
-It was the first time I tackled a large project by myself
-It taught me a lot about programming drawing and animation

Although I was not able to fit everything I wanted into this project, I am very happy with the product and look forward to improving it over time.

Future of Data Structure Visualization

I would like to make animations for sorting, searching, and deleting for applicable data structures. I would also like a practical way for the user to view certain code segments for each data structure.

Acknowledgments

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