



Computer Science 501

Data Structures & Algorithms

The College of Saint Rose
Fall 2013

Lab 6: The Two Towers Problem

Due: 6:00 PM, Wednesday, October 30, 2013

This week's assignment is the laboratory at the end of Chapter 8 in Bailey. You will gain experience writing your own generally-useful `Iterator` class and use it to solve an interesting problem.

Notes and Hints

When you implement your `SubsetIterator` that extends `AbstractIterator`, be sure to import `structure5.*` and `java.util.Iterator` at the top of your file. Also remember that your `SubsetIterator` should use generic types. It is far from obvious how to accomplish this, so here is what your class header should look like for the `SubsetIterator`:

```
public class SubsetIterator<E,T extends Vector<E>> extends AbstractIterator<T>
```

During the implementation of your `SubsetIterator`'s `get` and `next` methods, you will need to create a `Vector<E>` and return it as a `T` to satisfy the required return types specified by `AbstractIterator<T>` for those methods. Java's syntax for this is again not entirely obvious. This should work:

```
T subset = (T)new Vector<E>();
```

For testing, write a `main` method of your `SubsetIterator` that creates a `Vector<Integer>` with the `Integers` from 0 through 7, creates a `SubsetIterator<Integer, Vector<Integer>>` with this `Vector<Integer>`, and then prints out all subsets returned and a count of the subsets returned. Make sure you end up with 256 subsets printed. Please leave this `main` method in your program when you submit.

Write the `main` method to solve the two towers problem in a separate class called `TwoTowers`, proceeding as specified in the lab description in the text.

Thought Questions

In a plain-text file named `README`, write your answers to the following thought questions.

1. Thought question 1 from Bailey p. 177. (1 point)
2. Thought question 2 from Bailey p. 177. (2 points)

3. What is the time complexity of this problem? Explain briefly. (1 point)
4. How long does it take your program to find the answer to the 20-block problem? (hint: try the `time` command rather than instrumenting your source code with a timer). (1 point)
5. Based on the time taken to solve the 20-block problem, about how long do you expect it would take to solve the 21-block problem? What is the actual time? (1 point)
6. How long does it take to solve the 22-, 23-, 24-, and 25-block problems? (1 point)
7. Do these agree with your expectations, given the time complexity of the problem? (1 point)
8. Estimate the time that would be needed to solve the 40- and 60-block problems, and explain briefly how you arrived at these approximations. (You can try these if you're very patient, but for the purposes of this question, just estimate based on the run times of the smaller problems). (2 points)

Before 6:00 PM, Wednesday, October 30, 2013, submit your Java program for grading. There are two things you need to do to complete the submission: (i) upload a copy of your tar or zip file (for your program, please include `.java` files only, no `.class` files) using Submission Box at <http://sb.teresco.org> under assignment "TwoTowers", and (ii) print and turn in a hard copy of your program.

Don't forget to check your programs for compliance with the Style Guide for CSC 501 Programs

Grading

This lab assignment is graded out of 30 points.

Grading Breakdown	
Program design and style	2 points
Program documentation	4 points
Program correctness: <code>SubsetIterator</code>	8 points
Program correctness: <code>TwoTowers</code>	6 points
Thought questions	10 points