

EXERCISE 1: Experimental Analysis Review

Suppose that you collect the following timing data for a program as a function of the input size n .

n	$T(n)$
125	0.03 sec
1,000	1.00 sec
8,000	32.00 sec
64,000	1,024.00 sec
512,000	32,768.00 sec

Estimate the running time of the program as a function of n and use tilde notation.

EXERCISE 2: Experimental Analysis Hands-on Activity

(a) Download the precept project folder (`precept1.zip`) from the precepts page and unzip it. Launch IntelliJ, click on open and then choose the project folder you have just unzipped.

(b) Discuss with your group about what the `ErdosRenyi.java` program does.

(c) Run **ErdosRenyi.java** with a fixed number of experiments $k = 100$. Start with the input size $n = 12500$ and double n as appropriate. Complete the table below. Compute b , assuming that the running time follows the form an^b .

n	$T(n)$	$\frac{T(2n)}{T(n)}$	$\lg \frac{T(2n)}{T(n)}$
12,500			
25,000			
50,000			
100,000			
200,000			

(d) Run **ErdosRenyi.java** with a fixed $n = 50000$. Start with $k = 25$ and double k as appropriate and complete the table below. Assuming that the running time follows the form ak^c , compute c .

k	$T(k)$	$\frac{T(2k)}{T(k)}$	$\lg \frac{T(2k)}{T(k)}$
25			
50			
100			
200			
400			

(e) Based on your answers in the two previous questions, come up with a formula in the form

$$T(n, k) = an^bk^c$$

to express the running time of the program as a function of n and k .

(f) Why is it not a good idea to use data with running times less than 0.25 seconds?

EXERCISE 3: Memory Analysis

Consider the following Java class.

```
1 public class MyClass {  
2  
3     private int n;  
4     private Integer[][] grid;  
5  
6     public MyClass(int n) {  
7         this.n = n;  
8         grid = new Integer[n][n];  
9     }  
10 }
```

(a) Use tilde notation to describe how much memory an object of type **MyClass** requires as a function of n right after the constructor finishes execution.

(b) Use tilde notation to describe how much memory a **MyClass** object requires as a function of n , assuming that there are no *null* items in the grid. Note that every object of type **Integer** requires 24 bytes.