

## Feedback — Analysis of Algorithms

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You submitted this quiz on **Sun 6 Sep 2015 11:52 AM EDT**. You got a score of **1.00** out of **3.00**. You can [attempt again](#), if you'd like.

To specify an array or sequence of values in an answer, separate the values in the sequence by whitespace. For example, if the question asks for the first ten powers of two (starting at 1), then the following answer is acceptable:

1 2 4 8 16 32 64 128 256 512

If you wish to discuss a particular question and answer in the forums, please post the entire question and answer, including the seed (which can be used by the course staff to uniquely identify the question) and the explanation (which contains the correct answer).

### Question 1

(seed = 355837)

Suppose that you time a program as a function of  $N$  and produce the following table.

$N$	seconds
-----	
2048	0.000
4096	0.001
8192	0.002
16384	0.008
32768	0.024
65536	0.072

131072	0.222
262144	0.680
524288	2.080
1048576	6.380
2097152	19.519
4194304	59.896
8388608	183.483
16777216	562.189
33554432	1722.004

Estimate the order of growth of the running time as a function of N. Assume that the running time obeys a power law  $T(N) \sim a N^b$ . For your answer, enter the constant b. Your answer will be marked as correct if it is within 1% of the target answer - we recommend using two digits after the decimal separator, e.g., 2.34.

You entered:

1.11

Your Answer		Score	Explanation
1.11	✗	0.00	
Total		0.00 / 1.00	

### Question Explanation

The theoretical order-of-growth is  $N^{(21/13)} = 1.62$

The empirical order-of-growth is  $N^{(\log_2 \text{ ratio})}$

N	seconds	ratio	log <sub>2</sub> ratio
-----			
2048	0.000	-	-
4096	0.001	-	-
8192	0.002	2.00	1.00
16384	0.008	4.00	2.00
32768	0.024	3.00	1.58
65536	0.072	3.00	1.58
131072	0.222	3.08	1.62

262144	0.680	3.06	1.61
524288	2.080	3.06	1.61
1048576	6.380	3.07	1.62
2097152	19.519	3.06	1.61
4194304	59.896	3.07	1.62
8388608	183.483	3.06	1.62
16777216	562.189	3.06	1.62
33554432	1722.004	3.06	1.61

## Question 2

(seed = 974590)

What is the order of growth of the worst case running time of the following code fragment as a function of N?

```
int sum = 0;
for (int i = 1; i <= N/2; i = i*2)
    sum++;
```

Your Answer	Score	Explanation
<input type="radio"/> 1		
<input checked="" type="radio"/> log N	✓ 1.00	
<input type="radio"/> $N^{(1/2)}$		
<input type="radio"/> N		
<input type="radio"/> N log N		
<input type="radio"/> $N^{(3/2)}$		
<input type="radio"/> $N^2$		

☐ $N^2 \log N$ ☐ $N^{(5/2)}$ ☐ $N^3$ ☐ $N^4$ ☐ $N^5$ ☐ $N^6$ ☐ $N^7$ 

Total

1.00 / 1.00

**Question Explanation**

The answer is :  $\log N$

The  $i$  loops iterates  $\sim \lg(N/2) \sim \lg N$  times.

**Question 3**

(seed = 799113)

Given the following definition of a MysteryBox object:

```
public class MysteryBox {  
    private final long x0, x1, x2;  
    private final int y0, y1;  
    private final boolean z0, z1, z2, z3;  
    private final double[] a = new double[256];  
  
    ...  
}
```

}

Using the 64-bit memory cost model from lecture, how many bytes does each object of type MysteryBox use? Include all memory allocated when the client calls new MysteryBox().

**You entered:**

Your Answer		Score	Explanation
2128	✖	0.00	
Total		0.00 / 1.00	

### Question Explanation

The correct answer is: 2136

```

public class MysteryBox {                                // 16 (object overhead)
    private final long x0, x1, x2;                        // 24 (3 long)
    private final int y0, y1;                             // 8 (2 int)
    private final boolean z0, z1, z2, z3;                // 4 (4 boolean)
    private final double[] a = new double[256];          // 8 (reference to array)
                                                         // 2072 (double array of size 256)
    ...                                                    4 (padding to round up to a multiple of 8)
}                                                         ----
                                                         2136

```