

Problem set 7  
(Assigned on October 31)

1. What are the binary numbers  $10_2, 100_2, 1000_2, \dots$ , in decimal?  
Can you see a pattern?

2. What are the binary numbers  $1_2, 11_2, 111_2, 1111_2, \dots$  in decimal?  
Can you see a pattern? What is the sum of  $111_2 + 1_2$ ? What about  $111111_2 + 1_2$  or  $\underbrace{111 \dots 111}_2 + 1_2$ ?  
100 ones

3. Portia and her husband lived happily ever after (we talked about Portia on Sunday) and had a daughter, Portia II (we will call her Portia). When she grew up, she decided to choose a husband using a well established casket method. In this test, each lid contained two statements, and Portia explained that no lid contained more than one false statement and there is exactly one portrait in caskets:

<p><b>GOLD</b> THE PORTRAIT IS NOT IN HERE</p>	<p><b>SILVER</b> THE PORTRAIT IS NOT IN THE GOLD CASKET</p>	<p><b>LEAD</b> THE PORTRAIT IS NOT IN HERE</p>
<p>THE ARTIST OF THE PORTRAIT IS FROM VENICE</p>	<p>THE ARTIST OF THE PORTRAIT IS REALLY FROM FLORENCE</p>	<p>THE PORTRAIT IS REALLY IN THE SILVER CASKET</p>

Which casket should a suitor choose to find the portrait?

4. If the suitor passed the first test, he was taken into another room, which contained new three caskets. Portia explained that caskets contained exactly one portrait, and on one of the lids, both statements were true, on another one both statements were false, and on the third, one was true and one was false.

<b>GOLD</b> THE PORTRAIT IS NOT IN THIS CASKET	<b>SILVER</b> THE PORTRAIT IS NOT IN THE GOLD CASKET	<b>LEAD</b> THE PORTRAIT IS NOT IN THIS CASKET
IT IS IN THE SILVER CASKET	IT IS IN THE LEAD CASKET	IT IS IN THE GOLD CASKET

Which casket should a suitor choose to find the portrait?