

AP Computer Science Principles  
Ticket Out the Door  
Set 2: Limitations of Storing Numbers

Name \_\_\_\_\_ Period \_\_\_\_\_

<b>Skill 2.01 Exercise 1</b>
Consider a computer that uses 6 bits to represent integers: 1 bit for the sign and 5 bits for the actual number. What's the largest positive integer it can represent?
If the left-most bit represents the sign, where 0 = positive and 1 = negative, what is 11001 in decimal?
11001
If the left-most bit represents the sign, where 0 = positive and 1 = negative, what is -21 in decimal?

<b>Skill 2.02 Exercise 1</b>
On a computer which uses 6 bits to represent integers (with 1 bit to represent the sign), which of these operations result in overflow?
15+15
8 * 4
3+29
30+1

<b>Skill 2.03 Exercise 1</b>
Convert each of the floating point numbers to binary
0.125
0.03125
0.675
0.375
10.75

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### Skill 2.04 Exercise 1

A scientist is running a program to calculate the volume of a cone:

```
radius ← 17.24  
height ← 5.24  
volume ← PI * (radius * radius) * (height / 3)
```

The code relies on the built-in constant PI. After running the code, the variable volume stores 1630.9266447568566.

Their supervisor checks their results by running the same calculation on their own computer. Their program results in a volume of 1630.9266447564448.

The two values are very close, but not quite the same. Why?

### Skill 2.04 Exercise 2

Nuru writes this code to calculate the final cost of an item with a discount applied:

```
price ← 0.7  
discount ← 0.2  
final ← price - discount
```

They're surprised to see that final stores the value 0.49999999999999994 instead of 0.5.

What is the best explanation for that result?

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