

Boolean Operators: Fun or Not?

- Fill in the table for the following formula: $(x_1 \vee x_2) \vee (x_2 \wedge x_3)$
(i.e., $(x_1 \text{ OR } x_2) \text{ OR } (x_2 \text{ AND } x_3)$)

x_1	x_2	x_3	Result
True	True	True	
True	True	False	
True	False	True	
True	False	False	
False	True	True	
False	True	False	
False	False	True	
False	False	False	

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2. Fill in the table for the following formula: $(x_1 \vee x_2) \wedge \bar{x}_3$ (i.e., (x₁ OR x₂) AND (NOT x₃))

x_1	x_2	x_3	Result
True	True	True	
True	True	False	
True	False	True	
True	False	False	
False	True	True	
False	True	False	
False	False	True	
False	False	False	

3. Is there a variable that determines the value of the whole formula (i.e., the result of the formula will be whatever value this variable is)? If so, which variable is this?

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Data Representation

1. Convert the hexadecimal number 0x312 into binary.
2. Convert the binary number 11 0011 0011 1110 to hexadecimal.
3. Convert the decimal number 133 to binary.
4. Give the result (in binary) obtained from $100100 + 01101$.
5. True or false: $\{0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F,G,H,I\}$ is the set of digits in the hexadecimal number system.
6. What is the maximum RGB value possible?
7. How many numbers can be represented using 3 hexadecimal digits?
8. A long time ago, BC used to use license numbers that had the form: alphabet alphabet alphabet number number number (e.g., ABC 012). How many license plate numbers are possible under this formatting scheme?
 - a. $26 \times 26 \times 26 \times 10 \times 10 \times 10 = 17\,576\,000$
 - b. $26 \times 26 \times 26 \times 11 \times 11 \times 11 = 23\,393\,656$
 - c. $26 \times 26 \times 26 \times 26 \times 26 \times 26 = 308\,915\,776$
 - d. $16 \times 16 \times 16 \times 16 \times 16 \times 16 = 16\,777\,216$

Data Mining

1. What are the two key properties that help us identify valid association rules?
 - a. Support and K-Means clustering
 - b. Support and Confidence
 - c. Confidence and Transactions
 - d. Modus ponens and Clustering
2. Use the transactions table below to answer the following two questions:

Transaction	Items
T1	Beach, Sun, Sunscreen
T2	Ball, Frisbee, Cloudy, Sunscreen
T3	Umbrella, Towel, Sun, Beach, Frisbee
T4	Cloudy, Lotion, Swim Wear, Frisbee
T5	Picnic, Volleyball, Lotion, Sun, Beach

- A. What is the support of the set {Sun, Beach}?
 - a. $3/3 = 1$
 - b. $2/3$
 - c. $3/5$
 - d. None of the above
 - B. What is the confidence of Sun \rightarrow Frisbee?
 - a. $1/3$
 - b. $3/4$
 - c. $2/3$
 - d. None of the above
3. Which of the following about support is false?
 - a. Support is the degree to which items appear together
 - b. Intuitively, Support captures Cause and Effect.
 - c. Support threshold is one property to check if the rule $X \rightarrow Y$ is valid
 - d. All of the above is true

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4. Which of the following is not a downside of K-means clustering?
 - a. The algorithm may give different cluster solutions depending on how the initial centroids are chosen
 - b. It is not always clear how to choose k, the number of clusters
 - c. You can use this algorithm on any number of data points
 - d. Depending on the data points, it is possible there is no final answer

5. What is dirty data and give an example of this. How might this cause issues in automation?

Artificial Intelligence

1. State and explain the two notions of Artificial Intelligence

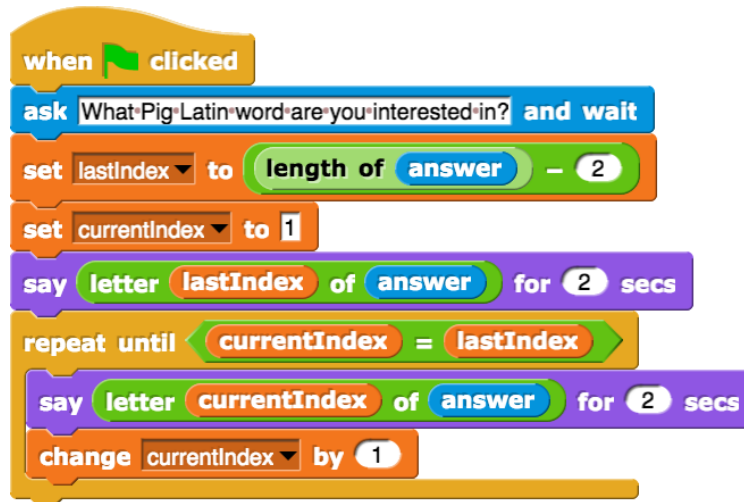
2. What are some pros and cons of self-driving cars?

Natural Language Processing (NLP)

1. What are some limitations of traditional NLP?
2. Can “The tall lady in blue jeans drove the car” be parsed by the grammar below?
S \rightarrow NP VP
VP \rightarrow V NP | V NP PP
PP \rightarrow P NP
V \rightarrow “drove”
NP \rightarrow Det N | Det N PP | Det Adj N
Det \rightarrow “the”
N \rightarrow “lady” | “jeans” | “car”
P \rightarrow “in”
Adj \rightarrow “tall” | “blue”
3. How does Eliza construct responses to the user when asked a question?

Snap It!

[Pig Latin](#) is a made up language that takes the first letter of a word and puts it at the end. It then adds AY to the end of the word. For example, the word “cat” would become “atcay”.



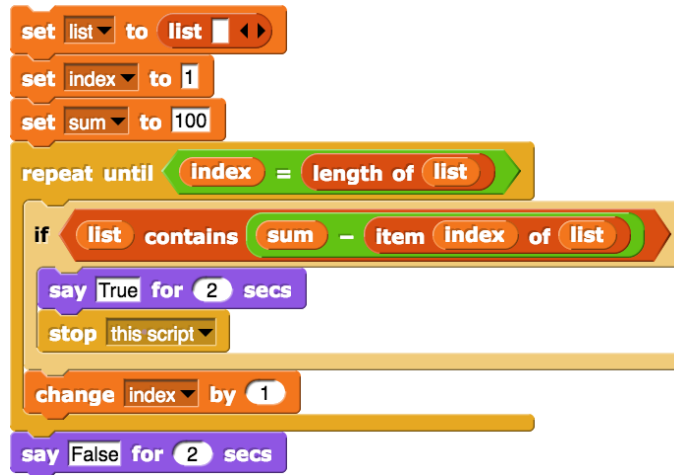
```
when clicked
ask What Pig Latin word are you interested in? and wait
set lastIndex to length of answer - 2
set currentIndex to 1
say letter lastIndex of answer for 2 secs
repeat until currentIndex = lastIndex
say letter currentIndex of answer for 2 secs
change currentIndex by 1
```

1. What is the piece of code (above) trying to do?

2. How many variables are in this code snippet?

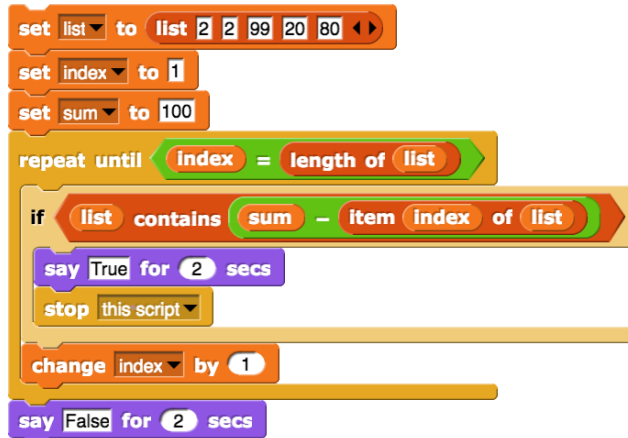
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3. Use one sentence to describe what the program below does. What would it return?



```
set list to list
set index to 1
set sum to 100
repeat until (index = length of list)
  if (list contains (sum - item index of list))
    say True for 2 secs
    stop this script
  change index by 1
  say False for 2 secs
```

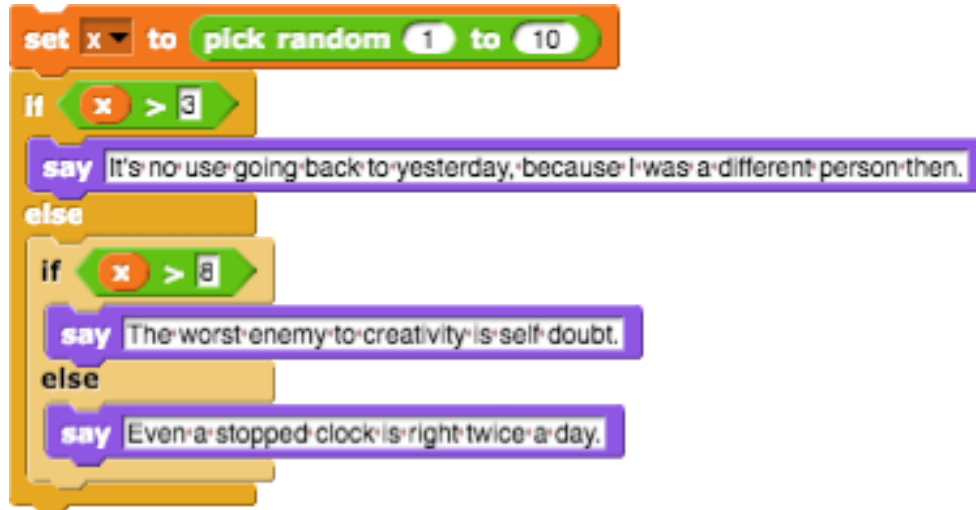
4. What will the above program return if the list is: `list 2 2 99 20 80`. In other words, if the code looked like the following, what would it return?



```
set list to list 2 2 99 20 80
set index to 1
set sum to 100
repeat until (index = length of list)
  if (list contains (sum - item index of list))
    say True for 2 secs
    stop this script
  change index by 1
  say False for 2 secs
```

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5. Amelia wrote the following code to randomly output different quotes. She doesn't care which quote is outputted as long as they are randomly outputted. However, she realizes that the program never outputs "The worst enemy to creativity is self doubt" Find the bug that causes this problem.



```
set x to pick random 1 to 10
if x > 3
  say "It's no use going back to yesterday, because I was a different person then."
else
  if x > 8
    say "The worst enemy to creativity is self doubt."
  else
    say "Even a stopped clock is right twice a day."
```

The code consists of the following blocks:

- set x to pick random 1 to 10** (orange block)
- if x > 3** (green block)
- say "It's no use going back to yesterday, because I was a different person then."** (purple block)
- else** (yellow block)
- if x > 8** (green block)
- say "The worst enemy to creativity is self doubt."** (purple block)
- else** (yellow block)
- say "Even a stopped clock is right twice a day."** (purple block)

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Multiple Choice

1. In a set of numbers, the median is:
 - a. The sum of numbers, divided by the total number of numbers
 - b. The number that occurs more frequently
 - c. The number in the middle of a set of numbers when the numbers are arranged in order.
2. Which of the following is the meaning of the acronym DNS:
 - a. Domain Name Services
 - b. Domain Name Servers
 - c. Directory Name Servers
 - d. Direct Name Services
3. What do you think will happen if you take a color picture of Las Vegas, and for every pixel, you replace the RGB values with the average of the three values?
 - a. Every pixel turns black
 - b. The image becomes a grayscale image
 - c. Every pixel turns white
 - d. The image becomes reddish

Hardware

1. True or false: All the memory your computer uses can be stored in cache
2. List one similarity and one difference between cache and register
3. Order the following from fastest to smallest: RAM, Hard drive, Cache, Registers