

Boolean Operators: Fun or Not?

1. 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 | |

Answer:

| x_1 | x_2 | x_3 | $(x_1 \vee x_2)$ | $(x_2 \wedge x_3)$ | Result |
|-------|-------|-------|------------------|--------------------|--------|
| True | True | True | True | True | True |
| True | True | False | True | False | True |
| True | False | True | True | False | True |
| True | False | False | True | False | True |
| False | True | True | True | True | True |
| False | True | False | True | False | True |
| False | False | True | False | False | False |
| False | False | False | False | False | False |

2. Fill in the table for the following formula: $(x_1 \vee x_2) \wedge \overline{x_3}$ (i.e., $(x_1 \text{ OR } x_2) \text{ AND (NOT } x_3)$)

| 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 | |

Answer:

| x_1 | x_2 | x_3 | $(x_1 \vee x_2)$ | $\overline{x_3}$ | Result |
|-------|-------|-------|------------------|------------------|--------|
| True | True | True | True | False | False |
| True | True | False | True | True | True |
| True | False | True | True | False | False |
| True | False | False | True | True | True |
| False | True | True | True | False | False |
| False | True | False | True | True | True |
| False | False | True | False | False | False |
| False | False | False | False | True | 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?

None. If there was a variable that would determine the value of the whole equation, you would see the value of the variable match with the result. $\overline{x_3}$ comes close but the last row in the table does not match the value in the result.

Data Representation

1. Convert the hexadecimal number 0x312 into binary.

11 0001 0010

2. Convert the binary number 11 0011 0011 1110 to hexadecimal.

0x333E

(The 0x portion of the answer is just a notation we use to indicate a number is in hexadecimal form. Having just 333E is also acceptable).

3. Convert the decimal number 133 to binary.

1000 0101

4. Give the result (in binary) obtained from 100100 + 01101.

110001

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.

False

6. What is the maximum RGB value possible?

FFFFFF (white)

7. How many numbers can be represented using 3 hexadecimal digits?

4096

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. $16 \times 16 \times 16 \times 16 \times 16 \times 16 = 16\,777\,216$

Answer: a

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

Answer: b

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

Answer: c

- B. What is the confidence of Sun \rightarrow Frisbee?

- a. $1/3$
- b. $3/4$
- c. $2/3$
- d. None of the above

Answer: a

3. Which of the following about support is false?
- Support is the degree to which items appear together
 - Intuitively, Support captures Cause and Effect.
 - Support threshold is one property to check if the rule $X \rightarrow Y$ is valid
 - All of the above is true

Answer: b. This is for Confidence not Support

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

Answer: c

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

Possible Answers:

- “Dirty data” is data that is not consistent and there are multiple possible interpretations of data to represent the same thing.
- Examples of dirty data include: incomplete data, duplicated data, data with ranges outside of what was intended (e.g., I put in 10000 for the year I was born).
- When you try to automate something, you are trying to get a computer to replicate what you would normally do. For example, when I am trying to fill in my taxes, I look at what line number it is asking me to find data for, go to my T4 to find the corresponding line, and then copy the value from my T4 to my tax form. When values fall outside of the norm, the computer doesn't know what to do and can treat this anomaly by shutting down (e.g., error messages or it freezes), filling in a random value, or by behaving in some other manner.

Artificial Intelligence

1. State and explain the two notions of Artificial Intelligence

Weak AI: The computer just has to APPEAR intelligent (e.g., Turing's imitation game, Cleverbot, IBM Watson). It doesn't necessarily create ideas nor does it understand what it is saying.

Strong AI: The computer has to be able to think. It can create ideas or understand (e.g., Data).

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

Pros:

- The 360 has a larger field of vision than human drivers inside of cars have
- Removes human emotion and avoids intoxicated or drunk drivers driving on the roads
- People can relax in the car, more time to be productive

Cons:

- Liability issues, uncertain who should be responsible for accidents
- May cause future generations to not know how to drive
- Hackers could cause accidents and control the car
- Solutions to ethical problems and dilemmas must be programmed into the self-driving car (e.g., If a collision is inevitable (e.g., either run into a building or curve and hit a pedestrian on the street), should the passenger be killed by the car running into the wall or should the car swerve to the right and hit a pedestrian?)

Natural Language Processing (NLP)

1. What are some limitations of traditional NLP?

Possible Answers (from slides):

- Natural language is structurally ambiguous so parsing alone cannot lead to understanding
- Synonyms for words can't be used interchangeably in every context and it's difficult for traditional NLP to determine when synonyms can and can't be used. (This is related to the first point about ambiguity.)
- Natural languages have many exceptions to grammatical rules, no agreed upon grammar for all uses of a language

2. Can "The tall lady in blue jeans drove the car" be parsed by the grammar below?

$S \rightarrow NP VP$

$VP \rightarrow V NP \mid V NP PP$

$PP \rightarrow P NP$

$V \rightarrow \text{"drove"}$

$NP \rightarrow Det N \mid Det N PP \mid Det Adj N$

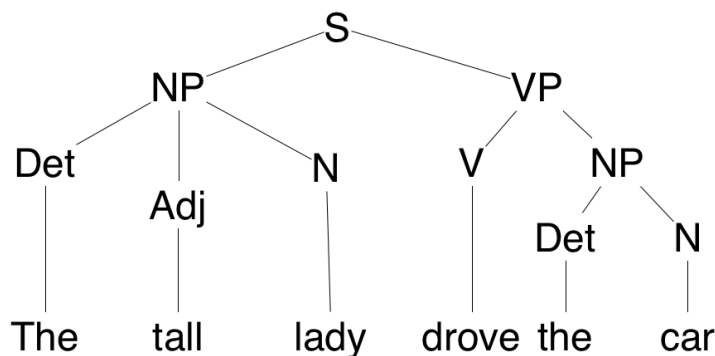
$Det \rightarrow \text{"the"}$

$N \rightarrow \text{"lady"} \mid \text{"jeans"} \mid \text{"car"}$

$P \rightarrow \text{"in"}$

$Adj \rightarrow \text{"tall"} \mid \text{"blue"}$

No, NP could only parse into Det Adj N or Det N PP, but not Det Adj N PP. You would only get as far as the image below.

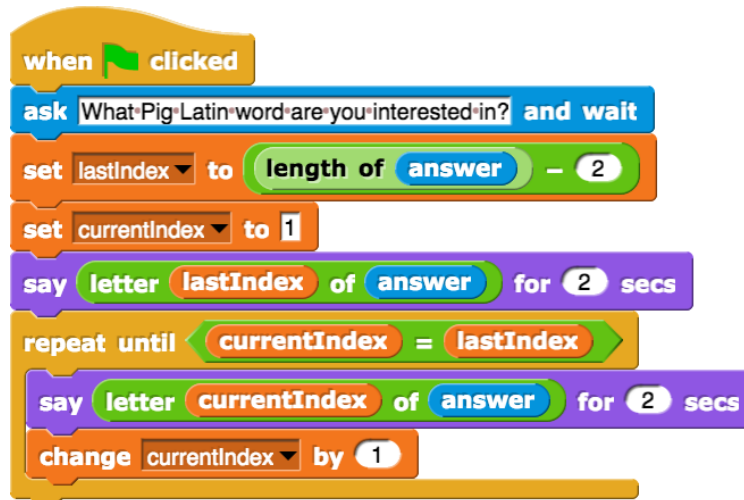


3. How does Eliza construct responses to the user when asked a question?

She usually repeats a portion of what was asked in the answer.

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”.



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

The code above takes a Pig Latin word and changes it back into its original form. For example, given the Pig Latin word “IGPAY”, it says P and then IG. Thus, the user will know what a Pig Latin word originally was.

2. How many variables are in this code snippet?

Two: lastIndex and currentIndex.

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
  
```

Checks if any 2 pair of elements in the list add up to 100.

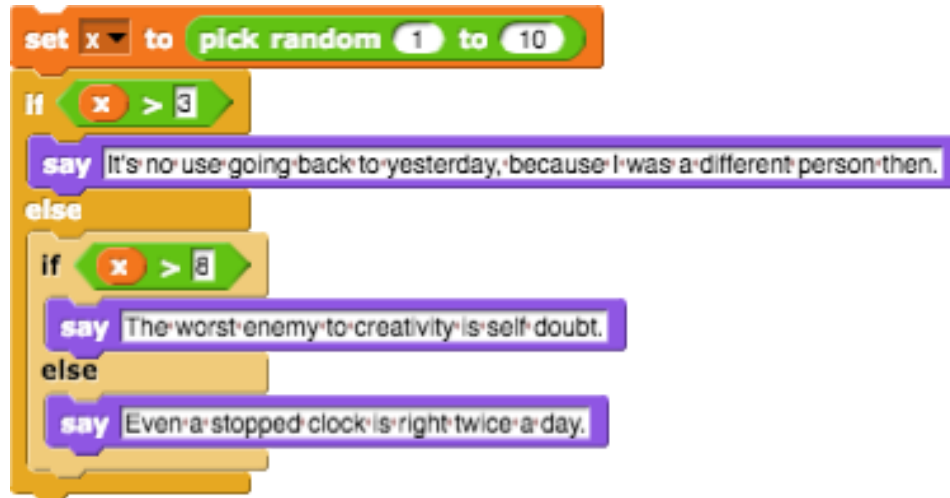
4. What will the above program return if the list is: `list 2 2 99 20 80`. In other words, if the code looked like the following, what would it return?

```

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
  
```

Returns "True".

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 $x > 8$ case will never be reached because the $x > 3$ case would have already caught it. Therefore, Amelia should flip these two statements around.

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.

Answer: c

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

Answer: b

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

Answer: b

Hardware

1. True or false: All the memory your computer uses can be stored in cache
False
2. List one similarity and one difference between cache and register
 - Similarity: fast to access
 - Difference: Cache stores memory on chip whereas register holds the data that the computer is actively working with
3. Order the following from fastest to smallest: RAM, Hard drive, Cache, Registers
Registers, Cache, RAM, Hard disk