

Problem #1

```
import re
import numpy as np

sport = "sport"

# PATTERNS: our templates and responses

p0 = r"(.+) like (.+)"
r0 = [r"What makes you like {1}?", r"Have you ever played {1}?", r"Do you prefer to watch or play {1}?"]

p1 = r"(.+) have played (.+) for (.+)"
r1 = [r"How long have you played {1}?", r"Why did you start playing {1}"]

p1_1 = r"(.+) have played (.+)"
r1_1 = [(r"How long have you played that sport?", (r"Why did you start playing that sport?"))]

p1_2 = r"yes i have (.+)"
r1_2 = [r"Why have you {0}?", r"How long have you {0}?", r"What made you {0}?"]

p1_3 = r"yes i have"
r1_3 = [(r"Why have you played that sport?", (r"How long have you played that sport?"), (r"What made you play that sport?"))]

p1_4 = r"i have (.+)"
r1_4 = [r"How long have you {0}?", r"Why did you start {0}?"]

p2 = r"i think (.+)"
r2 = [r"Why do you think {0}?", r"What makes you think {0}?", r"Did someone tell you {0}?"]

p3 = r"i prefer to (.+)"
r3 = [r"Why do you prefer to {0}?", r"When do you {0}?"]

p3_1 = r"i prefer (.+)"
r3_1 = [r"Why do you prefer {0}?", r"What makes you prefer {0}?"]

p4 = r"i can (.+)"
r4 = [r"Why can you {0}?", r"Do you like to {0}?"]

p5 = r"i (.+) at (.+)"
r5 = [r"Why do you {0} at {1}?", r"Do you {0} at {1} with anyone else?"]

p5_1 = r"(.+) likes to (.+) at (.+)"
r5_1 = [r"Why does {0} like to {1} at {2}?", r"Does {0} like to {1} at {2} with anyone else?"]

p6 = r"i (.+) when (.+)"
r6 = [r"Why do you {0} when {1}?", r"When else do you {0}?"]
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p6_1 = r"(.+) when (.+)"
r6_1 = [r"Why does {0} when {1}?", r"When else does {0}?"]

p7 = r"i (.+) with (.+)"
r7 = [r"Why do you {0} with {1}?", r"Does {1} like to {0}?"]

p8 = r"it is (.+) to (.+)"
r8 = [r"Why do you think it is {0} to {1}?", r"Did someone convince you that it is {0} to {1}?"]

p9 = r"i (.+) because (.+)"
r9 = [r"Why does {1} cause you to {0}?", r"Is {1} a reason for anything else?"]

p10 = r"i like that (.+) is (.+)"
r10 = [r"Is {0} always {1}?", r"Why do you like that {0} is {1}?"]

p11 = r"i believe (.+)"
r11 = [r"Convince me of {0}.", r"What makes you believe {0}?", r"When did you start to believe {0}?"]

p12 = r"(.+) have to (.+)"
r12 = [r"Why do {0} have to {1}?"]

p12_1 = r"i have to (.+)"
r12_1 = [r"Why do you have to {0}?"]

p12_2 = r"(.+) has to (.+)"
r12_2 = [r"Why does {0} have to {1}?"]

p13 = r"(.+) is (.+)"
r13 = [r"What makes {0} {1}?", r"Is it always the case that {0} is {1}?", r"Why do you believe that {0} is {1}?"]
```

```
# We use a dictionary to store and templates and their corresponding responses
patterns = {
    p0 : r0,
    p1 : r1, p1_1 : r1_1, p1_2 : r1_2, p1_3 : r1_3, p1_4 : r1_4,
    p2 : r2,
    p3 : r3, p3_1 : r3_1,
    p4 : r4,
    p5 : r5, p5_1 : r5_1,
    p6 : r6, p6_1 : r6_1,
    p7 : r7,
    p8 : r8,
    p9 : r9,
    p10 : r10,
    p11 : r11,
    p12 : r12, p12_1 : r12_1, p12_2 : r12_2,
    p13 : r13 }

# We create a list of alternate responses (when no template matches)
alternates = ["What is another sport you like?", "Tell me more.", "I'd like to hear more about that.", "What is (another) sport you have played?", "Can you elaborate?"]
# We create a list of possible ways in which the user could say goodbye
exits = ["goodbye", "good bye!", "bye"]
```

```

# to start the conversation, we run this function with any value for n
def runConversation(n):

    # INTRO
    print("ELIZA: Hello user! To exit the conversation at any time, just say goodbye!")
    name = input("ELIZA: What is your name? \n")
    print("ELIZA: Welcome {}! Remember, our topic is sports ".format(name))
    sport = input("ELIZA: What sport would you like to talk about? \n")
    print("ELIZA: Tell me about {}".format(sport))

    # The conversatin will run until the user gives a departure word
    while True:

        # Getting the user's response
        user = input("Your turn now! \n").lower()

        # Checking if we need to end the conversation
        if (user.lower() in exits):
            print("ELIZA: Good Bye! Conversation Over")
            return
        m = 0

        # STEP 1: Check for a match (more precise)
        for patt in patterns.keys():
            m = re.match(patt, user)
            # Check for each template if we have found a match, and use it if so
            if m:
                p = patt
                inputs = m.groups()
                formats = ["none", "none", "none"]
                for i in range(0, len(inputs)):
                    formats[i] = inputs[i]
                # Generate outputs by keying into dictionary and uniformly select one
                outputs = patterns.get(p)
                select = np.random.random_integers(0, len(outputs) - 1)
                output = outputs[select]
                # Respond and Break
                print("ELIZA: ", output.format(formats[0], formats[1]))
                break

        # If no match from STEP 1, start STEP 2: check for a search (less precise)
        if (m == None):
            for patt in patterns.keys():
                m = re.search(patt, user)
                # Check for each template if we have found a search, and use it if so
                if m:
                    p = patt
                    inputs = m.groups()
                    formats = ["none", "none", "none"]
                    for i in range(0, len(inputs)):
                        formats[i] = inputs[i]
                    # Generate outputs by keying into dictionary and uniformly select one
                    outputs = patterns.get(p)
                    select = np.random.random_integers(0, len(outputs) - 1)
                    output = outputs[select]
                    # Respond and Break
                    print("ELIZA: ", output.format(formats[0], formats[1]))
                    break

        #If no match or search from STEP 1 and STEP 2, start STEP 3: generate a universal response
        if (m == None):
            select = np.random.random_integers(0, len(alternates) - 1)
            print("ELIZA: ", alternates[select])

# Start the conversation on execution of the program
runConversation(1)

```

Problem #2

ELIZA's conversation with me

ELIZA: Hello user! To exit the conversation at any time, just say goodbye!

ELIZA: What is your name?

sophie

ELIZA: Welcome sophie! Remember, our topic is sports

ELIZA: What sport would you like to talk about?

volleyball

ELIZA: Tell me about volleyball.

Your turn now!

Volleyball is a fun game

ELIZA: Is it always the case that volleyball is a fun game?

Your turn now!

i believe it is always fun

ELIZA: What makes you believe it is always fun?

Your turn now!

it is a fast game

ELIZA: Is it always the case that it is a fast game?

Your turn now!

yes the players have to move quickly

ELIZA: Why do yes the players have to move quickly?

Your turn now!

they have to keep the ball off the ground

ELIZA: Why do they have to keep the ball off the ground?

Your turn now!

that is how they win the game

ELIZA: Why do you believe that that is how they win the game?

Your turn now!

the play is over when the ball hits the ground

ELIZA: Why do you believe that the play is over when the ball hits the ground?

Your turn now!

those are the rules

ELIZA: What is another sport you like?

Your turn now!

i like soccer

ELIZA: Do you prefer to watch or play soccer?

Your turn now!

i prefer to watch soccer

ELIZA: Why do you prefer to watch soccer?

Your turn now!

i get to watch it with my friends

ELIZA: Why do you get to watch it with my friends?

Your turn now!

they come over when soccer is on tv

ELIZA: Why do you believe that they come over when soccer is on tv?

Your turn now!

it is fun

ELIZA: Is it always the case that it is fun?

Your turn now!

i believe it is fun

ELIZA: When did you start to believe it is fun?

Your turn now!

i started to think it is fun when they started coming over

ELIZA: When else do you started to think it is fun?

Your turn now!

i think it is fun for us to be together

ELIZA: What makes you think it is fun for us to be together?

Your turn now!

we always have a good time

ELIZA: Can you elaborate?

Your turn now!

we have all played soccer before

ELIZA: I'd like to hear more about that.

Your turn now!

i have played soccer for 3 years

ELIZA: Why did you start playing soccer

Your turn now!

it is good to be fit

ELIZA: Why do you think it is good to be fit?

Your turn now!

it is important to be healthy

ELIZA: Did someone convince you that it is important to be healthy?

Your turn now!

yes

ELIZA: What is (another) sport you have played?

Your turn now!

i have played hockey for 4 years

ELIZA: Why did you start playing hockey

Your turn now!

i started when i was young

ELIZA: When else do you started?

Your turn now!

never

ELIZA: What is another sport you like?

Your turn now!

i like lacrosse

ELIZA: Do you prefer to watch or play lacrosse?

Your turn now!

i prefer to play lacrosse

ELIZA: When do you play lacrosse?

Your turn now!

i play lacrosse when I have friends to play with

ELIZA: Why do you play lacrosse when i have friends to play with?

Your turn now!

i can set up a game

ELIZA: Do you like to set up a game?

Your turn now!

i like to set up games

ELIZA: Do you prefer to watch or play to set up games?

Your turn now!

i prefer to set up the game and then play in it

ELIZA: When do you set up the game and then play in it?

Your turn now!

i do that when i have friends to play with

ELIZA: Why do you do that when i have friends to play with?

Your turn now!

i think it is fun

ELIZA: Did someone tell you it is fun?

Your turn now!

no i think it is fun

ELIZA: Why do you believe that no i think it is fun?

Your turn now!

i have played before

ELIZA: How long have you played that sport?

Your turn now!

i have played for 3 years

ELIZA: Why did you start playing that sport?

Your turn now!

i believe it is fun

ELIZA: Convince me of it is fun.

Your turn now!

the players have to skate quickly

ELIZA: Why do the players have to skate quickly?

Your turn now!

they have to score goals

ELIZA: Why do they have to score goals?

Your turn now!

they want to win

ELIZA: Can you elaborate?

Your turn now!

i want to win when i play

ELIZA: Why do you want to win when i play?

Your turn now!

i can feel proud

ELIZA: Do you like to feel proud?

Your turn now!

yes i do like to feel proud

ELIZA: Have you ever played to feel proud?

Your turn now!

it is fun to feel proud

ELIZA: Why do you think it is fun to feel proud?

Your turn now!

bye

ELIZA: Good Bye! Conversation Over

ELIZA's conversation with a friend

ELIZA: Hello user! To exit the conversation at any time, just say goodbye!

ELIZA: What is your name?

kevin

ELIZA: Welcome kevin! Remember, our topic is sports

ELIZA: What sport would you like to talk about?

football

ELIZA: Tell me about football.

Your turn now!

football is fun

ELIZA: Why do you believe that football is fun?

Your turn now!

football is fun because it is fun

ELIZA: Is it always the case that football is fun because it is fun?

Your turn now!

yes

ELIZA: I'd like to hear more about that.

Your turn now!

we are done with this

ELIZA: What is another sport you like?

Your turn now!

ping pong

ELIZA: What is another sport you like?

Your turn now!

i like ping pong

ELIZA: Do you prefer to watch or play ping pong?

Your turn now!

i prefer to play ping pong

ELIZA: When do you play ping pong?

Your turn now!

i play ping pong all the time

ELIZA: Tell me more.

Your turn now!

thats it

ELIZA: Tell me more.

Your turn now!

i play ping pong when i am sad

ELIZA: When else do you play ping pong?

Your turn now!

i play ping pong when i am happy

ELIZA: Why do you play ping pong when i am happy?

Your turn now!

i play ping pong because ping pong makes me more happy

ELIZA: Why does ping pong makes me more happy cause you to play ping pong?

Your turn now!

because happiness is good

ELIZA: Is it always the case that because happiness is good?

Your turn now!

yes

ELIZA: What is (another) sport you have played?

Your turn now!

i have played volleyball

ELIZA: Why did you start playing that sport?

Your turn now!

i started playing volleyball in high scool

ELIZA: Can you elaborate?

Your turn now!

I used to play volleyball at the beach

ELIZA: Why do you used to play volleyball at the beach?

Your turn now!

the beach is fun

ELIZA: What makes the beach fun?

Your turn now!

it is warm and sunny

ELIZA: Is it always the case that it is warm and sunny?

Your turn now!

no

ELIZA: Tell me more.

Your turn now!

sometimes it is dark and cloudy

ELIZA: What makes sometimes it dark and cloudy?

Your turn now!

it is dark and cloudy when it storms

ELIZA: What makes it dark and cloudy when it storms?

Your turn now!

sometimes it has to rain

ELIZA: Why does sometimes it have to rain?

Your turn now!

the water in the atmosphere condenses when it gets high

ELIZA: Tell me more.

Your turn now!

water vapor has to go back to liquid

ELIZA: Why does water vapor have to go back to liquid?

Your turn now!

it has to because of the laws of physics

ELIZA: Why does it have to because of the laws of physics?

Your turn now!

i believe in the laws of physics

ELIZA: When did you start to believe in the laws of physics?

Your turn now!

i started when I learned them in school

ELIZA: Why do you started when i learned them in school?

Your turn now!

i have to pass my tests

ELIZA: Why did you start to pass my tests?

Your turn now!

i started to pass because i am smart

ELIZA: Why does i am smart cause you to started to pass?

Your turn now!

i dont know

ELIZA: Tell me more.

Your turn now!

no

ELIZA: Tell me more.

Your turn now!

absolutely not

ELIZA: I'd like to hear more about that.

Your turn now!

please stop

ELIZA: What is (another) sport you have played?

Your turn now!

i like golf

ELIZA: What makes you like golf?

Your turn now!

a player has to practice a lot

ELIZA: Why does a player have to practice a lot?

Your turn now!

a player has to practice because golf is hard

Kevin's Impressions:

- This ELIZA has some good responses, but at times gets repetitive
- If it isn't able to match his response to a template, the alternate response is not always good
- Sometimes it grabs the wrong parts of the response
- It doesn't act like it's actually engaging in the conversation.

Problem #3

There are a couple ways I could make ELIZA better:

- I could add more rules
- I could add some sort of function/system that appropriately converts pronouns, nouns, verbs, etc. to avoid sticky language responses
- I could add some sort of 'memoization' feature, in which ELIZA is able to store past information the user has given her and incorporate that in her responses
- I could give ELIZA more information about the topic from the start, so she can respond more genuinely with her own information
- I can include more appropriate alternate responses, and some sort of system that avoids the same one being repeated to avoid awkward back-and-forth's (as seen in Kevin's conversation)

Problem #4

An ELIZA bot would probably not work well for on any sentence that involves asking her about anything that would pertain to 'her' consciousness.

For examples:

1. ELIZA, what are your morals?
2. ELIZA, how do you feel about <controversial issue>?
3. ELIZA, what do you value in life?
4. ELIZA, what is it like to be in love?

These are all questions that most people could easily answer by drawing on their consciousness or past experience. However, since ELIZA has neither of those things, she would not be able to answer these questions well. Likely, she would give some generic response that didn't quite answer the question (depending on the implementation).