# NLP FAQ MATCHING

NATURAL LANGUAGE PROCESSING
04/29/2018

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## Project Description:

We need to create a system that performs FAQ matching and returns the question similar or the same as what the user entered. The key idea is to somehow use the NLP features to map the custom question provided by the user to the actual question in the FAQs. The goal of the project is to implement the system in such a way that it does faq mapping based on semantic features and not just based on the syntactic features.

## Proposed Solution:

So, the most obvious and naïve solution is to try to just match the words in the question provided by the user to the words in the actual FAQs that we have. A slight improvement is the instead of just trying to match the question with only the questions in the corpus, try to match the question words with the words in the answer to the question as well. The full implementation of this approach is explained later in this report. The advantage of this approach is that it is fast and matches the question to the correct FAQ when you enter the question as it is. It even works if you change the order of words in the question, so it is better than just doing string matching. It will also work if you leave out some of the words in the question provided that the words you entered are unique enough to identify the matching FAQ uniquely. The disadvantage of this approach is that if the users phrases his/her question using some synonym or hypernym than this approach will not work correctly. It will even fail if the user changed just the tense of the sentence.

For example: who created bitcoin? Works

But who produced bitcoin? Does not work.

The solution to this problem is using the NLP features and search the correct fact based on these features. The complete details about the implementation will be provided later in the report. The idea is to use some of the features like pos tags, synonyms, hypernyms, head words, lemmas to match the user's question to one of the questions in our corpus of FAQs.

For extracting these features, we are using the NLTK tools and each tool will be described later. Then we are using SOLR to save these features with the actual question. Now to get better results we need to decide how to use these features effectively because all the features do not have the same importance. So, using SOLR

different weights to different features and come up with top 10 answers for each user question.

# Full Implementation Details:

## Task 1:

The first task for us was to decide a domain for the corpus and then list down 50 questions and answers which becomes our corpus for the user's question. We decided that our domain will be crypto-currency and specifically bitcoins. We gathered the questions from the following sources.

https://bitcoin.org/en/faq#what-is-bitcoin
https://www.bitcoin.com/faq

We had to pick and choose some questions and reword some of them, so they are well within readable range, because some of them can be a page long.

You can find the list of questions in the appendix of the report.

## Task 2: Bag of words:

This is a naïve way of implementing the system, but it is still better than the string matching. We have implemented the system as follows.

We first read all the 50 questions from as csv file in tuple list. Where the first tuple element if the tokenized words of the question and second tuple is the tokenized words of the answer. We pass this list to a function which implements our bag of words approach.

The function asks the user to input a question and creates a dictionary of the words in question with number of times each word occurred in the question. We also create a dictionary of each of the 50 questions and answers in the corpus. Now word matching is calculated based on the overlap. We implemented it in a such a way that

the overlap with the question should have more importance than the overlap with the answer.

The function prints out the top 10 FAQs matching with the user's input. We also wrote some analysis code to check how good is the bag of words approach working. It obviously works perfect for the exact same question and the question where you change the orders a little. It also works if you leave out some words but the words you entered are enough to identify the matching FAQ uniquely. Because this approach is very naïve it does not do matching based on the semantics so if you change the word with a synonym or hypernym it will not work correctly. We implemented an MRR analysis and it scores 0.4 on that. We noticed that it often leads to tie between FAQs which is obvious for this kind of implementation.
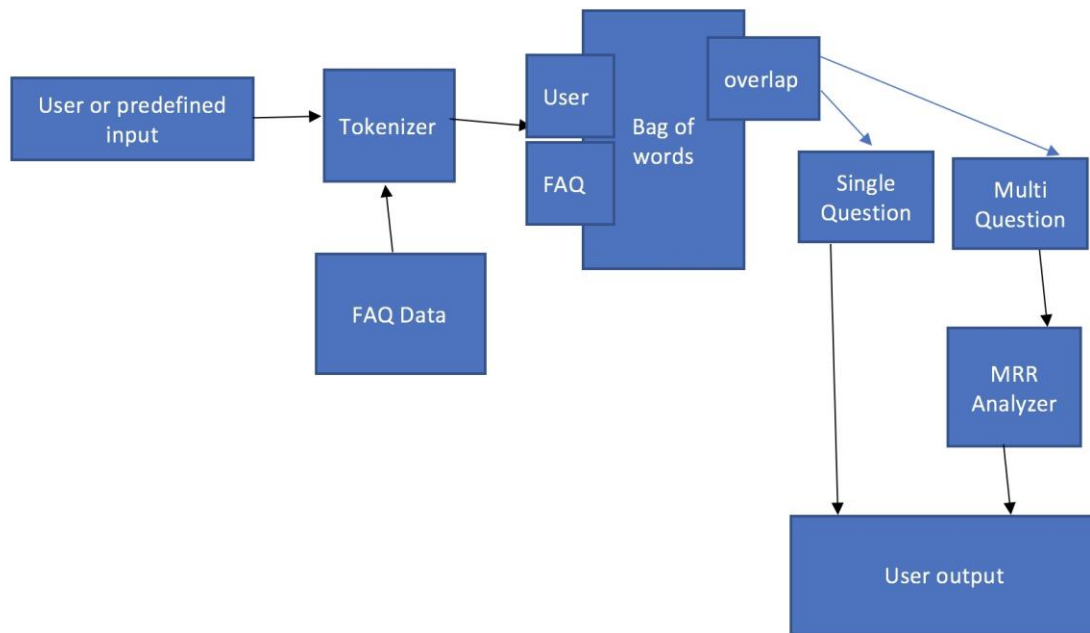


## Task 3: Feature Extraction:

In this task we are supposed to implement the deeper NLP pipeline. In other words we are supposed to extract NLP features from the corpus data and store them so we can use them when performing a search in task4.

We used NLTK library functions and Stanford-CoreNLP library. From Stanford CoreNLP we used the dependency parser.

We extracted following features from the corpus.

- Words (Tokenized sentence)
- Words after removing stop-words
- Lemmas of the words
- Stems of the words
- Pos tags of words
- Head words for the sentences.
- Hypernyms
- Hyponyms
- Synonyms
- Meronyms
- Holonyms

We extracted these features separately from the questions and answers and stored it in the SOLR.

The task implementation is as follows.

We parse the csv data read from the previous task to the function which performs the indexing. We will be storing all our features as data for SOLR which will later be used for indexed searching. So, we need to connect to the SOLR instance first. For that we need to make sure that we start the SOLR servers before running this task. We need to create an instance on SOLR admin panel where we can store the data. After doing that we need to connect to the SOLR instance. For that we use pysolr . We pass in the address of the instance we need to connect to the pysolr and get a connection variable returned by it.

Then we iterate through each FAQ in our corpus and perform the following on each of the question and answer in the corpus.

1. Tokenize the question and answer separately using nltk.tokenize
2. Remove stop words from the tokenize words
3. Get pos tags for the tokenized question and answer using nltk.pos_tag
4. Get lemmas for the pos tagged questions and answers.
5. Get stem for tokenized question and answer using PorterStemmer of nltk.
6. Get head words for question and answer using dependency parse which is using the Stanford coreNLP library
7. Since the wordnet does not have sufficient synonyms for the words that are part of our domain. We have a custom synonym map. When

a head word is one of the keys in the map. We add the synonym of that head words in the head words list.

8. Then using the tokenized question-answer and pos_tagged question and answer try to get the actual sense of the word using lesk and find the synonyms, hypernyms, meronyms, holonyms and hyponyms of the words. The feature size is restricted to 30.
9. After extracting all these features to store them in SOLR, we need to prepare a Jason object.
10. We make a json object which includes question id, the FAQ it self and all the features that we extracted.
11. We make a list of 50 such json object and store them in SOLR.

All the extracted features can be seen in the SOLR admin panel.
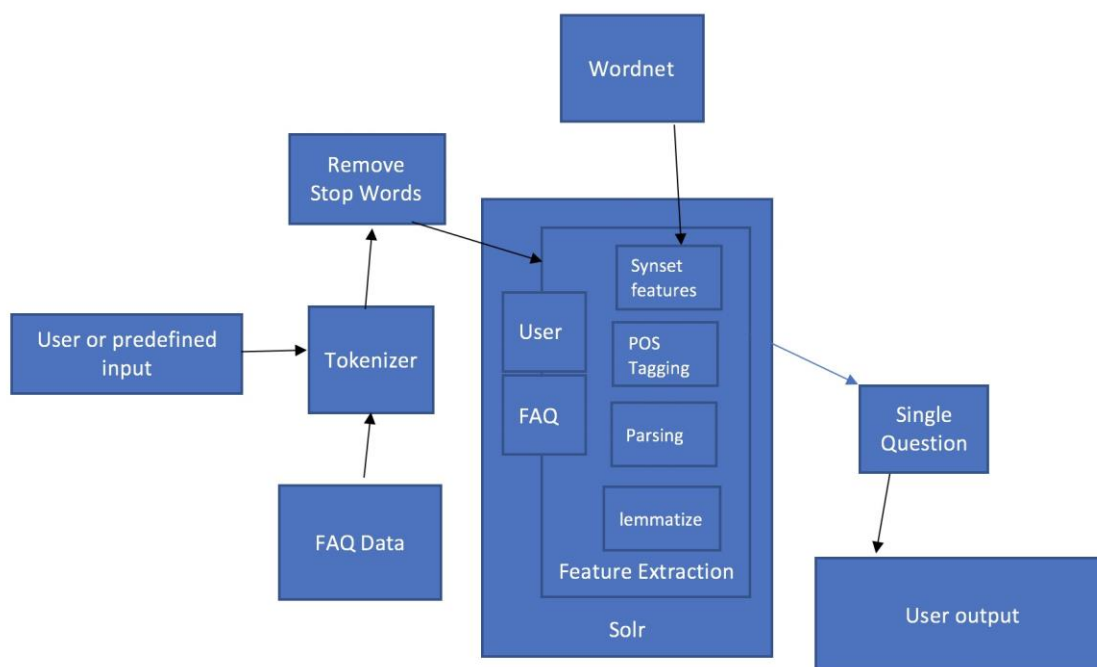


## Task 4: Search Using NLP Features:

In this task we are trying to develop a way in which we can use the features extracted in the previous task to greatly improve our FAQ matching results. How to use the features depends on our understanding of the feature and some experiments. To just test the result, we queried on these features without giving specific weights to the feature was not that good as expected. So obviously we needed to find which features should have higher weightage then others. Obviously if the user enters the

same question than it should have the highest weight so the most weight is given to just direct word matching of user defined question to the FAQ question. If the words in user's question overlap with the answer of some FAQ it should be a good answer but not as good as the one that matches the question. The head words, hypernyms and lemmas also play a good role in matching the FAQ. The logical explanation for it is that the head words in most cases convey the most information about a topic, the hypernyms most likely provide a generalized concepts and lemmas are essentially the same words. The features such as pos tag are less important compared to others. The weights given to all features are as follows.

- FAQ question: 4.8
- FAQ answer: 2.8
- POS tags of question: 0.02
- POS tags of answer: 0.001
- Lemmas of question: 3.0
- Lemmas of answer:3.0
-  Synonyms of question:3.0
- Synonyms of answer:3.0
- Hypernyms of question:3.0
- Hypernyms of answer:1.5
- Holonyms of question:0.14
- Holonyms of answer:0.10
- Meronyms of question:0.14
- Meronyms of answer:0.10
- Head words of question:3.0
- Head words of answer:2.5
- Hyponyms of question:0.24
- Hyponyms of answer:0.14

These weights were decided after trying on different weights and understanding how each feature can help getting the best result. There can be a better assignment of weights, but these weights were the best according to our experiments.

The complete implementation details are as follows:
There are two implementation of the search fuction:
1>User input statement is searched
2>10 different statements are searched, and their results are compared for analysis.

1>User input statement is searched:

In this implementation we search for the question the user has entered and return the top 10 matching FAQ using the approach defined above. We first get the user question, tokenize it and pass it to a function to do the searching. The above defined features are extracted from the user question as well. So, we tokenize the question, get the head words of the question, get lemmas, hypernyms, hyponyms, holonyms, meronyms, stems and pos tags for the question. Then we construct a composite query by giving different weights to different features as described above. We pass this composite query to SOLR and get the top 10 results from it.
Print each result with the score on the prompt.

2> Analysis:

In this implementation we are trying to find how good is the above approach doing some analysis on the results that our approach provides. We have 10 different question which are used to preform this analysis. The questions are modified a little so that we can test how good our approach was. We did an MRR analysis and the score was 0.775. We were able to predict most of the questions. We failed just to predict one of them(inside of top_10).
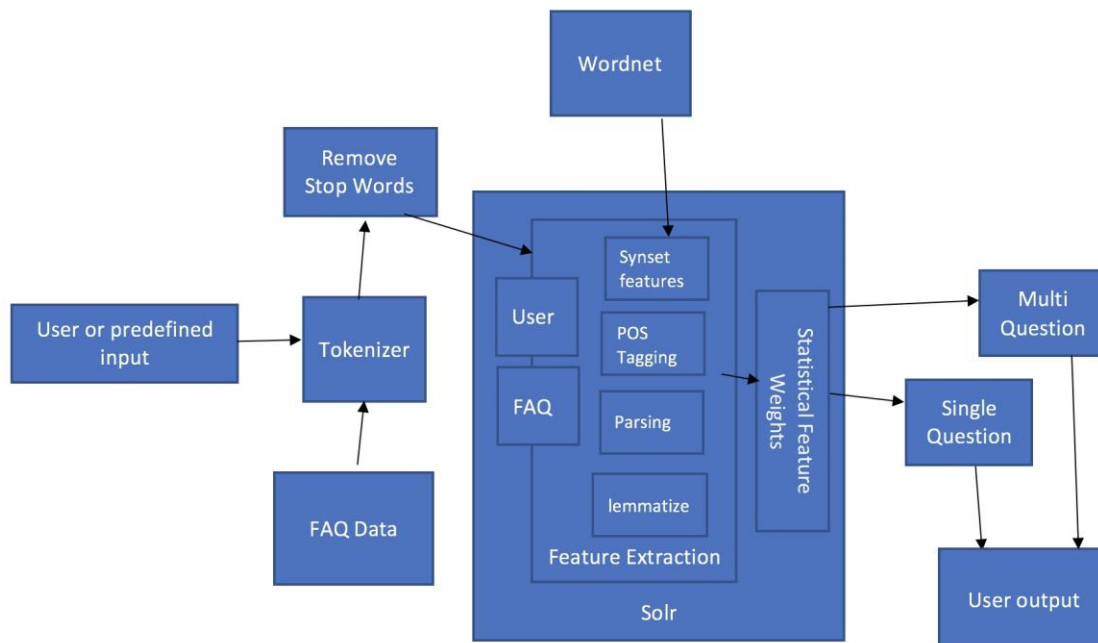
## Programming Tools:

We have used Solr-7.3.0 with Python 3.6
stanford-corenlp 3.9.1 jar file
(https://stanfordnlp.github.io/CoreNLP/download.html)
imports used: pysolr, nltk, csv ,time , copy , operator

## Results and Error Analysis:

As mentioned before we observed that the simple word overlap approach fails to give good result if we phrase the same question using synonyms or hypernyms. It also fails if we using a different tense or use plural instead of a singular word. It still gives an MRR of 0.5 which is because of the small set of questions that we have. But the point to note here is that the approach either succeeds completely by getting the perfect result or just fails and does not have the right answer in the top 10.

Now for task 4, we introduced the other fields and are querying over all of them, we observed that since we had a wide range of options and varieties to match the query vector, we started getting some more relevant results (sometimes better than task 2 and sometimes the same) making the MRR 0.675. Which may not look like a big improvement but thing to note here is it only fails to provide the answer in top 10 once in our test of 10 sentences which is pretty good.
Examples:
For the query: created who bitcoin?

Top 10 results that we got:
- for Task 2:
#1who created bitcoin?
#2won't the finite amount of bitcoins be a limitation?
#2how does the blockchain work?
#2who controls the bitcoin?
#2how are bitcoins created?
#3is bitcoin vulnerable to quantum computing?
#3how does bitcoin mining work?
#3how does bitcoin work?
#3how does one acquire bitcoins?
#3why do bitcoins have value?

Notice the tie for the third rank which is supposed to happen because we are just considering word matching, so we don't have many features to give scores to each question. So most of the question that are irrelevant will get the same score. This can make a difference when you have large set of FAQs. Also notice that the question worked even though the order of the words is different, so it is still better than the simple string matching.

- for Task 4:
1.who created bitcoin? -77.80449
2.how does mining create unique bitcoin? -  58.588078
3.how are bitcoins created? - 51.829216
4.what if someone creates a better digital currency?-23.537128
5.can i make money with bitcoin?-14.449906
6. won't the finite amount of bitcoins be a limitation?-11.632439
7.how difficult is it to make a bitcoin payment?-11.024079
8.who controls the bitcoin?-10.978394
9.what do i need to start mining? -10.655673
10. hasn't bitcoin been hacked in the past? -9.340654

Notice the different score given to each answer. Also the answers that apart from the best one are also somewhat more related to the asked question. Because we have lot of other features to match the question to , we have a distinct score for each question which reduces the cases of tie.

Example 2 : who produced bitcoin?

Top 10 results that we got:
- for Task 2:
#1how does the blockchain work?
#1who controls the bitcoin?
#1who created bitcoin?
#2is bitcoin vulnerable to quantum computing?
#2how does bitcoin mining work?
#2how does bitcoin work?
#2how does one acquire bitcoins?
#2why do bitcoins have value?
#2won't the finite amount of bitcoins be a limitation?
#2what are the disadvantages of bitcoin?
        Notice that just changing one word with its synonym causes this naïve approach to fail.

-for Task 4:
1.who created bitcoin? - 18.113102
2.how does mining create unique bitcoin? - 10.517111

3.how are bitcoins created? - 8.340271
4.what if someone bought up all the existing bitcoins?-5.486493
5.what if someone creates a better digital currency?- 4.7139
6.who controls the bitcoin?- 3.4989896
7. is bitcoin a bubble? - 3.1767037
8.isn't speculation and volatility a problem for bitcoin? -0.3660265
9.is bitcoin anonymous? - 0.3482286
10. can bitcoin be regulated? - 0.3426929

Notice this approach still works even though we changed the wordings of the question.

## Problems Encountered:

There was very less documentation available about how to run SOLR and how to combine SOLR with python. So it was challenge to start using SOLR. It was also hard to find the best method to query in SOLR since there a lot of ways in which SOLR data can be queried but it was hard to find how to do that using python. Then there was a challenge on how to use dependency parse to extract the feature. We had decided that we will extract head words using dependency parse but it was hard to integrate coreNLP Stanford parser with a python program. Finally we found a way to run a local server on the machine and do the indexing very efficiently.

## Pending Issues:

None as of now.

## Potential Improvements:

The Project always can be improved by adding more knowledge to the system. One problem is that the word net does not have enough information about most of the words that our domain has. We could include information about that to improve system. If we have larger corpus we have better chance of finding the best weight for each feature which can always improve system. Also adding more knowledge about the semantics of the question can always help the system. For example, if we can come up with the perfect LFTS for the questions the system performance can be highly improved.

# Appendix: 50 FAQ list: -

1>Is Bitcoin vulnerable to quantum computing?
        Yes, most systems relying on cryptography in general are, including traditional banking systems. However, quantum computers don't yet exist and probably won't for a while. In the event that quantum computing could be an imminent threat to Bitcoin, the protocol could be upgraded to use post-quantum algorithms.

2>How does Bitcoin mining work?
        Bitcoin mining works by using the resources on contributing computers. The users CPU solves an easily verifiable yet provable mathmatical problem which is used to create Blocks of transactions. When the netowork verifies the correct answer the miner is award newly minted coin.

3>How does Bitcoin work?
        Bitcoin works by moulding trust amogst Bitcoin users. Client side processes are employed to validate the ledger to verfy trust. The ledger is built off of cryptographic signatures than can be verified all the way to the making of the first Bitcoin.

4>How does one acquire bitcoins?
        You can get bitcoin through payment for goods or services, purchasing bitcoins at a Bitcoin exchange or earning bitcoins through competitive mining. While it may be possible to find individuals who wish to sell bitcoins in exchange for a credit card or PayPal payment, most exchanges do not allow funding via these payment methods. This is due to cases where someone buys  bitcoins with PayPal, and then reverses their half of the transaction. This is commonly referred to as a chargeback.

5>Why do bitcoins have value?
        Bitcoins have value because they are useful as a form of money. Bitcoin has the characteristics of money (durability, portability, fungibility, scarcity, divisibility, and recognizability). It's these properties that establishes a valuation that users trust and is measured by other established currencies.

6>Won't the finite amount of bitcoins be a limitation?
        Bitcoin is unique in that only 21 million bitcoins will ever be created being a finite number. However, this will never be a limitation because transactions can be denominated in smaller sub-units of a bitcoin, such as bits - there are 1,000,000 bits in 1 bitcoin. Bitcoins can be divided up to 8 decimal places (0.000 000 01) and potentially even smaller units if that is ever required in the future as the average transaction size decreases.

7>What are the disadvantages of Bitcoin?
        The two major disadvanteges to Bitcoin is it's volatility and it's ongoing development. Bitcoin is volatile in that it's trading rate

changes rapidly.  Occassionally, improvements are added to the network
due to the technology being new and improving over time.

8>What do I need to start mining?
        In the early days of Bitcoin, anyone could find a new block
using their computer's CPU. As more and more people started mining, the
difficulty of finding new blocks increased greatly to the point where
the only cost-effective method of mining today is using specialized
hardware. You can visit BitcoinMining.com for more information.

9>Can Bitcoin be regulated?
        The Bitcoin protocol itself cannot be regulated without the
cooperation of nearly all its users, who choose what software they use.
It is not governed by any government though it can be influenced.

10>How Does The Blockchain Work?
        The blockchain works by recording all of the newly minted
bitcoins rewarded to miners who find blocks. Blocks are sets of
sent/received transactions that miners confirm for the network. As
these actions take place within the Bitcoin protocol the blockchain
acts as a ledger of account for all transactions undertaken within the
Bitcoin network.

11>Doesn't Bitcoin unfairly benefit early adopters?
        Some early adopters have large numbers of bitcoins because they
took risks and invested time and resources in an unproven technology
that was hardly used by anyone and that was much harder to secure
properly. As with any investiment early investors benefit and profit
from taking the increased risk.

12>Won't Bitcoin fall in a deflationary spiral?
        The deflationary spiral theory says that if prices are expected
to fall, people will move purchases into the future in order to benefit
from the lower prices. That fall in demand will in turn cause merchants
to lower their prices to try and stimulate demand, making the problem
worse and leading to an economic depression.

13>Is Bitcoin legal?
        To the best of our knowledge, Bitcoin has not been made illegal
by legislation in most jurisdictions. However, some jurisdictions such
as Argentina and Russia severely restrict or ban foreign currencies.
Other jurisdictions such as Thailand may limit the licensing of certain
entities such as Bitcoin exchanges. For the United States the
established legality of Bitcoin is sound.

14>What if someone creates a better digital currency?
        That can happen. For now, Bitcoin remains by far the most
popular decentralized cryptocurrency, but there can be no guarantee
that it will retain that position. There is already a set of
alternative

15>Hasn't Bitcoin been hacked in the past?
        The rules of the protocol and the cryptography used for Bitcoin
are still working years after its inception, which is a good indication
that the concept is well designed. However, security flaws exist in 3rd

party applications when developers try to cut corners or hack together insecure solutions.

16>What about Bitcoin and consumer protection?

  Consumers are protected by the integrity of the ledger. The security of their accounts is based on well known cryptographic systems. However, it remains to be seen if any consumer protection organzations will involve themselves in Bitcoin.

17>What is Bitcoin mining?

  Mining is the process of spending computing power to process transactions, secure the network, and keep everyone in the system synchronized together. It is very similar to minting coin. The mining process creates coins usable in the network. Bticoins do not exist until they are mined.

18>Who controls the Bitcoin?

  Nobody or any one person owns or has possesion of the keys to Bitcoin. Each member contributes to Bitcoin as a whole and agree on it's state creating a sort of group ownership with no central control.

19>How difficult is it to make a Bitcoin payment?

  Bitcoin payments are easier to make than debit or credit card purchases, and can be received without a merchant account. Payments are made from a wallet application, either on your computer or smartphone, by entering the recipient's address, the payment amount, and pressing send. To make it easier to enter a recipient's address, many wallets can obtain the address by scanning a QR code or touching two phones together with NFC technology.

20>What is the Blockchain?

  The Blockchain is a chain of blocks that represent the legder of the Bitcoin network. Each block contains transactions that have occured and link to a previous block all the way to the very first Genisis block.

21>What if someone bought up all the existing bitcoins?

  Only a fraction of bitcoins issued to date are found on the exchange markets for sale. Bitcoin markets are competitive, meaning the price of a bitcoin will rise or fall depending on supply and demand. It would be impracticle for someone to purchase all the existing coins and maintain that until all coins are available.

22>Is Bitcoin a Ponzi scheme?

  A Ponzi scheme is a fraudulent investment operation that pays returns to its investors from their own money, or the money paid by subsequent investors, instead of from profit earned by the individuals running the business. Bitcoin meets non of these cryteria nor any scam for that matter.

23>Why is bitcoin important?

  Bitcoin is a consensus network that enables a new payment system with no central authority. It plays a crucial part of economic importances for managing a ledger across untrusted parties.

24>Is Bitcoin secure?

The Bitcoin technology - the protocol and the cryptography - has a strong security track record. Bitcoin's most common vulnerability is in user error. Bitcoin wallet files that store the necessary private keys can be accidentally deleted, lost or stolen. In those cases the security issue is the end user and not the technology.

25>What happens when bitcoins are lost?

When a user loses his wallet, it has the effect of removing money out of circulation. Lost bitcoins still remain in the block chain just like any other bitcoins. However, lost bitcoins remain dormant forever because there is no way for anybody to find the private key(s) that would allow them to be spent again. Because of the law of supply and demand, when fewer bitcoins are available, the ones that are left will be in higher demand and increase in value to compensate.

26>What about Bitcoin and taxes?

Bitcoin is not a fiat currency with legal tender status in any jurisdiction, but often tax liability accrues regardless of the medium used. There is a wide variety of legislation in many different jurisdictions which could cause income, sales, payroll, capital gains, or some other form of tax liability to arise with Bitcoin.

27>Can I make money with Bitcoin?

You should never expect to get rich with Bitcoin or any emerging technology. With that said, many speculators have gained profited from the lucrative net growth of the Bitcoin value.

28>Who created Bitcoin?

Bitcoin was created by Satoshi Nakamoto in 2009. At that time tools were used to make and produce the coins, creating the Bitcoin ledger as we know it today.

29>What determines bitcoin's price?

The price of a bitcoin is determined by supply and demand. When demand for bitcoins increases, the price increases, and when demand falls, the price falls. There is only a limited number of bitcoins in circulation and new bitcoins are created at a predictable and decreasing rate, which means that demand must follow this level of inflation to keep the price stable. Because Bitcoin is still a relatively small market compared to what it could be, it doesn't take significant amounts of money to move the market price up or down, and thus the price of a bitcoin is still very volatile.

30>What does synchronizing mean and why does it take so long?

Long synchronization time is only required with full node clients. Technically speaking, synchronizing is the process of downloading and verifying all previous Bitcoin transactions on the network. For some Bitcoin clients to calculate the spendable balance of your Bitcoin wallet and make new transactions, it needs to be aware of all previous transactions.

31>How does mining create unique Bitcoin?

Mining creates the equivalent of a competitive lottery that makes it very difficult for anyone to consecutively add duplicate blocks of transactions into the block chain. This protects the neutrality of the network by preventing any singular individual from

gaining the power to block certain transactions. Beause of the properties of the Blockchain, each transaction can be traced to it's unqiue coin inception.

32>Is Bitcoin fully virtual and immaterial?

      Bitcoin is as virtual as the credit cards and online banking networks people use everyday. It is nonmaterial in the sense that everything is digital but most of the banking industry works with way already. Transactions are indiffernt to the type of currency being traded as they are just a record of accounts.

33>What if I receive a bitcoin when my computer is powered off?

      This works fine. The bitcoins will appear next time you start your wallet application. Bitcoins are not actually received by the software on your computer, they are appended to a public ledger that is shared between all the devices on the network. If you are sent bitcoins when your wallet client program is not running and you later launch it, it will download blocks and catch up with any transactions it did not already know about, and the bitcoins will eventually appear as if they were just received in real time. Your wallet is only needed when you wish to spend bitcoins.

34>Can bitcoins become worthless?

      Yes. History is littered with currencies that failed and are no longer used, such as the German Mark during the Weimar Republic and, more recently, the Zimbabwean dollar. These values have dropped and have been useless to use in any further transactions. Bitcoin is no different.

35>Is Bitcoin really used by people?

      Yes. Bitcoin is the most popular cryptocurrency and used used by many people. Due to it's nature it's impossible to tell how many people utilise bitcoin but at the end of April 2017, the total value of all existing bitcoins exceeded 20 billion US dollars. There are many examples of people using Bitcoin and apply it's value to everyday items such as the very first purchase which was a Pizza.

36>Can Bitcoin scale to become a major payment network?

      The Bitcoin network can already process a much higher number of transactions per second than it does today. It is, however, not entirely ready to scale to the level of major credit card networks. It is a system still in development and is expeted to be a major payment system in the future.

37>Is Bitcoin a bubble?

      A fast rise in price does not constitute a bubble. An artificial over-valuation that will lead to a sudden downward correction constitutes a bubble. Bubbles inevitably lead to crashes and Bitcoin appears to have a lot of room to grow.

38>Is Bitcoin anonymous?

      Bitcoin is designed to allow its users to send and receive payments with an acceptable level of privacy as well as any other form of money. However, Bitcoin is not anonymous and cannot offer the same level of privacy as cash.

39>What Is A Full Node?

Full nodes, or clients, validate transactions within the blockchain and are voluntarily maintained by individuals, groups and organizations (such as merchants for example) all around the world and broadcast all the messages within the protocol. Full nodes add an additional layer of security for these participants within the Bitcoin network and operate in an altruistic client meaning they work without reward.

40>Why do people trust Bitcoin?

Trust in Bitcoin comes from the mathematical properties of encryption and signatures that validate the validity of each block in the Blockchain. The ledger integrity is considered secure for these reasons.

41>What Can You get With Bitcoin?

You can purchase just about anything with bitcoins, from goods like clothing, electronics, food and art to handmade crafts. Bitcoin can also be used to get large items like cars, real estate, and investment vehicles such as precious metals. By using Purse.io users can buy just about anything from Amazon and get a discount of up to 20% and other bargains just by using Bitcoin.

42>How much will the transaction fee be?

Transactions can be processed without fees, but trying to send free transactions can require waiting days or weeks. Although fees may increase over time, normal fees currently only cost a tiny amount. By default, all Bitcoin wallets listed on Bitcoin.org add what they think is an appropriate fee to your transactions; most of those wallets will also give you chance to review the fee before sending the transaction.

43>Could users collude against Bitcoin?

It is not possible to change the Bitcoin protocol easily with collusion. Any Bitcoin client that doesn't comply with the same rules cannot enforce their own rules on other users. As per the current specification, double spending is not possible on the same block chain, and neither is spending bitcoins without a valid signature. Therefore, it is not possible to conspire to generate uncontrolled amounts of bitcoins out of thin air, spend other users' funds, corrupt the network, or anything similar.

44>What are the advantages of Bitcoin?

Payment freedom - It is possible to send and receive bitcoins anywhere in the world at any time. Traditional currency is disfavored over Bitcoin as transactions can be reversed. Bitcoin transactions cannot be reversed enabling users to have the advantage of fuller control.

45>How are bitcoins created?

You can get bitcoin through payment for goods or services, purchasing bitcoins at a Bitcoin exchange or earning bitcoins through competitive mining. While it may be possible to find individuals who wish to sell bitcoins in exchange for a credit card or PayPal payment, most exchanges do not allow funding via these payment methods. This is due to cases where someone buys  bitcoins with PayPal, and then reverses their half of the transaction. This is commonly referred to as a chargeback.

46>Isn't speculation and volatility a problem for Bitcoin?

This is a chicken and egg situation. For bitcoin's price to stabilize, a large scale economy needs to develop with more businesses and users. For a large scale economy to develop, businesses and users will seek for price stability. Until these stabilize, the value of Bitcoin will be volatile creating problems that need to be solved by investors and users.

47>Is Bitcoin useful for illegal activities?

Bitcoin is money, and money has always been used both for legal and illegal purposes. Cash, credit cards and current banking systems widely surpass Bitcoin in terms of their use to finance crime. Like anything else, Bitcoin can be used in a crime but that does not make the use of Bitcoin illegal.

48>How To Accept Bitcoin Payments For Your Store?

It is very easy for any merchant to accept Bitcoin, and most of the time preparing to add the feature to your payment services takes less than 10 minutes. Merchants can assume Bitcoin both online and at physical locations by using a merchant service payment provider like Bitpay, or even just using a simple wallet address generated on their own device in which users can send payments.

49>Why do I have to wait for confirmation?

User should expect some delay in transaction confirmation. Each block takes an average of a 10 minute delay until it's available to network. The network must check, confirm, and verify all transactions before they are trusted. User can wait longer which increases security. Waiting for 6 blocks to be verified is the recommend delay for large transactions.

50>Isn't Bitcoin mining a waste of energy?

Spending energy to secure and operate a payment system is hardly a waste. Like any other payment service, the use of Bitcoin entails processing costs. Services necessary for the operation of currently widespread monetary systems, such as banks, credit cards, and armored vehicles, also use a lot of energy. Bitcoin is not considered any more wasteful then many other services.