

Andrew: Hi, Nitesh. Welcome to the show. It's great to have you here today.

Nitesh: Hi, Andrew. Thanks for inviting me to the show. It's my pleasure to be here.

Andrew: Thank you very much. Can we please just start with a little bit of background on yourself?

Nitesh: Sure. So I am the cofounder and the business lead for iRageCapital and iRage Global, based out of India and Singapore. We are primarily into high frequency trading and quantitative trading, and we also have an education vertical in the name of QuantInsti, which is into algorithmic and quantitative trading training, so I cofounded these two businesses almost seven years back. Since then we have covered multiple geographies both in terms of trading to different markets as well as for training different people, so we have been doing that for almost seven years now.

Andrew: So initially, how did you get started in training?

Nitesh: So that's interesting question. I started off actually in college. I was doing electronics engineering from one of the premier institutes in India and I figured that while I was a lot interested in microelectronics, but then I also was quite attracted towards the pink papers, the newspapers, the business newspapers. It started off from there, and then I realized it was my calling probably so I did my MBA in finance and economics after that, after my B. Tech in Electronics Engineering. Then I moved on actually to a bank where I worked in the derivative structuring side and then I moved to a corporate trading desk to become a professional trader, and then we cofounded iRageCapital in Mumbai.

Andrew: Okay, so where did algorithmic trading fit into that? Did you start with algo trading straight away or did you kind of migrate into that over time?

Nitesh: So then, I was with one of the boutique appropriate trading firm in Mumbai we actually were more on the manual but model-based trading, so we started from there. But in India, algorithmic trading was allowed in 2008. So soon after that, we started with algorithmic trading because given our background, me and my cofounders, it was quite a natural thing to actually move towards algorithmic trading because we all had heavy technology plus analytical financial markets related background. So yeah so we started with algorithmic trading almost as soon as it was allowed in India and once we had some base in India surpassed, I had been based in Singapore for the past 3 years now, 2-1/2 years and we have been looking at capturing the global markets from Singapore here.

Andrew: Okay. So is there a particular style of trading that you're drawn to or that you prefer?

Nitesh: I'm more of a believer in automation, but not to say that I would like to automate each and everything, but still to the extent possible yes. Even if when we were doing manual trading, I was always like I would not be very keen on discretionary trading, which is based on human emotions or human output but more on maybe model based. All discretion must come from the model research, not coming from the human mind, that's my belief. So it should be pre-empted and it should be pre-modelled into your trading strategy or in the model itself. Then you can just follow it, or the model can keep evolving. It's not like once you created it, it's just like that, but the model can evolve but you should not have any discretion over it. It should be the model, which should have all the discretion.

Andrew: Okay, so when you're building these models, do you have a particular style, for instance a trend-following or mean reversion approach? What actual styles of trading do you like?

Nitesh: So I started off as more of a trend-following trader, but I realized it if you want to have steady returns and minimize the variance in returns, then it's better to have multiple paradigms to cover multiple trading paradigms. So now we cover trend following, market-making, mean reverting, statistical arbitrage, as well as your machine-learning based strategies, all of that. So it's more basically of a full gamut of different strategy paradigms that we work on, so that has helped us in keeping a reasonable return profile, so which are not too volatile.

Andrew: Yeah. All right then we might come back to statistical arbitrage a little bit later on. But firstly, one of the common questions I receive is how to choose back testing or a trading platform. It's probably something that you get as well through QuantInsti, so if we can just have a little bit of a chat about that first. Perhaps we can start with a very basic question, like what is an algorithmic trading platform.

Nitesh: Right, so an algorithmic trading platform, any algorithmic trading platform will have three components, which help us to automate the whole process. The process I would include getting the market data from the exchange or your liquidity provider, converting it into something, which your system can understand, then coding the strategy, that is you're putting in the logic in your platform, the strategy logic. Then getting it auto generated, and sending it out to the exchange again in a format that the exchange or your trading destination will understand.

Right, so you will have EPAs, which are provided by the exchanges or the trading destinations, FIX being most common of all, so you will have market adapter as one piece, which is converting market data into exchanges native format to your own format. Then you have the CEP engine, that is complex event processing engine, where all strategy logic. That's the brain of the platform to see in terms of the strategy logic; there you are putting in your strategic logic. Then you have the third part, which is called OMS, order management system, or order loading system. There the CEP engine is sending the instruction that you need to send this order to the exchange, and it is then converting it back to language that the exchange would understanding using the EPA that the exchange has offered or provided. So that's the top view model of any algorithmic trading platform.

For most of the traders, the key aspect will be the CEP engine because there is nothing much that they will be doing on the adapter's side, which is the market data side or the OMS side. It remains the same as they would not be touching that, but they will be primarily focused on the strategy side, so CEP engine is the thing that most of the traders actually work within.

Andrew: Okay, so you just mentioned a lot of different components there to an algorithmic platform. It can be quite a complicated system so what do you need to consider when you're trying to choose a platform that does all that?

Nitesh: So it would depend a lot on what exactly are you trying to achieve by using that platform. What I mean by what you're trying to achieve is that what kind of asset class you want to trade, what kind of frequency you plan to trade, how latency sensitive are you, right? These are some of the basic questions that you have to answer before you go ahead and pick up a platform. I'm coming from the strategy platform perspective, from the execution perspective. Similarly, if you're coming from the back testing side, then also you will have similar questions to answer, so what kind of the asset class you want to trade into, what kind of strategies you will be trading into, and what are all the functionalities that you need. Do you want all the coding capabilities to be present in that platform, are you keen towards having one particular language or your programming language agnostic, so all those things would matter a lot.

Andrew: Do you consider the testing and the execution to be separate platforms, or can you combine them into one platform?

Nitesh: Normally it's a wise idea to keep them separate because then you are putting it into the trading side. You do not want too many functionalities there because you do not want to make your application bulky. The lighter your application is, the better the efficiency would be, so which can also provide you with lower latency numbers. But on this back testing side, you want your back testing to be as comprehensive as possible. Generally, it's a good idea if you can keep your back testing as well as your trading system separate at all. If you have your own technology, then a lot of people want to do is that they will use the same technology but probably keep the back testing side or the back testing services system much more equipped with a lot of functionalities but use a streamlined version of the same in terms of functionality in the trading side.

Andrew: Okay. Now you did mention programming language. There's a lot of different options for platforms and languages. How do you determine what the best programming language is for you?

Nitesh: Okay, in terms of programming language, if you're looking at high frequency trading strategies, then C++ is the standard, so most HFT firms use C++ for programming on their strategy side as well as overall. The primary reason being that the memory leaks and all those things are much less in C++ because it is not taking each and everything as object unlike say much easier language like Python where you might face issues when you have a huge amount of data or if you are looking at very high-performance numbers. There might be some issues there, but it's much easier if you are using Python.

So that's why you will see so many platforms using Python as the default language these days for both back testing as well as for coding up the strategies because a lot more people are coming on the trading side. But I think that has been historical as well the people were not really conversed with the technology or the programming side, so they have a good understanding of the market, but when it comes to hardcore programming, maybe they're not that comfortable. So Python is something, which

is not very difficult to pick up, so that's why I think Python is becoming more and more popular these days on the algorithmic trading side.

Andrew: Python has become quite a popular program in recent times. You mentioned one of the benefits is it's quite easy to use but are there any other benefits that make people drawn to using Python?

Nitesh: Yes, certainly. So there are a lot of scientific libraries which are labelled for Python, so you have NUMPY, you have Pandas, all those things which are readily available and can be used for Python. And also one more factor that I think a lot of easy to use and widely available platforms like Quantopian or QuantConnect, these guys have come up with Python, although QuantConnect too offers for other languages also. But more and more platforms are coming in which are offering services if you are coding in Python primarily because it's more people can actually use that service. So from that perspective, if you are good at Python, then it becomes easier to use those services as well, use those platforms as well.

Andrew: Yeah, sure. So those are the benefits but how about the drawbacks of using a platform like Python?

Nitesh: So a platform like Python is basically in Python you will see almost every variable, it is considered as an object, right, which would mean that it will be saving a lot of information, which might not be required, so like on average – it's just an estimate. Like on average, it would be two to three times heavier than C++ based program or C-language variables. Then it goes to a scale then there is a possibility that there can be some performance bottlenecks and memory leaks, so that's the primary disadvantage of using Python. The pros very often in the case of Python takes over the cons, so effectively if you're not into ultra high frequency trading, then it's all right. But if you're into high-frequency trading, then probably it might not be a good idea.

Andrew: Okay, great. Let's have a quick chat about data integration because there are some retail trading packages, for instance MetaTrader, TradeStation, which have data built into the platform and then others like Python, which don't have data included, so what considerations do you need to make regarding data in which you want to trade?

Nitesh: Sure, okay. In data integration, you have two things. One is your market data, which is stocks, futures, forex, or whatever you're trading and the market price information for that and the second is related to the events that are happening, which are like news or economic data releases, all those things. Quandl is something which has come up and is becoming more and more popular now, which provides data for both your equities as well as emerging market data and also your economic data. They are offered quite as free of cost. It covers many, many geographies including Asia, US, Europe, all of that, and if you can use the EPA or you can use the various plug-ins for using in Python or even Excel, so that is something which is becoming very popular. Since it also aggregates, you can get it from Google Finance, Yahoo Finance, or some other directly from some other exchanges as well.

I think those who are looking for data integration, it might be a good thing to look at Quandl, but other than that, there are a lot of data vendors which are there, of course, so who have been providing pretty good services, so that can also be done. But I believe that as we progress, as we move forward, the data integration especially on the economic data and news data side, that is becoming more and

more especially with the advent of social media, those things are also affecting a lot of strategies. I was attending a conference recently and there was this complete discussion on the sentiment analysis in finance and especially for the trading side and so much is happening. People have been using the Twitter feeds, the Facebook feeds and integrating them, and trying to draw sentiment analysis, which they are trying to use in their trading strategies.

So I believe that some of these vendors hopefully and most likely I believe, they would also be coming with their own solutions, much cheaper solutions because right now the solutions are slightly the ones that Thomson Reuters, or the other data vendors provide for machine-readable news and economic data reading, machine-read economic data so that's likely more expensive and not really integrated that much towards retail individual traders. But hopefully as the technology gains some pace, I think we should have more and more tools where we would be able to use that data for the retail or individual trader as well. So Quandl is only providing for your economic data. For the sentiment analysis, still not there, but I'm guessing it is just a matter of time

Andrew: Yeah, I'm sure someone is working on it already. My experience in the past though with free data is it's quite dirty, there's a lot of errors. I haven't actually used Quandl so I can't comment on that, but what do you need to consider about the quality of data?

Nitesh: I think ultimately if you are highly worried about the qualities aspect of data, I think it would be good to record data and use that, so that's what most of the leading firms do for creating a strategy and estimating the returns roughly. It's all right to use any of these data service providers. I'm not saying they do not provide correct data but there is a possibility of course for some of the vendors. So it's normally advisable that you actually record the data on your own site and use that if you really want exact results because then you know what time the data was received on your server. You're already aware of how much latency there is between your server and the exchange where it is streaming it from, so all those things help a lot in making sure what you are testing, you know what you are testing it on.

Andrew: Okay. One final question on algorithmic platforms before we move on, so you mentioned a couple of web-based platforms are available too. What benefits do they provide? Why would someone want to use those?

Nitesh: Basically all these web-based platforms, their one primary benefit is they're web-based so you can use it from anywhere, any machine, anywhere, so that helps a lot of people. If you're not highly concerned about latency in microseconds or says tens of milliseconds also, then I think it's a reasonable thing to use. It's a good compromise that you're making in latency for the ease that you're getting for automating your strategy, so that's one.

Also it does not need any development on your side so like there are tools so to say IB Python and IBPy to use to connect to interactive brokers using Python so they provide you with the API bridge. But there are a few more steps that you need to do before you can take it live. On these platforms, you can actually just log in and if you already have an account with one of the brokers that they support, then you can just maybe take your strategy live as well once you're done with the back testing, so that acts a lot of the convenience I believe.

Andrew: Okay. All right, well thanks Nitesh for sharing some of your knowledge on algorithmic platforms, I'm sure that will be very helpful. So let's move on to statistical arbitrage, which was one of the styles of trading that you said that you're using in your portfolio. So can we just start with a little bit of background on what it actually is, what's the underlying concept?

Nitesh: Certainly. So in statistical arbitrage, as the name suggests, there is not too much of arbitrage in it, but the name gained significance from the fact that most of the statistical arbitrage pairs or the portfolios, they tend to be delta neutral or beta neutral in nature. So that's where I think I believe the arbitrage term got coined into pairs trading because it was known as pairs trading when it was started for implementation like I think in mid 1980s by Nunzio Tartaglia and his group who were working at Morgan Stanley. They were actually assigned to do something for risk management, for the risk management on the balance sheet side, so for the block trades to devise a mechanism for hedging the block trades that Morgan Stanley was undertaking. Then they realized that instead of using it for hedging, why not create a portfolio where they can trade it, where they are buying one stock and selling other stocks, buying the stock, which is not performing well and selling the stock, which is well performing.

That gave them this idea of pairs trading, which was immensely successful at that point in time and it was like almost a percentage returns on a daily basis that they were able to generate at that time. Obviously not to say that you can generate similar returns, no but obviously if you come up maybe with a new strategy paradigm, then I guess you might have similar kind of returns. But that was when it started, and the concept was that you were buying your stock, which is not performing so well and selling the stock, which is performing really well but both are from the same sector, same industry. At that point in time, it was more of the rules that they had created rather than the models because it was based on the observations, which later on probably more statistical inputs were added to it. By 2000, I think it was like so many people have been using statistical arbitrage.

So it could include your pairs trading and similarly it also includes all forms of index arbitrage and any other related trading strategy where you are buying or selling – not necessarily buying or selling all the time. There are two things which are negatively correlated, then you might be buying both and creating a statistical arbitrage pair, so that's the underlying things a bit of history and the underlying concept in the easiest words that I can describe.

Andrew: I guess one of the more important points of statistical arbitrage is finding pairs that perhaps a steady relationship you could say. How do you choose those pairs? I mean you said that they used to do same sector, same industry. How has that evolved? These days how do we choose pairs?

Nitesh: Right, so normally there are few things that you need to look at while selecting pairs. First are the qualitative aspects of the pair, which will be whether they are from the same sector. Second would be the product and services they're offering. Is it the same, similar in nature? To give you an example, if I have two companies, two cement companies and they are both selling cement, so if I remove the label from the bag of cement, it might be difficult for a layman to differentiate between the two different products. It should be a similar product or maybe service, which they are offering and they are similar in market size both in terms of market capitalization and also the revenues that they have. This would

ensure that you do not get legged out on one of the legs. They should have similar liquidity profile, so it should not be that one is immensely liquid, the other is not liquid at all and then you might have the risk of getting stuck with a position in one of the legs while taking the position or aspiring other position. These are some of the qualitative aspects.

And then the quantitative aspects where you – so earlier when it started, when we started putting into statistical arbitrage, so we started off with correlation where you're looking at correlation whether how closely correlated to stocks or to asset classes were, but very soon it was replaced by co-integration, so where you look at the co-integration whether the two stocks, the two asset classes whether they are co-integrated, whether the price are co-integrated. If yes, then we are using that, then probably it might make sense to trade this pair, given all the qualitative aspects are also satisfied.

Andrew: Can you choose pairs purely on the quant basis or does it really need to also include the qualitative side?

Nitesh: It's always good to include the qualitative side so that normally helps a lot. Otherwise at times it can become a challenge if you are only looking at the quantitative side. But what a lot of people also do is, since you have like hundreds of thousands of pairs which are available in the market, say from the same sector itself, you dig that up and maybe just to have preliminary strategy where you're saying, "Okay I will just use correlation even though I know that the approach is slightly flawed, but it will give me approximate results and it will help me filter down my list from thousands to maybe a few hundreds."

Then I run my full gamut of statistical tests, which would include cointegration, testing for cointegration along with other things as well and then I can have some select pairs. Then I think after that, it might be a good idea, say if you have a few dozen pairs or say a dozen pairs, then I think it's a good idea to look at the qualitative aspect as well. You can go ahead without that also but if the markets are running fine, if there is not too much volatility, it should be fine. But in case there is any mayhem or something, then these qualitative aspects can actually help you.

Andrew: Yeah, okay. Let's talk about a little bit about the mayhem for a minute. What are some of the challenges of trading this particular style?

Nitesh: So the problem in the times of mayhem while you're trading these particular stocks is that statistical arbitrage is a mean-reverting strategy. What that means is that you're assuming that the prices will be coming back to the mean, so as in the ratio will be coming back to the mean, so ratio of the two prices. You will expect that to come back to the mean after some time. But in times of mayhem, there can be too much pressure on the prices on some individual sectors as well, so basically there can be a lot of random movements. Then at that point in time, it is possible that the fluctuations that happen at that point in time, that might trigger your stop-losses because you might not have any further margin to put in or anything like that.

But I think the bigger area of concern normally in statistical arbitrage is event-related risks, which are specific to one leg. Say if you are trading into two stocks and one of the stock, there is some news of for example some fraud, maybe which happened in that company or some big regulatory step, which

will have a very – not regulatory step but that would ideally affect both the companies, but say some key management decision or some merger or something like that, which is expected to drive down the prices of that stock heavily. You might get, even though it is underperforming, but it will probably underperform further more because there is some big news or big announcement, which has come in.

That is the primary risk that a statistical arbitrage dealer will carry. But here you can see that if there was as what I was saying that a regulatory announcement or something like that which is driving down the prices of that stock, it is very likely that if you have paid heed to those qualitative parameters, then it would have helped you. Because then you are looking at the similar-sized companies in the same sector, offering similar products and services, so most likely they will be affected in the same manner by those regulations. It's more likely that both will be going down probably together to a similar extent, so the risks from that perspective reduces a bit.

Andrew: Yeah, it's interesting, Nitesh, that you mentioned some of those issues because I think a common misconception with statistical arbitrage is that it's risk-free, but obviously from some of the points you raised that it is not always the case.

Nitesh: Yes, definitely. Definitely not risk-free strategy, but relatively less risk probably, yes that I can say.

Andrew: Yeah, okay. So you mentioned some of the drawbacks or other things that can go wrong, but what are the benefits of trading statistical arbitrage?

Nitesh: So one of the key benefits of trading statistical arbitrage would be the margin benefits that your broker can provide you because you have very little delta exposure or you're trading into stocks, which have a high degree of correlation between their return. So you can expect a good amount of margin offset from the exchanges especially the exchanges that follow SPAN-based margin methodology and also from the brokers also. Your cash outlay can reduce significantly in terms of margin that you will be paying, especially if you're trading into futures. Then also in addition to that, what is happening is you have understanding of what the price spans are.

So when you are trading a trend-following strategy, the whole chart is for the right, so the prices can go anywhere and you would like them to go anywhere because you are hoping that if it is going up, then it just keeps going up. But in case of statistical arbitrage, you are looking at a narrow range, so you can be more focused. Is that okay if the prices are between these and you can come up with more and more trading rules, which are applicable for that range, and if it is going out of that range, then probably you can trigger a stop-loss or maybe there can be other things also that you can do but not yet. So that's another advantage of doing statistical arbitrage.

Definitely it's slightly less risky to the market movements, so overall market movements. If the overall market is going down or going up, that does not necessarily mean that your startup portfolio would be going up. It can be going either of this, so there is a high likelihood of extracting the alpha from the strategy.

Andrew: Okay. What about different environments of volatility? Have you found if that works better in low-volatility compared to high-volatility environments or not at all?

Nitesh: So we have had a study done from like almost 2006 until 2014 sometime back, a couple of years back. We realized that it does tend to perform better when you have some volatility in the system. Not too high but reasonably decent volatility is always good because basically it's opportunity-based system, so when there is some temporary pressure on one of the stocks, which is temporary, not permanent, so it will make sure that the price ratio reverts back to the mean in a much faster manner as compared to if it was not volatile at all. So very low volatility is not a great idea but some volatility is good. If the level is highly volatile, then again probably it's not a good idea.

Andrew: Okay so what do you think is the most important factor in statistical arbitrage trading?

Nitesh: So the most important factor in statistical arbitrage trading would be I think it's applicable for any trading, but I think most of all statistical arbitrage and that is stop-loss. What happens is that in trend-following strategies, you know that if you are trailing your stop-loss, so you can be more aggressive on the stop-loss probably, so low stop-loss and high return, so high-take profits. That's what normally the mantra is for trend-following strategies. But in case of mean-reverting or statistical arbitrage strategies what happens is that since you have established cointegration and the price ratio is going away from the mean, then as the further away it is, the more likelihood there is that it will come back to the mean. So basically you can say at a higher confidence interval that it will come back to the mean, which means that if it is going away from the mean you should be scaling up, rather than cutting down my position, right, which is slightly opposite to what you will do in a trend-following strategy, where if it is going in your favour, you will scale up or in pairs trading or in statistical arbitrage, more often than not you will be scaling up and it is going against you.

So what that means is that you will be having a big position. You might accumulate a very big position over a short duration of time while the prices move against you and then if you do not trigger your stop-loss at the right time and the cointegration breaks then it can result into very massive losses because the position would be very huge. So that's what I think is the most critical thing that one should keep in mind while doing statistical arbitrage.

Andrew: Okay, so let me just check if I understood the stop-loss correctly because typically a stop-loss is really related to the price of the instrument but you're saying that you're looking at the ratio between the two pairs and then that triggers your exit?

Nitesh: Right. So you see from the stop-loss as a quant trader, I would define a stop-loss condition or stop-loss as the time when my hypothesis fails. So my model has been based on some hypothesis. If my hypothesis stays correct, I'm not triggering my stop-loss. But once my hypothesis is broken, that is when I should be triggering my stop-loss immediately. When doing statistical arbitrage, your primary hypothesis often is that the pair, the prices of the two stocks say for example is cointegrated. So if the cointegration breaks, which would mean that my hypothesis is broken and once that hypothesis and I should trigger a stop-loss.

Having said that, but you might have some other parameters in your model so where you might be scaling up your position, scaling down your positions, which might also have an impact on how much loss you can take. I agree that your hypothesis might have not broken, but you might be broken, your

trading account might be slightly broken. So you need to take a stop-loss. You need to put those things into your model when you're creating a strategy.

Andrew: Okay, thanks for explaining that. So for people who wanted to get started building statistical arbitrage models, what would you recommend they do?

Nitesh: So the idea would be to model the strategy first. First is to evaluate the hypothesis whether it is right or wrong. Second is creating the tradable instrument, so basically it can be ratio. It can be log ratio. It can be something where you adjust few things, so I've seen people even re adjusting for like say you are doing a pair between US dollar index versus S&P, then they might have very different volatility structure, volatility structure, which would mean that you might want to make some changes into them if you are doing it on returns or if you are doing it on prices. So there are a lot of things, which I've seen people doing and some of them have been quite successful, so they create their own index, which might not be just the ratio but they might have done certain permutation combinations on that. So that's another step, so creating tradable instrument and then the pair or whatever the ratio or whatever it is.

Then you model it with all the conditions that you have in mind, so if you are looking at how you want to scale up your strategy, what will be the stop-loss trigger points, how you want to exit your trades in terms of profits. So you will be exiting all your position at once or you will be exiting all your positions later on at separate points. So all those things have to be decided and have to be factored into the model. Then you test it against so it can be simulator or it can be some test market where you can test it on and then you take it to live. That's what a typical process especially for a startup strategy should be.

Andrew: Okay. Are there any common issues or mistakes that you see traders making when they develop these types of strategies?

Nitesh: Yes [laughter]. There are definitely, a lot of them I believe. But let me highlight one of the interesting ones that people face especially for the first time in a quantitative manner. So what happens is that we very often use Z-score to take the positions in statistical arbitrage. What happens is that at times, the Z-score you have taken the position entered a pair position at a score of 2 and it comes down to say 0, but you are still losing money. So the people becomes slightly baffled why is that happening because the pair has converged, it has reverted back to mean, then I should be making money. So what happens in those cases is that the whole statistical analysis that we do it is based on the assumption for that pair ratio that the mean is constant, so basically the series is stationary. What would happen in real life that the mean would change. It will not remain stationary, so when the mean changes, your Z-score will come back to the mean or the mean goes back to the Z-score, whichever you want to put it. But yeah that is something that people should know and probably factor that in while deciding their entry and exits based on Z-score, which is quite popular I believe. So that's one.

Second is I normally say that don't underrate the qualitative aspects of it because what happens in strategies like statistical arbitrage, you make money all the time, but you lose big on select days so that's what you need to control. That can only happen by a combination of implementing prudent practices while creating those pairs, where your qualitative aspects can help and second is by being

very clear on your stop-loss in terms of numbers. Where is your stop-loss, so that has to be pre-decided and recorded, so that there is no emotion attached to that. So that's another.

Andrew: Yeah, sure. All right, thanks Nitesh for explaining that. Now we might just move on to some of the audience questions. We've got a few here that have been submitted.

So we'll start with Tim. Tim's question is, "What do you think is the most important thing before creating a profitable strategy in conjunction with choosing the right pairs to apply to the strategy to?"

Nitesh: Okay, so most important thing before creating a profitable strategy? As I said, the most important thing that you need to do, assuming that it's for the pairs, yeah, it's for the pairs, so it would be the qualitative aspects as I said and also the model how you are planning to back test, how you are planning to test the strategy. Let me give you an example. What happens is that in a lot of strategies especially if you move towards higher frequency, on medium-frequency and also on high-frequency side, you might not be hitting the orders like you might not be hitting market orders all the time. You might be quoting because your profit margins are 10 for every trade as on the per-trade basis so you might want to save on the bid-ask spread. So if you want to do that, then in that case maybe you might end up quoting on one of the legs and covering when you get a fill on the first leg, which sounds perfect but when it comes to back testing such model, it can become a nightmare because when you are quoting, you don't know how the market would have behaved if it was real market.

So simulating such thing can be very difficult. There are a lot of work which prop firms do in getting and creating models by using various distribution models where the simulator can try and reflect in a way how the actual market would have reflected if such order was placed. So that's the second thing that I believe you should have in mind before you create strategy, when you start, before you start the strategy.

Andrew: Yeah. Okay. There is a second part to Tim's question actually. It says, "As we know, most people are focused on entries for trading, but equally if not more important, exit strategy. Could you give an example of an exit strategy you like to incorporate into systems or how you define its time to exit?"

Nitesh: Okay, so for exit, I believe there are two ways to look at it. One is when you are making a profit; another is when you are making a loss. When you are making a profit, the key is you do not want to exit early. You want to extract the maximum profit out of the pair as much as possible. But it's not as complicated as it would have been in the trend-following strategy where you do not know where it would go, and in a statistical arbitrage, you can see that in most of the cases, people take their profits around the mean, when it gets back to the mean. But that's not a rule but just in common practice. A lot of people also do it actually take their take profits slightly before it approaches the mean just to avoid mad rush at that time. It's a self-fulfilling prophecy because if that is true, then everyone will be doing that, and they will be mad rush at that point itself. But still I think in most of the cases, you will be when you are on the profit side, you will be exiting when it's near the mean or when it's at the mean.

On the stop-loss side, so that's where the thing is that the challenge is that you do not want to say especially given today's first part is that if the cointegration breaks, then you exit right away. That's simple, but if the cointegration is not broken, so if it is going against you, then instead of putting a trailing stop-loss, what you would possibly be doing is that you will be scaling up your position. That's what the general practice is though, so you will be scaling up your position and normally what people do is that you will have a blanket stop-loss so that I have a blanket stop-loss of say \$1,000 or \$5,000, whatever amount it would be. So that's the blanket stop-loss for all my computations combined. If that is triggered, I'll just dump all my positions. If it is not, then I will probably keep scaling up given my hypothesis is not broken and then exit as it comes back into profit. Now when it comes back, there you can have like whether you want to exit all at once or you want to keep it so first in, first out or you want to have it last in first out, both are quite acceptable approaches so you can do that.

Andrew: All right, thanks. Now the next question is from Nikhil. Nikhil says, "Who would you choose between the following two candidates for your trading desk: Person A with average academic qualifications but an audited one-year profitable money track record, or Person B with top-notch academic qualifications and a profitable back-tested track record?"

Nitesh: Okay, so if it was up to me, then I think I would definitely give more weight to someone who has a one-year profitable real money track record, but in the end it depends on a number of things, first being what you have traded if that is what we also trade, that's one. Second is whether the trading philosophy or the trading style that you have implemented while making those profits is the same that we do on our side. So, this would be the two things which will probably affect the decision even if it is real-money profitable track record, and then also the profile that you're looking at. If I'm looking at analyst profile where I need someone to dig through the data and do all the data crunching, number crunching, and come up with strategy ideas, I might go with someone, the Person B, with top-notch academic qualification with a profitable back-test record. But if the person would be in charge of making trading decisions, then I think again Person A would get more weightage on that.

Andrew: Thanks a lot.

Nitesh: That's for me, but not for the general industry [laughter].

Andrew: It sounds like Nakil is looking for a job on a trading desk [laughter]. Okay, the next one is from Rahul. It's similar kind of topic. "What do you think is the most important factor to be a good algorithmic trader?"

Nitesh: So to be algorithmic trader, I think it's slightly different for how it is for conventional trading. In conventional trading, the things you need are first obviously is a good understanding of the markets, then your trading acumen, which is attitude basically what we say, so you need to be good with numbers and all those things, and then of course your discipline. Right these are the three primary attributes, which when used to look in the conventional trading paradigm, but if algorithmic trading, I think the discipline and those things are slightly taken care of by the machine itself, not to say that you can afford to be ill disciplined. You cannot be because you still have to follow all the risk management conditions and make sure that the codes are fail safe.

But the skill sets that are required are slightly different. One would be your so like this I something that we came up while we were creating the course for executive program in algorithmic trading, which is EPAT, which we offer in QuantInsti, so we thought it has to be comprehensive. So what are the skill sets that a successful algorithmic trader would need? One is he needs to have a very good understanding of statistics and econometrics, so that's one. So that acts as a building block for the modelling as well as your strategy building, modelling optimization and implementation, every variable using those building blocks. Then second is on the financial computing, which would include your different programming languages as well as statistical tools, which are used where you can model and test those strategies. Third one is the quantitative trading side, in which you look at various trading strategy paradigms, so like today we were discussing what the statistical arbitrage. Similarly, they are trend following and machine-learning based trading strategies, market-making. A lot of strategy paradigms that are there, which you should have a good idea about.

These are the three primary things. So basically it's not just the financial markets expertise but you also need to have some amount of technology expertise if I may say so, so that will definitely help you in becoming a better algorithmic trader.

Andrew: Thanks, Nitesh. Now a question from John. John asks, "For someone who wants to be a systematic trader but has no programming experience, what would you recommend their path should be?"

Nitesh: Right. For John, I think if you want to be a systematic trader, it depends on whether you are looking at automating your strategies. If you are not, then I think you can pick up some basic programming skills and that should be fine. Not too much of programming language understanding would be required, but if you want to automate your strategies as well, then it might be a good idea to gather some programming experience.

Andrew: Okay. Thanks. There's a question here from Jonathan. We've kind of covered it a little bit earlier. I'll just mention it anyway, so Jonathan was having some issues. He trades forex using the MetaTrader platform and it has some limitations for back testing. He wanted to know what other systems traders use, what applications and platforms. I think we covered that quite nicely at the start of the interview. Do you have anything extra to add to that question?

Nitesh: I think so basically on the forex side, what happens is that you have more and more like there are so many brokers and portals which offer some platforms or the other for like almost free of costs I believe. I think you might want to have a look at them as well in addition to the ones that you're already using like MT4 and all, so it might be a good idea to have a look at them also. That might help you in case MT4 is not getting to your requirements.

Andrew: Yeah, sure. Okay, thank you. Okay final audience question is from Michael. Michael would like to know, "What do you think is the future of trading?"

Nitesh: Okay, so as you know my background where we are into high-frequency trading and automated trading, so we tend to believe that automation is the future. But we also often say that the future is already here because like even in markets like in US markets especially in equities, you have more than 70 percent to 80 percent of the exchange volumes which is happening through automated systems.

Even in new markets where algorithmic trading is relatively new like India, you have more than 50 percent of the volumes and derivatives that is happening through algorithmic trading systems. So that is something that is I would say that already arrived and will arrive where it is not the case.

But what would be more interesting is I was saying earlier also would be the inclusion of all the various miscellaneous data, which are floating all around especially with the recent advancement that we're seeing in the big data analysis and analytics. It would be not a surprise if you start seeing a lot of data gathering and data analysis, which is happening outside of emerging markets, which tends to affect financial markets. You see people building bridges between that and using those for creating trading strategies. That is something, which I believe is not yet there in full purview and I'm sure that would come; the rest other things like arbitrage or market making, they will keep on evolving.

I think the automation has helped the market makers to make markets in a much tighter fashion as compared to what it was say probably 25, 30 years back when you only had specialists in the pit and making very wide markets, so your trading costs used to be huge. But that is no longer the case, thanks to the technology advancements. I think all those things will continue to happen similar to how we have seen in automobile industry. Just like earlier on the shop floors, you used to see the workers, all the workers who are assembling the parts and doing all those things and as the technology advanced, you saw shop floor workers to be replaced by the machines. Not to say that these machines operate by themselves, they are automated but someone is definitely controlling it, so you just keep on improving your skill sets to go up in the value chain. In the whole process, the process becomes much more efficient.

Andrew: Can I ask you a little bit more about high frequency trading actually because there's been some reports published on the Internet showing the profits from high-frequency trading is in decline. So I don't know if that's actually true because I don't work at a HFT shop, but do you think the edge there is being eroded away and do you think we will start seeing less high-frequency trading over time?

Nitesh: I think what is happening is that the technology costs have been increasing for the top players, so if you want to be the fastest guy in the market, then it is becoming more and more expensive to beat that. Earlier if you were at your 10 microseconds, if your system latency was at 10 microseconds, you were a happy man. Now even if you are at 5 microseconds to 6 microseconds, you probably won't be able to compete if you are on the high-frequency side.

Andrew: Wow!

Nitesh: Yeah. So people have invested a lot and it's not just that on the technology side but also infrastructure side, so you had earlier the cables, the fibre-optics, and then which gave room to microwave now, which is becoming more and more popular. Now then you have laser, which is coming in. The thing is that whichever is the latest technology, it would be absolutely expensive. It seems to be that because that can give you kind of profits as well. But that is becoming more and more difficult for the general people in HFT, so only the premium within the HFTs is able to compete on that side. The volumes are still there, but just that's probably the number of shops would probably decline or maybe it might have to go through a consolidation phase a bit.

What is also happening is that more and more companies are moving more towards machine-learning side where you have more logic that you can program and use that as an edge as compared to just to your advantage, which is becoming like the basis common for everyone. Then the improvements, the further enhancements are becoming prohibitively expensive for a lot of people.

Andrew: That's interesting. Thanks for showing that, Nitesh. I'm going to start wrapping up now with some quick closing questions.

Nitesh: Sure.

Andrew: What is the biggest lesson you've learned through trading?

Nitesh: So I think the biggest lesson that I have learned through trading or while I was doing trading is that trading is not just buying or selling. If you want to be successful in that, you need to treat trading as a business. So like in any business, if you want to succeed, you can have certain competitive edges, so same thing applies here as well, so if you want to succeed in trading, if you want a successful trading strategy, then you need to have certain competitive edges that you need to gather. It can be anything. It can be your trading strategy itself or the speed at which you can come up with new ideas, or it can be your infrastructure technology, or it can be your low brokerage, or it can be the markets that you can have access to. It can be anything, but it has to make self-competitive edges that you need to work towards gathering them to make sure that you are profitable.

Just like in any business, you will do that even if you are opening a grocery shop, you will probably look at the comparable advantages in terms of what kind of rent you're paying, what kind of location you have your shop at, how you're procuring those goods, so it's the same thing. You need to treat it as a business.

Andrew: Yeah, yeah. Great bit of advice there. Thank you. What advice would you give someone who's just starting out in the algorithmic trading field?

Nitesh: I think what I would suggest is that build your base right first instead of trying to put your strategies into live as soon as possible. It is better to understand the nuances because one thing that you need to understand about algorithmic trading when you're automating stuff is that when it's human brain or when a person is analysing things or making trading decisions, he has advantage of common sense, right? A machine does not have it. It has as much common sense as you program it for.

So there are certain nuances, so you might be excellent trader but if you are switching to algorithmic trading side, it might be a good idea to build a good base there to get a good understanding of what are the different factors and what are the various skills like on the programming side, or on the analytic side, quant, side, so you better brush that up.

Andrew: Yeah, okay. Do you have any favourite trading books?

Nitesh: Actually I'm not so much into the fiction side, but I think I have enjoyed the ones with some drama in it. But I think on the nonfiction like the classics, the whole classics a few decades old I guess like *Liar's*

Poker and all those, the ones all the reminiscences of a stockbroker, so that's I think I like that. On the nonfiction side, I believe I like the *Investment Psychology* by Murphy, so I like that quite a bit. It's been a long time since I read that, but I definitely remember a lot of things that I read in that book, so I think it's really nice, yeah.

Andrew: Okay, great. I think you mentioned earlier you're part of QuantInsti, do you want to give us just a quick little explanation about what that is?

Nitesh: Yeah, sure. So QuantInsti is into algorithmic trading and quantitative trading training. What we do there is that we provide the comprehensive programs, which is executive program in algorithmic trading, which is a 6-month long program. It begins only targeted towards working professionals and done through a live webinar setup, so that has actually enabled people from more than 30 countries across all the six inhabited continents to participate in our program and get benefited from that.

It includes all the various aspects of algorithmic trading and not just like stats and financial computing and quant trading. But also even from the regulations perspective say if you are trading in US markets or in emerging markets or in any of the developed market, so what are the regulations that you need to be aware, what are the compliances, even back side along with the technology and network admin infrastructure, what are the tips there, what can do the trick for you. All those things also be covered, so highly practical program. It has received good reception in the past 5 years since it was launched. Yeah I think that I would be happy if we are to keep offering that program.

We have also been able to actually gather the globally leading faculty members like the domain experts like their different domains like Dr. Yves Hilpisch from Germany, author of *Python for Finance*, who has been leading on the Python module for EPAT. Similarly, for trend-following strategies, we have Dr. Ernest P. Chan, who also wrote *Introduction to Algorithmic Trading*, which is very much like a textbook in a lot of cases. He's based out of Canada, so he takes those sessions. Then similarly other practitioners at iRage and otherwise who take up different modules as per their expertise. It's been good.

Andrew: That's great. I actually know someone who's been through that, the EPAT course and the feedback was pretty good so anyone who is interested should go to the website to see what it's all about. All right. Thanks so much for your time today, Nitesh. Is there anything else that you'd like to mention before we wrap up today?

Nitesh: I think I'll just say one thing that prepare yourself well and make a lot of money.

Andrew: Yeah. Well, I think preparation is important because it's not an easy job, is it?

Nitesh: Yes, yes. I definitely agree, so you need to put in and it has to come through practice. A lot of it has come through practice so yes.

Andrew: Excellent, all right, well thank you very much again for your time today, Nitesh. It was great.

Nitesh: Thank you so much, Andrew. It was my pleasure being here.

Andrew: Yeah, thanks. You gave us some great tips on how to choose an algorithmic platform and some great tips on start arb as well. So thank you very much for sharing all that fantastic knowledge with us. I'm sure people will find it valuable. I wish you all the best for the future.

Nitesh: Thank you so much, Andrew. It has been wonderful being here and thank you. Thanks a lot in meeting us.

Andrew: Right, cheers!

Nitesh: Thanks, bye-bye.

Andrew: Okay, bye-bye.

Nitesh: Cheers!