STD Session 5

**Karthik C:** [00:00:00] Assignments, okay. So I'll give two assignments together today, right? Uh, construction of the discovery matrix app. As you know, any of you started working on it? No? Okay, so formally I'll, uh, just update both the assignments. So, today we'll move into diagnosis, right? So far we've been working on.

Okay, time to take notes.

Oh, you're sorry. Sorry. Sorry, sorry. One cherry, Why? Who's coming? Oh,

okay. Sorry. It's fine. This is a dirty seat even more. Give me your hand. I'm just helping. You want me to bring the chat there? Yeah, he'll bring it. [00:01:00] Let's go. Bro, I'll sign it. Come. Come on. Is that required for you? Bro! Bro! What happened? It's bad, it's bad. Okay. It's just fine now. Did you realize that this was an addition to the mix?

This is an adjacency matrix. What is that? A influences B, B influences C, A influences C. Oh, okay. This is an adjacency matrix if you put zeros and ones. What's an adjacency matrix? If there exists an edge between A and B. And if you make amatic like this [00:02:00] to denote

O and D. DSA Ds. Ah yeah. DSA is also,

it looks so exit last class.

For senior sandwich, which makes you better. Why is it sitting in between guys? Listen, right, so. I told you right, at the beginning of the semester, we will be going from discovery, diagnosis, right? So, today we are switching over to diagnosis. What is the English meaning of the word diagnosis? Treat, but no.

Finding out what is the problem. Diagnosis is not treat. Finding out what problem is. He is saying finding out what is the problem. What is your [00:03:00] roll number? You underst stand up and answer hold about Cs. CS 3 23 B 1, 0 1. 0 1 0 1 2. Alright, what's your name? Chris? Yes, Chris. Harith. I1027 1027? Yes, sir. Right, so Harith and Chris, right?

So he's saying treatment, it's not treatment, right? We have yet to get into the treatment part. We need a system to treat right? We don't even have a system. He's trying to build a system. So, to start with, right, what did we say? Guys on the last bench. You I see somebody murmuring. Sit straight. Don't hunch like that.

Sit straight. Last benches. Sit straight. I want you to sit here. Right? So, what is that I have been emphasizing from the beginning of the semester? [00:04:00] Guys, if I see somebody talking, you talk to me or I'll ask you to leave. I should only hear myself. Right, that is better. Right, so this is what we said at the beginning, right.

So you start with, right, do not focus on the solution space. Yes or no? Yeah. Right, do not jump to the solution, right, because, man what is your problem? Right, listen, right. So I said do not jump to the solution space, right, because the problem with solution space is what? You will have a hammer and you will start treating every problem as a lame, right, that is not what we want.

So. Discovery phase is what we emphasize is, right, so far, we spoke about stakeholder. Can somebody tell me who is the stakeholder is? Speaker 2 Affected by it. Affected he is saying. Why are you late? Why are you guys late? Five minutes late. Five minutes late, why? Give me some explaining[00:05:00]

food. You should plan accordingly, right? Right?

At the beginning, what did we say? Right? So you start on the problem, right? Understand the problem. There are a lot of people, right? So, What is the English meaning of the word stakeholder? Anyone who has a stake, what is stake? Who has a? Share is a? Uh, involvement, who says involvement? Technically, yes, involved is fine.

You have a risk. I have a stake in the system, right? I am affected by it. Right? Anything that happens, I am going to get, I am going to face the consequences. Right? For instance, right? Look at this remote. If it doesn't work, I'm a client, right? I'm a customer. If it doesn't work, it's going to affect me. It's going to affect the sales of Logitech, right?

Or whoever made this. So, that's the point. Right. So, [00:06:00] so, now your stakeholders, right, there are many stakeholders, many, we spoke about the education system, classroom scenario, right. Who are the stakeholders? Obviously, the students, teachers, faculty, the admin support staff, even you can go up to the extent of even talking about the, the, the, the, the, the, the, the, the, the, the, So, the question is, okay, if you keep going in this fashion, security is also, but does the security have any bearing on the outcome of your education?

In some way, yes, right, in some way yes, but not directly. So which means you exclude. So today, we are going to list down stakeholders, okay. So let us call them yes. right, we will use symbols, right? So yes, so you have yes one, yes two, yes three, yes four, so on, and so forth. Now you have to actually limit your stakeholders, you cannot include everybody, right?

Let me take a common example I always use, okay? Take a mobile phone, Okay. So, I am starting with, okay, I want to [00:07:00] innovate, right, a new company comes in, okay, no more Tata feels like, right, okay, we are running software, right, we are also getting into semiconductor. So, suddenly they feel, okay. So, let me start paying a phone right, I will put some 2000 crores right.

Let me start paying a phone. Now where would, where would they start? Obviously, they cannot make the same phone right? Only the market is saturated enough. So, how, how will they try to differentiate themselves? Any idea? Last week we, I taught you a tool right. So, you construct a discovery matrix and ask the question.

What is the hierarchy? Is form important? You This process important, this medium important, right, you ask all these questions, right. Now, once you sit, and then you work on it, right, then as an outcome, it is, it is a semi mathematical approach, the discovery metrics, construction of discovery metrics, is a semi mathematical approach, using which it will help me I am going to show you how to identify the interrelationship between different elements, [00:08:00] right?

Form, right? The function, the medium, right? The process, so on and so forth, right? The expected behavior, right? What is the behavior of the product that is required, right? All this will help me do that. Now the thing is, I can see the interrelationship. Today, I am going to teach you something that How do you identify pattern?

You have a big matrix, right? What will be the dimension on the matrix, anyone? What will be the size of a typical, uh, discovery matrix? 20 or 25 cross 20. It can be anything, typically. You can include as many variables. But I asked you to restrict it to 20. 12. Because it will become unmanageable, right? If it is too huge, right?

DSM, Design Structure Matrix, right, towards the end of the course I will cover. There I will show you, right? It will be 200 by 200, the size of the matrix, right? It will be, you cannot process it. It's simply too much for an average human being to process. So what do we do? We look at clustering. For instance, if I have a huge matrix, right?

Let's call, n by n, let's call it 20 by 20. That's the size of the matrix, right? Okay. So you have [00:09:00] that many rows and that many columns, right? So, even with 20 by 20, right? That's like 400 different relationships I'm saying, on or off, right? 0 or 1, right? That's what we said. Now the problem is, what did we say, you You've got B.

Now you ask the question, does A influence B? That's the question. Remember that word. Does A influence B? So that being the case, if the answer is 0, okay, there is no relationship. If there is a relationship, you say 1, right? This we saw in detail last week. So you've constructed now. Now 0, 1, 1, 0, right? It's, it's, it's random, right?

Now, how do I identify a pattern out of this, right? So let us see this, right? So today we are going to look at something called SNAC analysis, ok. What is SNAC? SNACs, remember that way, S N A C K S, right? Remove that, SNAC, right? What is SNAC? S is for [00:10:00] stakeholder, A

and C, ok. A and C, I have already taught you. What is A and C? Alterability.

And C is constraint. Right? We will go in detail. Each and every term I will explain in detail. Guys, keep your phones in silent mode. Right? That is the first thing I expect you to do. Why keep my phone in silent mode? Right? So, S is stakeholder. Let us see if you figure out the answer. So S is stakeholder, A is alterable.

I will explain what alterable says. Then constraint. You know stakeholder, right? We have been discussing about this. This you know. What is a constraint? Any idea? In your, in CS terminology, what does constraint mean? Condition. Condition. Is condition a constraint? Foundation. [00:11:00] Foundation. Foundation. Bounding.

Bounding. Okay. You are talking about limits. Okay. It's talking about limits. Okay. Are you familiar with optimization, ConX of optimization? Have you read these some mathematical methods? How many of you have heard of ConX of optimization? Anyone? No. Sorry. I'll give you a simple, uh, question. Why equal expire?

What is the mini. What is the equation of? What will you get if you plot this? You will get a parabola. Right? Where will the minima be? At 0, 0. Need not be at 0, 0. It can be anywhere. What if, if, right, for this S, if I put C? Then at, It can be anywhere. Then at 0, 0. Now you are saying, you know this. Now I will give you a generic expression.

Okay? AXQ plus BXOF, right? CXOF. It is a differential, differentiating. It is [00:12:00] a, it is a, it is a, it is a, it is a, it is a, it is a, it Hey, so what's going on with this, with this, with this? Right towards the later part, right? If I've got a car like this, it is the . Now the question is there is there is one here.

There is one here. There is one here. Right. There are local minima and there is, there is global minima. Depends on quantity. So you can ask all these questions. Now constraint if I say, somebody said bounds, limits, right, that is what you said. What is your number? I1064. 10? [00:13:00] 64. Right. So I said, I can put a bounding box here or I can move it.

Okay. Now, that is a limit. Constraint is different. Please do not confuse it. That is why I put this, right, simple example. You will understand. I will give you an example. What is a constraint? Time is a constraint. I cannot take this class beyond 5. That is a constraint. Terminating condition. Right.

Terminating condition. No, I would not call it terminating condition, right. I will give you a physical example. Later on, I will come to this example again. Let us say, you want to increase the sanitation, improve the sanitation. What do you do? First of all, we will have to put it. Okay, let's say everybody is doing that.

Now, be logical collection. Okay, now the problem is, Kandigai the road is fixed. The size is fixed. Maybe a big lorry cannot come and go. What I can do, increase the number of times that they clean the dustbin. Okay, garbage [00:14:00] bin. That is something I can change. What is it I cannot change? Size of the road. So size of the road becomes a constraint.

Do you understand? The number of times I send in a garbage truck, I can increase or decrease. But I cannot change the infrastructure. Infrastructure is a constraint. Money that I have to spend is a constraint. Time that I have to spend is a constraint. Right? Certain things can be changed. And when I say most variable, I'm talking about the most particular variable, right?

You take a parameter or event, if that can be changed, we call this an alterable. Right, I repeat. If you have a parameter or an event, right, that can be changed in a small window of time. That's the important thing. Time factor is [00:15:00] important. Right? On the contrary, if I have a parameter that I cannot change in a small interval of time, I call it a constraint.

Right? So this is the formal definition. Is everybody following this? Anybody who wants me to repeat? Guys, everybody clear with this, right? So, I repeat, if you have a parameter or an event, right, that can be changed in a small interval of time, then I call it an alterable, something I can change, right? If I cannot change, for instance, like infrastructure, size of the road, Right.

Basically, it is not possible for me to change. I mean, technically I can, right, pull down a few buildings, widen the road, right, but that is dependent on a lot of other things, right. That I cannot do immediately, right. Wake, wake your friend up. Why is he writing like that? Right. You understand? Right. Always remember, right.

What is the constraint? Right. So generally, right, you write an objective [00:16:00] function. can you do numerical methods right? I don't know if you have a course, you do numerical methods, right? You write an objective function and then you'll try to basically find the minima, you will maximize or minimize. You will have limits.

Right. X will have a limit. X one two, X two have some limit. Point five, two, two. Now it's a limit. Don't take this as a constraint. This is not a constraint. What is a constraint? Your constraint can be in terms of something I cannot change. Right. What is the constraint here? I can only occupy 200 students, 220 students.

Can I put more students? No. Right? That is the constraint I have to work with. Right? So always remember that. This is clear? Stakeholder. Right? Now, we have to look at what need. Right? What is need? Need. Necessity. Requirement. So, I have stakeholders. Stakeholders have need. Right? By [00:17:00] choosing or altering certain alterables.

And right. Working around certain constraints, I am going to fulfill the needs of my stakeholders. So that's what holds snack analysis with all, we look at examples as you follow, I repeat there are multiple stakeholders should take any system. There are a lot of stakeholders, and those stakeholders have multiple needs.

I'll, I'll show different permutations, right? You have stakeholder 1, 2, 3, 4, so on and so forth. And each of those two stakeholders might have, might have shared needs. What you want, what I want, maybe the same. Look at a phone. What is it you want in a phone? Good battery life. I will say the same thing. Good battery life.

Right, but sometimes I will ask something. I need a pulse ator, you'll like, I don't need it. I don't need that. I don't need that. Right? Why do I need a pulse ator on the phone? Samsung used to sell one. Right? So those stakeholders which ask for a particular feature, if they are in minority, what happens? It won't be implement.

You don't be there financially. It makes no sense. Even if it's fire piece, right, the manufacturer is not [00:18:00] gonna do it, for instance. Then similarly. You look at website design. Have you heard of sku? osm? Are you familiar with this word

sku? Om.

If you're interested in ui, ux, right? This is the word you should know, what is ku osm sku? OSM is earlier if you go to Windows xp, right? xp, right? Because seven actually little bit diverse from this idea. So the thinking was. People are used to handling real world objects, right? Chalk piece, mic, right, pointer, so on and so forth.

So if I am making a virtual model of the same thing, it will look exactly like this. In fact, it will look like a photo of this. Sometimes they used to even take photographs and use it as an icon for, right, for any clickable element. So it'll look, if it's a clock, you literally have a clock, right? It'll look like a clock.

Now what has happened? Right? Now, I [00:19:00] might have like this. If you open Android, right? That's it. This is not skeuomorphic. It is a clock. Right? All of you just even take your cell phone and see. Look at your mail, your Gmail icon. Look at Firefox. All of you are familiar with the icon of Firefox, right? Look at the icon of Firefox, 15 years back, you will actually have a fox.

It will have defined features. Stain, feathers, everything. Right? Not feathers. Right? The fur. Right? The fur of the fox. It will be very pronounced. Right? Now what happened? Slowly. Right? What people realized? Because why? When they move to virtual, right, what is a touch screen, right? It makes no sense, right? So you have to have actual elements that you are familiar with.

Now that everybody is familiar, they said, why spend time doing a very detailed graphic design? I'll scrap that. If it's a mail, Google Mail has what? That's it, that's a mail. Then an envelope. You have an envelope? That's it. [00:20:00] That's my mailing icon. If you go to the old Google it will actually have a much more actual, it will look closer to the actual envelope.

You understand? So that, that principle is called skeuomorphism. So this fell out of favour. I am somebody who likes it. Why? I grew up with this. Now when I see like a bland icon, right, 2D, it doesn't have no depth. Look at any icons in modern day phones, right? iPhone actually They propagated this idea. Look at iPhone three or four, five, right?

You'll have beautiful icons. Actually, they let go of that idea. Why? Because for them, if they let go crossing board, they don't have to do, they don't have to render it at such a high resolution. They can simply have a simple right representative. Idea and then user knows. You get it, right? Look at your phone, right?

Phone icon is what? That's it. This is what, that's it. If you go to the old Android, right? 3D old one, 2008, 2009. You'll [00:21:00] actually have a 3D model, actually. Ok. So, why am I telling this? I am a stakeholder who will ask for the Yes, but majority of you like, why do I need them? So, what so I as a manufacturer, what is my intent to fulfill as many people as possible not everybody right?

There is a concept in mathematics called 95th percentile. Have you heard of this? I have to draw. All of you know normal distribution right, so if you know that. All

of you know this, right? You assume any distribution is, right? Normal, right? So that's, that's something, most of it. Height of people, your average, earning, Right, so on and [00:22:00] so forth. Anything, more or less it will follow this distribution. Now, if I am making this pointer, and if I am caught between, how do I arrive on the exact length of this?

So, which means you have to look at my fingers. Okay. Is this an average finger? May not be. So, you take, do what is called, you do a, Do, do a complete study of all Indians. Okay, all the way from Kashmir to Punjab. You go, do a study and then measure everybody's hand. Male, female, different age groups, right?

Then you have a, you'll have this. Somebody will have very small hands. Somebody will have very large hands. Right? So who do I build the phone for? If I make a pointer here in the middle, right, most of the people at the wide end of the spectrum can use it. Yes or no? If I make a phone for this fellow here, this fellow here cannot even use it.[00:23:00]

Extremely big hands. If I make a phone for this fellow, right, the largest guy, smallest guy will suffer. So what do I do? I hit a compromise. I do it for the median. Right? The middle guy. Who is the middle fellow? Everything you use, the size of the bottle cap, the size of the bottle cap. Right. Pointer, everything.

When I say everything, every single thing that you are using in day to day life. Size of the handle. You go to train, go to public transport, handle is there, height, again, 5. 65, 5. 7 feet, right? It is for 90, 50 percentile. So, goes to the handle, goes Right. So in design, it's called non inclusive design. So technically, this is how traditionally we've been doing.

Why? Because these are extremes, right? The remaining 5%, right, those people, [00:24:00] they are at the extremes. So there is no way. Or, it's like when you buy a shirt, small, medium, large, XL, XXL, that. I cannot build an electronic product like that, right? That becomes too cumbersome. So, what do I do? I built for the 95th person there.

So what are we doing? We have stakeholders. Some of them consciously I am going to let go. Right? Now, what would be a better solution? It would be better if I can make it 100, I can make it for the entire thing. There are certain designs which can do that. Designs which can adapt. What is adaptation?

Dynamically, I can actually change. Let's say I, I turn a screw and this will go and shrink. That's If I make a model like that, everybody can use it, but that complicates the design, right. So if I have a design that can morph, that can adapt, right, in other words, a design that has complexity. Yes or no? What did we discuss about complexity in the previous classes?

Any design, depending on the demographic, who, whom are [00:25:00] you using, right, to quote me, to just, just to their hands, right. If I can change the width and breadth, somehow. Right. Okay. Don't worry how, I am somehow doing it. Then which means, I am fulfilling the requirements, the needs. I am fulfilling the needs of all my stakeholders.

But that design needlessly complicates, right, needlessly not complicates, has complication, which I am forcing other users to buy. This fellow will sit in the 95th panel and be like, why should I suffer because of you? Right? So rather, what would be another way, right. You go with something like small, medium, large, right.

You classify based on that, right. That is why phones come in different sizes, right. Some people, they want smaller phones. Every phone you see, any model, right, there is pro, there is, what is the thing man, right. They have max, pro, max, right, different names they have. Why? Because somebody will prefer a small, they will have smaller handsets.

I need a smaller display, right? Google recently 9, 9 Pro, ah? [00:26:00] They have the same size screen, right? Because someone like me, I want a smaller screen, but I want a powerful processor. I don't want to buy a bigger phone, right? So you understand? Always remember my phones, your applications, your websites. So, I don't know if it is connected.

I can show you a fantastic thing. No, it won't work. The network is not there. The disk is dead, guys. N05 is not there at all. You cleaned it. No. It's not smelling like coffee anymore. Right?

So And you will read the text. I had a handyman doing this for us. Because I already say what I know. Just read this quickly. Guys, quickly read this, this picture. [00:27:00] Right? This is something we don't realize, right? What did you read first? This one. You will read this first, and then you will read this. Then this one, and you will read this last.

Yes or no? Yes or no? Almost 90 percent of the time? Yes or no? Designer, Has an intent. So all the websites you view, you may not be thinking about it. This is UIUX. It's a beautiful area, right? I mean, actually specialize. Specialize in this space. So, so here I have a contrasting background. Font is big, bold.

Immediately, right? This is there at the first. I don't see that. I see this. I'm done with this. I should have gone here. No. Then V says, then this contrast still predominates, right? Then contrast is there. This has got the least contrast and it's got the smallest font, right? So Amazon flip card, whenever you go, whatever they want to sell, they'll, they'll use strategy.

You have to pay money for that. The product which is featured there, which will grab your attention. You have to pay extra money and that which is not, we'll end up like [00:28:00] that. It'll be just in front of your eyes. Why am I talking this? So it is like, when I talk about stakeholders, there are multiple stakeholders with multiple needs.

There is no way I can fulfill all the needs of all the stakeholders. So what I do, I draw boundary. What is the boundary? I say there are 10 stakeholders, but for the, well, for the sake of me building a product or a service, what am I going to do? I'm going to look at the, the most three important. In other words, like this, 90, 50%.

I look at this. So, this

is what diagnosis is all about, right. We have done something and we are going to make an inference. When you go to a doctor, what does he do first? He put a stethoscope and say, breathe. So, what does he do? He is trying to ascertain, he is trying to judge based on your symptoms. We have to, so discovery matrix has got lot of these [00:29:00] symptoms, right.

It is showing you lot of things. You have to know how to look into it, right. We will see how to look into it. Right. So, this, let me quickly recap, right. So, this you are all very familiar with this term, right. Fuzzy front end. We said, when you start making a product, right, when you try to address a problem with a solution, initially you have no idea, right.

Last guy, second last, is it correct? No. Right? So, you have no idea exactly when you start, so you go all over the place. And, right, so you have an idea, right, but you don't know where to start. Right, anyone, any of you, how many of you in some, some club? How many of you are participating in Smart India Hackathon SIH?

Many of you are doing that, right? When you start, right, do you know, before I'll write, where to start? No, right, yes or no? You don't know where to start, yes or no? Correct? Let's say, I'll start with something even familiar. You are preparing for JEE, man. Where do you start? [00:30:00] I don't know. Should I study mathematics?

Should I study physics? Which is important? I don't know. Chemistry is important. Somebody said organic chemistry is important. I don't know. I'm all over the place, yes or no? You'll be reading this. Your friend will No, no, no. This year they will focus here. Okay, this, right this, or no, you're going all over the place.

So in other words, after a while, guys, listen. Right? After a while what happens, right? You, you'll get some clarity and say for me, okay, this subject, not something, I cannot shine it. Let me keep it a science. It's gonna come for two mark and let it go. Okay, I am going to focus on the magic number, right?

There are certain, yes or no, nobody reads the entire JEE syllabus, right? Nobody, right? Probably the only the topper one might have, right? The 95th percentile of students who prepare for JEE would actually prepare for the 95th percentile of the syllabus. So you can put it that way. Right. So, that is how you generally prepare.

Right. Don't go back to your JEE days and just, [00:31:00] uh, unintentionally provoke a few nostalgia. Right. So, right. So, think about it that way. When you start, right, you don't know where to start. It's all over the place. That's, that's what we call fuzzy fronting. From there, you get an idea and then you start building, right?

Now, you hit a limit here, right? This is called pre chasm phase, right? There is a dip. What is that dip? Sir, I have an idea. Think about it this way. Guys, listen. Last benches, listen. Right? Sir, I have an idea. What is the idea? Imagine this is not there. I am only stuck with this. There is not even a projector.

How inefficient it will be. I have to write everything. I have to sit and draw this. That is going to take time. Right? So, having a slide is saving me. Time, like 10 x or 20 x, what will take me 20 minutes? I'm delivering it 20 seconds by showing this. That's it. I have to physically sit on drop. Right? So, but this projector, right?

The idea of you having somebody [00:32:00] thought of it, right? How did they get to this? Mm-Hmm. It is a very non-linear journey. What is a nonlinear journey? Right? Last warning, guys, if I see somebody, I ask you. It is not my intention to do that but, wake up your friend. What is the problem? I will go wash your face and come.

Mahesh, when you are home and then uh,

right. So, there is a dip. Why does that dip happen? Right. Let us, let us, let us address that. Right. Let us see why does that happen? How to come out of this. Right. So, when you start, you are going all over the place. Right? And then you actually start piecing the puzzle together. Right? You start working on a solution.

What happens to the solution? Right? You don't know where to manufacture it. I have a solution, sir. I am able to 3D print it. Now I have to mass manufacture. I have no idea. Right? So this is where an incubator, right, that comes in. Right? So it will [00:33:00] start up still with challenges in this stage. Right? I don't have funding.

I have a beautiful idea. Right? Idea is, teaching I am going to make it better. So my idea is, I am going to connect computers presentation. It will, it will project. That's my idea. Let's say, 3D printing. Right. What comes up with that idea? First, they're making the first LC product. That's their idea, right?

With that being the case, to build this, it'll cost a couple of millions of dollars of research and all that. Who's gonna fund them? Where will they source all the conce, right? They have put all this together as our right, so an incubator will healthier, right? So, so once it is, you come out of that stage.

Once you do the investment, remember 60% of the more than 60% of the commitment, remember the second class, second, third class values speak about is committed here. So this is what is called, this is [00:34:00] what is called a point of intersection, okay. Now, another recap right, understanding self, identifying an area of interest, seeking collaboration and negotiating problem of interest, this you have done right, hopefully right.

Next, observing, listening and discovering more about the problem and its context, historical, social, economic, technological trends. Right In a non-judgmental way, as a neutral observer, right? I may like physics, I may like chemistry, right? But without having a parent bias, how can I best give a observer standpoint, right?

So that's this all. Now we have something called solutions based and problems based, right? What is the difference, right? So you can actually go from solution to problem. You say, you can say, okay, sir, I know. I know rf. Yeah. I know RF, right? Okay. What can you do with RF? I can transfer data. Okay. That is a technology.

Right? Remember, business. So you go from science to [00:35:00] technology, technology to product, product to society. Always remember that. Right. This is one way I have some scientific principle, can be anything, but I have a visual electric crystal. I compress the crystal and makes charge. That's a principle. But if I can take that and build a MIMS based ator out of it, I can measure the orientation of a device.

Okay, fine. Then what? Then that I can use it in a cell phone to know whether it is in landscape or code. Right now it becomes a product Now that. I am giving to the society, right? It can go that way. But the inverse can also happen. What is, right? This is bottom up, right? We will do the top down. There is a problem somewhere.

Then, take the printer's example. Every time I have to go, draw it on the board. How can I speed that process? That's the problem space. Right? Then, for that, then somebody is sitting and observing over. If you are teaching, you have this problem. What can I do to make your life easier? To speed up? Think [00:36:00] about the mic, right?

Otherwise, I have to shout. Right? It's a three hour lecture. I can barely get by. For the third hour, I'm talking. So, I am pretty much exhausted. So, how do I, how do I make my life easy? Right, anything and everything I use has gone through all this. Right, I am just showing you the pattern which you normally don't get to see.

Right, so, point is, you can go either way. Problem to solution or solution to problem. But what is best to actually go from problem to solution. Because, the fit, what we call fit FIT, right. For this problem, You This solution will be ideal, right? You use the right tools and your approach will be fine, right?

That's what generally we suggested, right? So again, this is another recap, right? So typically I said most Indian companies do not start with discovery or diagnosis. Why take cards? Suzuki has a collaboration with Multi as a collaboration with Suzuki, right? What do they do? Your MA 800 is a rebrand at Japanese direction.

Right. So they take a car, Japanese car. Swift is an international car actually. [00:37:00] Swift. Right. Maruti Swift. You go to Europe, it is the same Swift. Right. Just that the quality will be a little bit better. They will put a slightly thicker metal plate. Safety system will be a little bit better. Right. And then, they do some cost, cost cutting.

Right. And then they sell it here. Now the thing is, if I am operating in that mode. Right. Then I do not really ask the question, who is my customer? Indian fellow. What, what is that customer want? What is this? Right. Uh, financial position. What is that he's willing to spend and what are the other things he's looking for?

If I'm asking that question, I'm, I'm going to discover diversity. Right? If I'm really asking that question, I'm is called new product development, NPT. If I'm doing NPT, which is new product development, right, I start with a typical life cycle, right? The lifecycle, I start here. Then I do a diagnosis, ok. This is what my customer wants.

Let me like piece together the puzzle. 10 of my customers want this. 10 of my customers want sedan. 10 of my customers want a hatchback. Right? Another 10 want [00:38:00] this. What SUV? What should I pick? Right. That is more of a diagnosis, right. Then you actually go design, manufacture, close it. Right. You keep going.

And then you see arrows going from each, any stage to any other stage you will find arrow. What does it mean? I discover a problem. I get to diagnosis. I can actually go back to discovery. Why? Diagnosis reveals, maybe my discovery matrix is ill conceived. It is not proper. I have to go redo it. If for instance, let us go back to t.

Finally, right, you come to the realization. Okay. The cup peanut, you keep the tea matters. If that is the inference you come to, that comes out high. mm-Hmm, , then that is against common sense, right? Yes or no? Right? Generally you're taking tea, yeah. You look at the TLA or the cup, right? But if will you base your vision based on that?

Obviously not, right? But if you are, inference ends up saying that it's against inclusion, it's against common knowledge, right? Then you go back right after you do the diagnosis, you go back to a discre. We messed up something [00:39:00] here. Let's leave it. And after repeated thing, right? If you end up right, then probably it is important.

Probably then you are not, right? That is why you have these groups also. After diagnosis, you go to design. You realize something, right? You are coming now, man. Uh, right? So after you design, right? You go back to diagnosis, right? After design, you go back to discovery also, right? So it is iterative, it's iterative, right?

So you can go from any phase to any phase, right? Sometimes, right, this example I gave you last week itself. Apple invested in a car, Apple car. They spent like 20, 30 billions of dollars on that, right? Which means they went to the design phase. It went from diagnosis, they went here. They didn't manufacture it.

They made a couple of prototypes and then somehow they said, let's grab the idea. right, they felt right, maybe it's not worth it, we spend some money, right? Let's not persecute any formula, right? Just grab the idea and let it persecute, right? So, understand this group. If you are doing new product development, if you are writing a software from scratch, [00:40:00] Right.

IRCTC website is there. Every one year, two years, right? They, they revamp the website, right? They keep changing it. Why? Somebody will write a custom script, book all the tickets. Now it's very difficult, right? You can't book more than 5, 6 tickets. It blocks you. If I'm logged in at 9. 50, all of us have this experience.

It says, alright, log you out exactly at 10. Right, you have to keep clicking it, making it active. Right, make, make sure the server understands. Probably, let's say I want to book one ticket. Right. 10 o'clock, server is overloaded, I cannot log in. Right? What do I do? I log in at 9. 50, just keep scrolling, visiting different parts of the website, and then keep praying.

Right? So, you do this. Now the point is, there are also these agents, brokers, right, who have custom scripts, take them, they'll get money, get a commission, they'll book all the tickets. How do I stop? They are also, I put CAPTCHA, all the things I do. They have a custom script that can recognize it in autofill also.

Which means I have to go back and redo that. Right? That is this cycle. That is not [00:41:00] discovery or diagnosis. I am revamping. I am doing a incremental change to my website. Right? These days what is happening? You have multi factor authentication. Ok, first it sends a message to your phone. Right? Guys, everybody is sleeping.

Like people who I, whom I know are like, uh, You heard a story? Even that makes like energy, you know. What happened today? Everybody is sleeping. He is drifting off, he is drifting off, she is drifting off, everybody is drifting off. Sir, I am not, sir. Huh? No, you drifted. Sir! You didn't realize you drifted. I just saw it.

So, guys, listen, I'm getting the exact same, guys, if you listen, I'll tell you a story. I'm just thinking what story to [00:42:00] tell. Okay. My design experience at data. Okay. How about discovery diagnosis, right? So the company I used to work for is listen, right? Again, this is hardware. Now, please don't complain. Is giving other example, because I worked with hardware all my life, right?

Very little software. I worked in my life, right? Most of what I've done is all electronics and mechanical things, me things, right? That's what I bulk of my life. I spent that very little coding on that, right? So, right. So. There are two things I'll talk about. Guys, listen. Okay. I'll show a video. Maybe this will be interesting.

I'll show you my PhD work. Guys, listen.

Guys, listen. Okay, it's an interesting work, right? Most of you are sleeping. Just to get your attention, let's take 2 3 [00:43:00] minutes. Let's take a detour. I will talk about again discovery, diagnosis, how I did this here. Back then, okay, see somebody talking, right, back then I did not have a formal introduction to all these systems here, I did not know that, right, but intuitively certain things, right, whatever is required, I did that, right, I'll, each of the step I'll explain, okay, fine.

Do I have your attention? Yes, sir. Yes, sir. You said hardly anyone. Do I have your attention? Yes, sir. Others are still sleeping. Okay, right. So, so, first, right, I will explain my Ph. D. work right, different stages. What do you mean? First day I go, right, I join and then I have to go pick an advisor. I go, there is a process who, who you want to be a guide, right, you given list and then the team picks up and say this is your guide.

Okay. I go meet him [00:44:00] and then say, sir, what should I do? What is my problem statement? PhD? I want to next five years, four to five years, I have to work on something. What is it you want me to work on? He said, surgical robotics. Surgical robotics. I have no idea what this is. Okay. He said, I said, I have no idea, sir.

I have no idea what this is. He said, you have to go read. Okay sir, I'll go read two days. You come, come and meet me. After two days I went. Again, I went to Google, right? That's back then, right? I'm talking 2010, 2011, right? I just went to Google, right? Whatever I can. Made a two page report, went and met him.

Said, now what do I do? You're giving me a generalized overview. I want you to make a tele operator.

So, what is this stereo operation, what, all right, again, go read, read, read, read, read. What am I doing? Right. I was given a problem statement saying surgical robotics. So, FFE, I [00:45:00] have no idea. I am going all over the place. What? Three months? Three months? So, I will be doing a little bit of a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a Again, it was, uh, funded by the government, right?

So, their trust was, you make a system that is similar to an American system, right? What is the American system? Okay. And I'll show you the working. Then you'll, you'll get to understand, right? Guys, only for you, I'm taking a detour. And even if you're not listening, I'll close and go back to Right. You want me to do that?

Again, even that is very low energy. Right. You understand? So, that, that, that is where I start. I have no idea I am going all over the place. [00:46:00] Right. Now then, I was not even allowed to touch the robot, the system which I am planning, trying to build. Right. Because why? It will work on patients. If I ruin it, they say it will go.

You cannot touch it, you can only view it. Okay? Right? So I am just looking, taking pictures. Okay? Reading whatever papers I can find, papers, uh, that is published, right? It's like, uh, look at the picture, figure out things. I cannot, I have not even touched the system, right? No idea, no feel. Doctor, he will describe it to me.

It will feel like this. It's like I'm seeing, I myself am not allowed to touch it. And I have to interpret through his hands. And I'm like, okay, this is how it will feel. Fine. If you hold a tissue, he will say, if you're cutting, right, your cornea, when they do transplant, right, your cornea is removed. So it is like, imagine doing this.

All of you can do suturing. How many of you can do button, man? Can you just teach a button? All of you can do it, right? So, um, If I ask you to suture butter, can you do it? [00:47:00] I give you a button and a piece of butter. Amul butter I give you. And I ask you, can you suture a button? Impossible, right? You suture, what will happen?

It will just come off. That is what a doctor is doing. When they take a cornea from a donor, when they put it on a patient, that is literally what he is doing. He said, Karthik, it will feel like suturing butter. You have no idea how difficult it is. Like, what the hell, right? So So, I am going to give you a little bit of a, a, a, a, a, a, a, a, a, a, a, a, a, a, Right?

Let's see it! He says, right, normally it will take me 10 years to get, develop the skill to a level where I can do it without feeling I will ruin them. Because if I ruin, it's not just [00:48:00] money. Somebody died, somebody donated, and I will ruin the guy who's receiving the thing also. Right? There's a lot at stake.

Lot at stake. Stakeholder. Right? Imagine. So, that being the case, right, I have to be exceptionally trained as a doctor to do this surgery. And it is going to take a lot of training. Where do I practice? I have to do the surgery. I have to do the surgery. Right, right. To get trained to do something like something as sensitive, as precise.

Right? Now, all of you do one thing. Take your pen, take your pen, hold your pen. I'm going to give you a constraint. What is the constraint? You cannot move your wrist. That is the constraint. I repeat, hold your pen as you normally hold. Okay? When you write, write. This is not allowed. This is not allowed. Okay?

This movement is not allowed. This is not allowed. Fix. You can use your, you can use your elbow, you can use your shoulder. Write your name [00:49:00] in caps. Do it now. Easy. You cannot move this. Right? This you are not allowed to do. Write your name in capital. Okay. Not even running man. Try it. How difficult it is? Can anyone do it?

Sir, we can move our fingers. You cannot move your fingers. Fingers also. No. Try writing. No, write it on your notebook. Oh, easy on you. Right on there. It doesn't even look like your own handwriting, right? It looks like somebody wrote it. Yes or no? Right? Or write A, B, C, D. Try that. It feels very difficult.

Difficult, right? Yes or no? You can write, man. See, the point is, I know you can write, but does it look like you're handwriting? No, right? Looks like somebody wrote it, right? Right? You can write Bhargav as written, but write Bhargav[00:50:00]

As you normally write,

that's this B and this B to this A. That's the point I'm trying to make. Right? So, now why did I ask you to do this? Okay. I gave you a constraint, but within this constraint, Now you write your name normally, just below what you wrote. So Bhargava wrote Bhargava, and he wrote Bhargava as he would normally.

It looks like two separate people, right? Not to mock you, just as an example. If I'm writing Karthik, right? Yes or no? So that's why often when I write, right, I put caps. Why? One thing is, right, here I cannot support, right? So my hand is freely floating. So caps makes life easier. That's why often you'll find I use capital letters when I write.

Right? Guys, listen. Again, right? Now, why did I give you this exercise? If I am [00:51:00] doing surgery, Okay, now we looked at I. You have to understand man, you have to understand constraints, what is alterable, right? This is a constraint. How is this a constraint? Right? You can ask this question. Sir, how is this a constraint?

Imagine doing this. You are doing this writing and all this. Okay? Now I put a hole in your stomach. If you have to, if you have to do surgery. Okay? Now through a tool, I'll show the video. Okay? That will make sense when you see the video. I have to write. With a stick. With a, imagine a chopstick. I have to, I have put a chopstick and then I have to write at the tip of the chopstick.

You understand? It's like suturing a button. Imagine you have a shirt in your belly. I have to suture a button. How difficult it will be? You get, get some idea? Now that's a constraint, right? Which means you lose this degree of freedom. I can't use it because it's outside, right? Everybody's following, right, what I'm saying?

So you lose dexterity. We call this [00:52:00] dexterity. You lose dexterity, right? That's a constraint. You have lost dexterity. That is something I cannot change. Okay. Now that's a constraint. What is that I can alter? My design I can alter. Right. What is that I can do in my design? So I said, OK. You have a chopstick.

OK. Now, in my design, what I did? OK. This chopstick inside, there is no way I am writing. Right. So, I did a old paper. What that fellow said? Move this inside. This, you keep it inside. Here, at the tip. So, you have a wrist. Make a artificial wrist inside the tip of the book. Now, you put it. You have the constraint, but you have an alterable.

What did I say? Parameter, event, that can be changed. Right? So I am changing that. I am changing the design. Right? So, that dexterity I get. Get the idea? Everybody is following? I will show you the actual video. It will make more sense. Right? Now, fine. Now, what has happened? My wrist, whenever I do this, there is a chota wrist, micro wrist we call it.

Whenever I do this, [00:53:00] what will it do? If I do this, it is like this.

Anything I do here, this is where the copy, right? So typically that's what you do with your computer mouse. What you do, you move the mouse, your pointer falls, right? So we call this steady operation. You understand? Matt? Did this idea come from So in design, right, what you have to do, we look for other fields for inspiration.

What is this other field for inspiration First is, so far you're all fine with me. Now, if I have to start the system from scratch, wake your friend up, wash your face and come man. Yes, you. Then why are you lying down? Right, if I have to start from scratch, I do not want to reinvent the wheel. So what I do is, look for an analogy.

What is an analogy? I said, right? Having a unified mathematical model, remember that slide where we compared water flow to traffic flow? Here I am giving you another example.[00:54:00]

Nuclear reactor, what is inside a nuclear reactor? You have U 235, uranium, right? Which is a fissile material, right? Which is radioactive. So, you put it behind a, put it behind what? Shield. You put it behind a lead shield, right? It's a very thick wall, right? So, radiation doesn't come into you. So, you put it behind a lead shield.

Now, uranium is there. I am outside, I am safe. How do I move it? Yes or no? So you have a cable operated system, right? I have some, some master here. I move this. I have a mechanical manipulator that will move that thing. Whatever I do here, that will do. Right? This idea is 50, 60 years old. It's not new. Got it?

So we call this. Why do you think I do here? That's going to replicate. So this is an inspiration. Look to another area. Now, slowly from fuzzy front end, I'm getting some clarity. This was almost a year. You understand? So what did I start with? I was given a problem statement. I didn't know [00:55:00] what to do. And I also was told the constraint.

Who are the stakeholders? What are the needs? Stakeholder we saw there. Yeah. Right patients and the doctor and the coupon manufacturer who make all this fine so far, fine. Next I have to do this. Now I'm given a constraint. I have to overcome the constraint. Constraint is a constraint. There's no right. You cannot give, guys, listen, guys, listen.

Last batch. You cannot give excuse for constraint. You cannot say, say, that's a constraints that I'm not able to do. No, you have to work around the constraint. Constraint is still there. Infrastructure constraint is still there. Bandwidth is a constraint. I want a HD video. Google meet you too. I need a full HD video.

Yes or no? It gives you a beautiful video. But you got a 10 Mbps connection or a 5 Mbps connection. It still works, right? How is he able to do that? Somehow he is compressing, right? And he has also keep, compensate for latency. Right? He is doing all that, right? Maybe there are a few packet losses he is compensating for that.

Right? So much he is [00:56:00] doing. Right? Suddenly there is a 10 packets drop. Right? Suddenly you will see people moving very fast. Yes or no? So. There are a lot of compensatory methods, right, that any right online tool uses to compensate for this lags, right. So I repeat, when you start, you start with a problem, not the solution, take the problem and you start ideating and you look at multiple concepts and this is where you will have very fuzzy, you will not, you will not know where to go and you are given a budget, financial budget and you are given a lot of physical constraints, this is what we call as constraint And there are certain things which you can change, those we call alterables, right?

And we have stakeholders and we have needs, right? So far clear? Now this, I've given you the background, let's, it's a big video, right? I'm just going to run through it, quickly show you the

Okay, so, right? I told you, right? So anything This is the input device, this is like a mouse, [00:57:00] it's a 3D mouse. Anything I move in space, right? It will track my hand Whether it is bent like this It's went like this, left, right? How are my fingers? I'm returning all the movements, right? 60 degrees of freedom.

It'll track it. Space. So, right. So that's the thing, right? So you can see, so all that, you've got a lot of wires, right? There are a lot of encoders here, right? So on and so forth, right? So it's, it's, you can track my hand in 3D space, right? So this is the, this is what is called the slave system. So you have a master, which is your computer mouse.

That's the 3D mouse I was talking about, right? The manipulator, the input device. Then I have a slave which will actually replicate whatever I am doing. If I go to the left, that fellow will go to the left. Right? It will keep tracking my hand. Ok. So, right? Specifics alone I am not going. I spoke about the wrist, right?

Try writing, right? So, this will actually restore some of the wrist, right? So, this is how we actually work around the constraint, right? So, I will quickly run through it. So, here actually, right? So, I am moving. Can you [00:58:00] see it? Here? I am moving my hand, you see? And it is also moving. Ok. Okay. In real time. Okay.

So whatever I'm doing, it's actually tracking my hand movement. Okay. So you can see, okay. All the tiny movement it's doing, right. You can see here, can you see this? Okay. So you see, right. Okay. Whatever I'm doing right. The movement I'm doing right. It's actually tracking the hand, my hand movement, very precisely.

Okay, got it. Right. So what is interesting? Right. So, this, right, you saw. What you saw was my hand movement and that thing was replicating. So, this is, this small actually. It has to go into your belly, it has to go into your eye, heart, everything. Now, when you make a system like this, right, I will come back to, story I promised I gave you the story, now we will come back to it.

Okay. What we are discussing at hand.[00:59:00]

Right? So, here, think about this system. You do discovery, then you do diagnosis. What is diagnosis? Okay. Who are my stakeholders? Okay. For instance, right? My stakeholders are patients. What sort of patients? Patient can anyone be in neurosurgery? This cannot do neurosurgery. That stakeholder This robot cannot move at that accuracy.

Not good enough, right? It will be like micrometer accuracy, right? This cannot do. Chuck, chuck that thing over there. I can't. This system, not in my benefit. I'm drawing the boundary. Abdominal surgery, yes. Gastrointestinal surgery, yes. Right? 1 or 2 mm accuracy, right? It can do. Fine. That's my, one of my customer.

Next, heart surgery, yes, I can do. What about, uh, intestine? May not be the right choice for this. You understand? So there are, even in patients, let me say, eh? Right. Somebody who needs surgery. Right. Within that, I [01:00:00] have to do, define a subdomain. Got it? Even when you are building a software, let's say Windows.

Windows is making Windows 12. Right. They cannot oversimplify it to a level where a 5 year old can use it. They can do that, yes or no? Put, like, this big start button. They can do that, right? What's stopping you? But that's not my intent. My intent is, A business professional and somebody who's a Even elderly who wants to send them I'll simplify it enough, right?

Everybody has a need. A child, a 5 year old child, I need some interesting Bugs Bunny musics. All these a kid will ask. I cannot put all that here. So, I'm I am trying to actually see, who I'm building my product for. Understand. That's the important question you have to ask. I have multiple stakeholders with multiple needs.

Right. Now I have to ask the question, who are my stakeholders? And I cannot fulfill all of their needs. Impossible. Nobody can do that. Which means I have to let go of a few stakeholders and let it go off. Even of those stakeholders that I, that I'm building my service for, some of them [01:01:00] I have to let go.

Understood? So, this clarity, right, is what you will do in the diagnosis stage. Understood? Fine? Right? That closes the loop. Right? So, what are the aspects to probe in the discovery matrix? Right? What is the real system of interest? Where am I focusing? Right, that's the question I'm asking. Then what are its unique characteristics, context, and constraints.

Constraints, we just spoke in detail about constraints. Right? Context, where is it used? Right? What are the high level part relations that can drive holistic change? Which means, which is the most critical load? We spoke about critical load in the last class, right? If I touch this, everything else is going to get fault or good, good thing or a bad thing?

In your phone, which is the critical component? If I ask that question, what will be the answer? Is it the battery? No. Is it the SOC? No da, everything is important. Is it your camera? Everything is important. Is it your display? Everything is important. He's saying everything is important, then which is, no meaning.

We have to have a hierarchy. That's the whole point. [01:02:00] See, that's the whole point. You cannot say everything is important. It's like in team making, what did we say? We said process is the most important thing. If I said everything, where do I innovate? That's the key point here. What is the real system of interest?

Somebody says battery, somebody says SOC, right? I will agree with you to a large extent. Yeah, the processor matters a lot. If you have a dumb processor, right, camera will suffer, phone quality will suffer, web browsing will suffer, pretty much it will impact everything. If you have a bad battery, still the life of the, the durability is bad.

But still it is usable. Phone is still usable. I might have to charge it often. You understand? So you cannot say everything is important. Waterproofing. Is it important? Yes. But most phones don't have it. If you buy a phone for 10, 000, no waterproofing. Buy it for 20, 000, probably it has it. You understand, even phones that are priced at one lakh will not have some features which a ten lakh, uh, ten thousand rupee phone will have.

What are they? Can somebody think of it? IR blaster. Exactly. Huh? [01:03:00] Audio socket, maybe a 3. 5mm jack. Huh? 3. 5mm jack. 3. 5mm? Right, yes or no? Buy a Samsung S24 Ultra. Doesn't have a IR blaster, right? But a ten thousand rupees, your Xiaomi will have. Right. So, right. So, you have to really ask this question. Right.

When you are making a website, when you are making a service, product, does not matter. Ask that question, stakeholder and promote further and define the boundary. Right. That is the important thing. Right. So, why do we do this? We can ask the question. Why are we concerned with this? It is only through a deeper understanding of the problem situation that you can define the problem in a creative way.

Right. So, how do you frame? Right. What is the design challenge I have? Sir, I have a budget of, probably, right, 10 lakh rupees. I have a team of 10 engineers. Guys, listen! I have a lot of memory. I have a lot of memory. So I have got a, what are you guys discussing man? Stand up. See I am shouting here like a mad man.

Right? I can barely shout. Please stand up. [01:04:00] What were you discussing with him? What were you discussing man?

Get out man. I have to ask you to leave. Cut their attendance, ask them to leave. Please make a note of it. Please leave the class. Say, I'm treating you as an adult. Right, ma? So what are your names? No, no. I saw you guys talk. Please leave. Right? I've gave you multiple ones. Please leave. No, no. I don't want any swearing.

No excuse, right. What's your name?

Sit down. I.

See, it's tiring, right? I actually spent, right, last time I took [01:05:00] this class was in last September. I said to us, I'm eating my lunch, I'm preparing notes. Right? All the examples are, it's not spontaneous. Some of it is spontaneous. Yes. Right. Maybe the story I told you I didn't plan. Right. That example, my worker that I didn't plan to do.

But then if you, this is the sort of participation review. I don't know what you said, right? So please come here, try talking nonstop for three hours. You understand how this, I already have, I've developed a knee problem, not even that over. So the question is, what is a design challenge? Right? So that's the question we are trying to answer, right?

Another five minutes I'll take, then I'll let you go for a break. Okay. So that's the question we are asking. Okay. So important thing, right? What do you see? So this during COVID, right? So we gave this exercise to students. So the question, the challenge we gave them was go photograph. So the class was happening at four Photograph any drink, any beverage you are drinking right now.[01:06:00]

So students took and made a collage, right? There is one, uh, student, right? That fellow put all the photos together. Now, if I give you this picture, what information do you get? Any idea? Last game? Drinks. You have beverages, lot of beverages, okay? What do you see? You have to be louder man, different cups, okay, louder, louder, I can barely hear you, no, cup and saucer, cup and saucer, that's what it is, cup and saucer, what is that, he is there, okay, then, hey bro, what is that, what do you see, that's random, that's Nothing.

What do you see, man? Tell me what you see. Okay. You're telling me the same thing. Anybody see anything different, sir? [01:07:00] Okay. It's all milk based. Okay. Nice. What's your roll number? Nine 60 I 65 1 0 6 5. Sir, only one picture with actual milk, sir. Okay. Unflavored milk? Yes. Can you put it that way? Yes. Okay. What else do you see?

Now, think about it this way. See, data analytics, right? The reason I am showing this, right, might sound superficial on its surface. This is data. You are given a lot of data. See, anybody who has done serious data crunching, what is the most difficult thing in data, data processing? Any idea? Parsing. Huh?

Parsing. He is saying parsing. No, even previous step. You have to clean the data. Cleaning the data. Okay. I have to clean the data. That is the, nobody, it is difficult to automate that process. Okay. I have to clean the data, right? That's the most difficult. Somebody has to manually set. It will take hours or even days.

When you have like millions of data points. Imagine, this is a class of 60. If I ask you for the NTN, it's 2000 cups. How can [01:08:00] anyone process that? Right? Look at the size of the data, right? So, If I ask that question, right, somebody is asking, what should we do in beverage market, right? If PepsiCo is asking this question, if they get this answer, right, what?

Nothing. I don't know what to do. Yes or no? This gives me information. People are saying different things. They are saying, okay, coffee, sir, milk, sir. And then I see, like, lot of cups. That's it. That's it. But can you get something, diagnosis, I'm talking about diagnosis. Can you get something out of it, some pattern can you see, I'll be giving you a clue.

Sir, you told 4. 30 p. m. At 4. 30 p. m., most of it is just coffee, tea and Okay, okay, okay. But look at the picture and tell me. Don't get into right. That sort of analysis. What I want is, this is your data. What can you infer from this? Can you see a pattern in this? Uh, yes. Okay. That's a good observation. What's your number?

[01:09:00] 5, 7 57.

Right? What's your name? What's your name? Shaul. Right? Shaul is correct. Right. So what is saying is said most of it is tea or coffee. Correct. Which is true. In fact, most of it is tea, right? Some of it is coffee. Okay. That is one pattern. Any other pattern? Do you see any other pattern? Yes. Huh? Color. Different colors, okay?

How can you classify, okay? Colors are there. Most of it is brown, you say? Sir, all the juices are in it. Okay, different shades, right? What's your number? I 36? 1036, what's your name? Most of it is in top. I cannot hear you, man. Umesh, right? So, Umesh is saying, sir I'm seeing new colours different shades rather, different shades I'm seeing.

Any other observation, yes. Applause More stuff is contained, hot drinks. Beautiful. Right, most of it is hot. What's the number? [01:10:00] Very good. Okay. Most of it is from South India. Is that what you're saying? Yeah. What's your number? 17. 17? Guys, listen, listen, listen. Okay. See, now you see, once I start asking these questions, this is diagnosis, right?

Yeah. Now imagine this is your discovery matrix, right. You have all this data. Initially when you see, you will be like, oh, I cannot make any sense of it. But now when I probe further, right, you are actually seeing some patterns. What is the pattern? He made a nice observation. What is your name? Priya. Priya?

Priya. So, Priyank is saying, sir, most of, right, all the cups, right, typically, right, mostly it's from Chennai, Bangalore, right, yes or no, mostly. Yeah, that makes sense, right, that's correct. Now, somebody's saying, sir, I see different shades. Somebody's saying, Shahul is saying, sir, there are only tea and coffee, predominantly.

This group is dominated by tea and coffee, [01:11:00] okay. Then what else do you see? Right? Yes. Ceramic or plastic? Ceramic or plastic, medium. He is talking about medium, yes.

Foam, foam. It has got foam, right? So, right, what is your number? Yes. I told bubbles to, I was about to say it's hot. How can you tell it's hot? I can make the bubbles. Right, so froth, right? So everything has got froth. Even without it being hot. You have already put, right? No. Already written, right? So. I can make the same thing without it being hot.

Guys, listen. Chris, right? Okay. So guys, listen. Now, we can classify, we can go on getting these insights, right? This is what getting an insight. But what makes sense if I am in the business of innovating, okay? He's saying, okay, it's got, right, what is it, froth, right? Something with froth, sir. Something that's got color, different shades.

Medium, somebody [01:12:00] said different cups, right? Somebody said, uh, right? It's only predominantly dominated by one particular beverage, right? I can go on, guys. Sir, I can go on classifying it like this, but, right? So this exercise we did in class, right? And then Students after a while, right, they spent one week and they started saying that it's okay.

This is all tea. This is non coffee. Right. This is coffee. Right. This cluster, right, it is some snacks is also there. Right. And somebody said, right, there is only milk and this probably looks like a juice. Right. Okay. This is like what? First level you can do. Then, can I get better data? He actually pointed, right, said time.

So that is what we did next. Right. We said morning, right, tea, coffee, beverage consumption. Right. So then we started doing this. Right. Students, they started classifying. What is the consumption of milk? Now this gives more perspective. If I am ITC, if I am, right, [01:13:00] in the business of what is called fast moving consumer goods, if I am making, right.

If I am Nestle, somebody who makes milk, if I am, uh, what is the company? Industrial Unilever, right. If I am Unilever, right, what am I making? I am making tea, coffee, right. So, so I am looking at this, right. Oh! South India this is the trend. North India may be different. If I go to East India, maybe it's got a different pattern, right?

So this region, tea sells well. This region, this particular coffee sells well. Right? I will have that market. How do I get that? Right? Just you start with this picture. You will get huge volumes of data. And then you have to sort through the data. You have to filter the data. Clean up the data. And then it looks like this.

Then can you make it better? That's the question we asked. Right? Can you make it better? Yes, what the next level the students did, said, who is my customer? Interns. Interns drink milk. Workers, right, tea. Supervisors drink non, non, uh, uh, [01:14:00] non tea, non coffee, right. Managers, upper management, non tea. Right? Again.

Right? I don't know what Dalgo is. Dalgona. Dalgona coffee. Right? It's a special premium coffee. Sir, in COVID that was very famous. Okay. Right? So that's why it's made in COVID. Okay. That's why it's there. Right? So, you see this, right? Now this gives me quantity, when it is consumed, who is consuming it, how much they are consuming it.

Right? All this data I have. Now, if I have to go, if somebody says, hey, I'm going to sell milk, I'll say, wait. This is your customer. Already there are three, four people are selling milk. And you are going to again sell milk. May not be a wise choice. Look at this orange box. Tea. Still market is huge. Maybe you can do something.

Or, milk only this fellow is selling. Even though quantity is low, competition is less. We can do better. Right, you can make all these informed decisions. Yes or no? Imagine doing this, right, for a software service. [01:15:00] Same thing, same data, for instance, right? I'll go back to IRCTC standard, all of you know, right?

Now, look at the principal rate that we saw, right? Where should I put the login button? What should be the color? Okay, who is my customer? What is their education level? How many tickets will they book? Right, all this, IRCD doesn't have a competitor. It is one service. Yes or no? You have to go the right way, there is only one, the government run service.

Now, in that, how do I make a good product? I am not going to compete against anybody. Now, the thing is, ok, I should make it, in a way, difficult for an algorithm. Right, now what are they doing? They are actually looking at the microjitter. Are you guys aware of it? When you move a mouse, Your hand, you cannot draw a straight line.

Impossible. When you move, right, because of your nervous system, you actually make micro vibrations. That Google tracks actually. The web page is tracking that movement. XY coordinates is constantly tracking, right, as you are moving, right. What is [01:16:00] happening? It knows, right, if you go from A to B without even having a capture, without having any fancy thing, just by, when you go click, sometimes, right, I was reading, you have all these fancy image, right, identify all the traffic lights, this is an age old problem, Google knows what is a traffic light.

But when you go to click a traffic light, there is a some disorder, there is some chaotic, there is a way human brain thinks. You will, if it is an algorithm, it will go like x, y, right? Yes or no? You will do in a random pattern. You will see the big light, small light. Now Google knows, okay, 95 percent of it is a human brain.

Right? Even algorithms, they are also making it better. They are also introducing some randomness there also. Right? Then you look at these microstutters. Again, somebody will program this. You have to defeat it, right? You have to somehow keep. Find the nuances, I was reading a paper, it says, at the elementary level, there are 6000 features my voice has, that can uniquely identify.

It's crazy, right? 6000 features, it's [01:17:00] not hundreds, it's not dozens, so many different features. Um, Uh, Transcript. Right. Now I am going to be trying. I think I should be saying transcript, some of you have gone through this already. So, I'll come back after break, right, then we'll go, we'll go deep into stack analysis.

So, time on my watch is 3. 17, let's get back into it in 10 minutes. 10 minutes, guys.[01:18:00]

Now, I will tell you all the important things. I cannot address all of you. How many times do I have to tell you? I'm not going to do it again. Are you listening to me now?[01:19:00]

See, first thing, I don't think you guys can You want to go out? Yeah, I need to get water also. How will you I'll go get the water then. Cold. Completely cold. Mine also. So I want to ease the process. That barrier you are breaking Hold up. I don't think you can reach it. Let's go. Go! Let's [01:20:00] go. Oh no.

Where are you going? Why? Why? Man,

man, man, man, man, man, man, man, man, man Candidate should be Ken, the academic. Yeah, I am completely hostile against him, he will do something. What's his name? Sir, he's my friend. I can't read it. Whose power bank is this? It's mine. Isn't it too big? How much is it? I don't know. 100 watts. Mr. Speed.[01:21:00]

In this process, what is a hiccup? What is important?

You can't do.[01:22:00]

If you have a ma, if you have a ma, like a talking phone, something, something. Okay. That is that city. And, uh, that is it. What is your problem? Mother, you start normalcy. Like a pet. Right? Like a pet. Like a pet. Like [01:23:00] a pet. Mmm, they got them.

That's

you. Look at the right here. May not even need. Then comes a repeated thing. Bro, can you fill mine also? Show me. I need to use the restroom. Ah, I see. Three? I was at ten. Yeah, man. Nice, nice. Can you play? What [01:24:00] is this game? What the freak, bro, how many How many confusions have you I don't know, bro. People are spamming.

We asked, they are asking, who told you about attendance? Priyank Jain. Sir asked, I was just thinking. Oh no, you also play COC. Will you take attendance or not? He is saying this. Raid 1 Village. That was it. Show me your I need rank. What, what did you say? Who said it? Bro, we asked if there would be attendance or not.

He said it. Bro, what? Now you started. No, no, no. Then? Okay, show me. Prove that you're a townhall fan. Now, uh, get, uh, raid this village. It was [01:25:00] a different idea. I was here. How would I know? No, no, raid this, raid one village and show me. I was in the third bench, he was in the first bench. Raid one village and I was talking to sir and asking why there was attendance.

Hey, what are people? Are you gay or what? Question tha. Rate one village bro. We don't have troops. Barbarians are there. Rate some Chinese guys villages. Isabella. Ahhhhhhhhhhhhhhhhh. Isabella. Isabella. Are you listening? Yes, I am. Why wouldn't I be? We just asked if you'd take attendance. We just asked. It's the same thing.

You know, you know, everyone knows. Then why are you asking me? I'm not asking. People are asking. What's wrong? What's wrong? What's [01:26:00] wrong? Even if I get it wrong, you still like it. This is Sabriya. This is not analog. Who? I copied it. This is analog.

Eight equal.

Really

what?

You can add me on Instagram. He's right. He's right. He's using Instagram. If he doesn't use it for 10, 000 minutes, why is he attacking? He'll lose. Your watch is on. It'll fall. It's on. The door is open. Bro, how many watts does the power bank have? How many mAh? [01:27:00] 25, 000. I don't know. 25 volts. Where? Stay away from Mr.

John Sufferish Jo Kali Bro, your team member is talking over there you've got to sit here Why are you wasting your time? He is not oure team Oh is he? Tell me about your team Who is in your team? Harit, Bhadresh, Adit, Bharat He left us. He left Santana too. Where did he go? He went to another team. No, to your team.

Oh, he left Santana too. He left Santana too? Santana wasn't there before. There were 6 people. There were 6 people, right? There were 6 people. He went to another team. There were 5 people. Who was the fifth?[01:28:00]

Yeah. Okay. What are we talking about? The next one. Yeah. Okay. Yeah. Okay. Yeah. Okay. [01:29:00] I think he's a restaurant. Students, settle down. Settle down like sediments. Students, settle down. Settle down like sediments with decantation.

Scoot.

Wake up your neighbor. Wake up our neighbors. Right? Do you guys never sleep in the night? No, sir. No, sir. Yes or no? Yes, sir. Nobody goes to bed on time, right? One o'clock, two o'clock, or four o'clock? Two o'clock. What do you guys do till two? Huh? Playing video games, [01:30:00] huh? Huh? Design, sir. Design? No, sir. Anyway.

Thank you. I don't think we give you that many assignments, man. Come on, I give you two assignments, man. We just do it, uh, do it at night, no? Why? Late at what do you do? Uh, evening? Huh? After six, man. After five. Five to twelve, six hour work, man. What do you do? Huh? We are in one lab, Danton, sir. We are in one lab.

Our lab is in six. We don't talk. We don't talk. We have to go to mess. We have to play some sports. See, you have something. Commute takes half the time. Commute takes half the time, uh. We have actually a smaller campus. Yeah. So, you think this is big? Our institute is extremely small. Wake your friend up. So, guys, quick recap, right?

So, last one and a half hours, what I have been trying to tell you is this, right? Quick summary. Any new product development you start with? Discovery. and then diagnosis. Discovery, we learned how to construct a discovery [01:31:00] matrix and prioritize, right, arrive at a hierarchy of, what is important, where should I focus to innovate, got it?

Next, today we are in the diagnosis phase, where I gave a couple of examples, where what I am trying to do is Right. Grow further into the problem understanding. Exactly right. What is that I want? Right. One of your friends, right? Right. I will use their example, right? For the benefit of the whole class, they said, sir, we want to build an app, right?

To do health monitoring. Psychological health monitoring, right? So this is what I said. Do a stakeholder consultation, go talk to the stakeholder. Who are the stakeholders, right? Obviously they're right. The counselors. People who specialize in that field, right? Then patients themselves, you can actually ask the other way also, but that'll be difficult to write, right?

That's why I said, and as an outcome, okay? They came with the, they showed me a list of observation, right? I said, you go ask a farmer, guys, listen. [01:32:00] You go ask a farmer, right? So if you go ask a farmer, right? Uh, what is that? What is your problem That fellow say? No water sir, no subsidies sir, no fertilizers are difficult, you will get a hundred different problems.

You go ask a computer programmer, what are your problems, AC is not working, it is too hot, right. Hundred different problems. But the point is, what is my area of interest? I cannot solve all your problems, right. I can take probably one or two of your problems and look for a technical solution, right. So, that is the motivation, right?

So, point of interest, right? Where are you channelizing? Where are you zooming in? Right? Now, we just took, right, the importance of, what is happening? How is it? I think it is

PowerPoint doing that. I do not know. It is Adobe. Yeah.

[01:33:00] So, this is what happens when you force a solution. Right? It is a good feature, right? It automatically gives you a summary and all that. That is fine. But now see I cannot even turn it off. Right? Maybe you can. Guys sit here. Guys repeat after me. Important thing, right? This is a fantastic example. See, yesterday, okay, guys listen, yesterday an interesting thing happened, right?

I was in the discussion room D2, okay. I was in the discussion room D2, suddenly, okay, there was a student who was obviously presenting, we were, uh, right, assessing. It started zooming out and zooming out on its own. Then I told the student, why are you doing this, right. That fellow, he was having a point where he kept it down.

He said, I didn't do it. It was doing this for 5 minutes. Right. I actually got edit, like what is happening, right? Something is off. I went, I checked the keyboard, mouse. Everything is fine. [01:34:00] We kept everything away. It was erratic. There is no pattern, okay? It is not like it is doing it consistent. We exited the presentation, cut the meeting, tried everything.

Okay. It was doing it repeatedly for five minutes. It drove me mad suddenly. Then I thought, okay, something wrong with the display board itself. Must be, right? You know what finally caused the problem? Any idea? Huh? Water. Water and space. Actually, we saw the problem. All, all the professors sitting there, you were like, oh, this is interesting.

Any idea? We thought the display is malfunctioning. No, it was fine. We thought maybe something wrong with the presenter. No. Any idea why this is the case? Nothing wrong with the software. Any idea? Key might be stuck. Key might be stuck. I did check that. That was my first. In fact, that was my first thing I checked for.

Right. Is there something stuck on the keyboard. Was there some metal or something placed? Metal or something. We did check all that. There would have been water. Possible. Right. That is the first [01:35:00] thing. But its it is erratic. Right. Maybe there is a short circuit. Yeah, but if there was metal there also it would have been erratic.

If there is metal, nobody is moving anything. See it. Right? You know what finally happened? There was a fly, sitting on the board. That fellow was moving, ok, it was jumping from here to here, and it was doing touch. And this was actually moving the presentation, back and forth, doing all nonsense things, right?

Finally we saw the fly, and can you think for that? Right? It's a capacitive display. It was a fly that was moving this slide, zooming in, zooming out, doing all chaos. Right. And it drove me nuts for five, 10 minutes, right? I am trying to apply all the systems theory. I know, okay, like this, let us do it systematically.

Process of elimination, let's start, right? I, I, I inspected the presenter. Nothing, nothing solved. Everything failed. Okay? So this is what happens. Please understand, right? So I am telling you to think outside the box, right? I'm, I'm thinking, asking you to like, it never occurred to me. The source of the problem [01:36:00] is something that is not part of the system at all.

Right. I was thinking of air command and interference from somewhere. No. Nothing. It was a house fly. There was a fly that was causing all this chaos. No, it was a very valuable lesson. Right. You think, right, right, it makes you humble actually. Okay. I still have a lot to learn. Right. Reason is right.

Everybody fails. That is the point I am trying to make. Right. Problem, troubleshooting. Right. It might be funny. Right. But when you are actually sitting and trying to solve. Right. It is frustrating. And you cannot figure out what to do. It is like I have eliminated every variable possible, right. This variable, I am not even aware of the existence of this variable, right.

And then finally this guy, you know, it flies and then lands, there I see the problem, like okay. Finally I was actually happy, okay. The solution showed, it revealed itself, finally, right. So, understand, the reason I gave that example is, right, so environment, right, elements of the environment that can actually throw [01:37:00] your, right.

Okay. Calibrate everything off, right? So, so this is fine, right? We looked at, right, an assortment of a collage of right hot beverages, right? Most of it doesn't have fruit juices or anything of that sort. Then you look at classifying them into clusters. Then you look at patterns. Who is consuming at what time, how much, right?

Once I have that data, it'll actually help me a lot, right? So how to do diagnosis by analyzing the discovery metrics for patterns of relation. Right. So, there are three methods. Right. Specifically today I will focus on stakeholder analysis, feedback analysis we have already covered. Right. Last week we looked at positive feedback, negative feedback, right, recursion and all that.

Then we will look at network analysis in the coming weeks.

I am not getting moved. Okay.[01:38:00]

So, how can we leverage other disciplines to improve problem solving? Right. Discovery. What you studied in design history should be applied here. Sociology, right? When I say , your sociology, right? Your previous courses at diagnosis, right? Pretty much , right? Whatever you read in matrix theory, right? That comes in theory, right?

Business case, right? I need a business care for potentially innovative product, service or solution, right? What you are studying in economics, even economics, right? That can be, now, this is the important part, right? Design. Two, make a prototype, right? Forget about large scale manufacturing as a student, you'll make probably one prototype, right?

So if you're doing that, you know, data structures, algorithms, material science mechanisms, this is detailed design. This is not part of this course. Remember, detailed design is not part of this course. Retail design. You do it right in smart product design, right? In prototyping and testing and smart product design, you do it in your third year, right?

Because you, you still, you're still learning the tools. DSPI ask. [01:39:00] Probably you are doing the course. Now, if I ask data structures, probably your data course, right? So you may not have all the tools in your toolkit, right? So, right. So let's go. Okay. Right, so you understand the context. Okay, so what is happening?

This is a joke. So what is the bad saying before this goes too far? You really need some stakeholder input. So this guy is what is a hunter? He's to kill all the animals. The bad is coming into him. I am a stakeholder. Complexity is the result of interactions among stakeholders, right. So what is complexity?

What did we see here? We said good complexity, bad complexity. Now good complexity is the result of multiple nodes that are interconnected, right. So in this case we are saying those multiple nodes are stakeholders, right, and it is because of the result, because of the result of interaction among those stakeholders, right.

So several interest group can be present in a situation, customer views. Can be different from employer employees use. What [01:40:00] does it mean if Samsung is building a phone? Right? Or if the guy who's coding right, making a website, Amazon, right? That fellow will have some perception of what this is what I think the user will use.

It's like the ePRO, a fly pro, I told you. Right? So the decision itself probably would not have planned for that. Right? Maybe I can think of a board that says Fly push board. Right. My board is right, artificial data that recognizes that it's a file that's going same, that is something I'm not planning for, right?

So employee views, right? The person who's actually doing the design of the system, right? Their views can be different from the actual customer. How I, I'm going to use it, right? Department loves use. Me only can be internal perception. What does it mean if I'm part of a design team? What I understand, right?

Foreign. Right. Uh, look at modules. You say modules. Okay? No company can develop a software from scratch. [01:41:00] Your Microsoft Windows is a collection. Actually, what do they do? Security probably there. This cloud, this happen, right? All otherwise went down. So they were contracting it to somebody. So no. Which means that model is not developed by Microsoft.

They're buying it from somebody right now. That's something right is. Made out of internal perception, what Microsoft thinks is security. Right? Somebody messed up. Right? But since they don't have a complete view, right. Complete, what do they call Right? Transparency, right. To all the different ways that Google, right.

That's the internal perception, right. That may be different from, right. That will only give you part of the idea. You'll not, you'll never have the complete overview. Right. That's the problem with integrating. One of the problems with integrating is. So, I have, I have been, I have been investing in human being, in our nature.

And, the reason I [01:42:00] am doing this is that I want people to understand, I want people to Water venting. There is a seal that failed, right? It went to the microprocessor. It was shot, shoting, a few lights if finally cleaned it and saw the problem. Thing is that seal right that fell, buys it from somebody right after a while, right?

Being parked in the sun for so long, that seal gives up right now that see if our that designed and developed it. It's a different thing, but I cannot do everything I have to model. So, I am going to do a little bit of a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a Then you can see brake system is different.

[01:43:00] Engine control unit is different. Entertainment system is different. Lot of safety systems are there that is different, right? The condition system, hvac, they'll say so many subsystems are there. Everything has got a micro and that talks to every other micro, right? Wiring alone, an average car has got about five kilometers of wiring.

Can you understand how long a wire it is? If one wire gets cut, how they even locate where the failure is, right? So what is the point? So your complexities. It's the result of having so many things that talk to so many other things. Got it. And everything has got redundancy in a system like a car or a lift, right?

It's got so much of redundancy between what is redundancy? All of you have got a fiber optic care connection at home. Have you seen Right? You have two wires actually. If you see why, if one cable gets cut, which is likely because if fiber, optic fiber is glass, actually glass breaks when you pen it. So at least you laugh.

So, I will [01:44:00] show you one practical example. example of having a backup, right. Often what will happen, right, especially in automotive systems, right, when something goes bad, okay. For instance, your brake, what is called assistive brake, right, you press, how many of you can drive? Have you driven a car without a power steering?

Have you? How easy it will be? Next to impossible, right. If you want to feel how it feels, don't turn on the car, unlock the car, don't start the engine. Try rotating, it'll be super tight. Have you seen that? You can't even rotate it. People who have driven go kart will understand, right. No power steering. You have to rotate, right.

You have to struggle to move, right. Now that gives you control, but it is difficult. Your power steering, right, there is an electric motor or a hydraulic pump. That provides, makes it easier to turn. Now if nothing fails, what will you do? I can still steer the car. It'll be very hard. Right? So the systems are designed such that there is a redundancy within what is [01:45:00] redundancy?

What is, what is redundancy Failure in case of failure, that is a backup system that is running your operating system. For instance, you try go to task manager and try crashing randomly processing, because you'll not renew that certain processes. Even if you kill it, it'll actually reboot. Have you seen that?

Right. SVC host. You have seen exe. A lot of these processes. You try closing. Some of it will be system critical. It will not let you shut down. I have actually forced shut down. Right. It will restart. Sometimes it will consume a lot of memory. 300 shut this down. I do not even know what it is doing. Let me simply kill it.

It does not actually restart. Because it may be a critical process to run the system. You understand? So, all these you have to think. Right. And it is important to recognize constraints in a situation, right, we spoke about in depth, right, at the beginning of today's lecture, right. Then, and distinguish between constraints and alterables, solution options, right, alterables already I gave you a case study also at the beginning [01:46:00] of the lecture, right.

So again, formal definition, who is a stakeholder? A stakeholder can be an individual, they can be a group, right, or an agency who have a stake in the system itself. Right, and their, their needs have to be fulfilled by the system, right? Stakeholder, you have stakeholders needs, right? Either by choice or by obligation.

What is obligation? Trust, right through we have to do it. There's no other choice, right? Can somebody give an gimme an example where you have to fulfill needs of a stakeholder by obligation? Covid time, hospital beds. Think about a simple example. Is it choice or obligation? Sir, camera quality is a choice, but the functionality of a phone is to make calls.

Yeah. So that's a must. Obligation. Obligation. Think about a doctor. Water facility. Think about a hospital. Water facility. A patient goes, the doctor is obligated to, it's his [01:47:00] obligation, it's not a choice, right? He cannot say, I will, I will choose to save. He has to, that fellow has to put his life on the line actually, same thing.

So that's a Obligation, not a choice. Whereas if you go to a hotel and say, I'll give you a food if you don't like, you can go elsewhere, right? He may not be, he may not feel obligated enough to take much care, right? That's what I, not the other way how you are , right? So who are stakeholders, right? Those who will be affected by the product or service, right?

The solution, right? They may or may not have a role in the product solution formulation. This is often the case. Right. Most of the products, right? For instance, look at the website. I ask the website, who am I? I don't know anything about web, right? Use any software you want, right? However you want. I don't even know.

You are actually testing whether I'm a human being when I'm moving the most. It's being done internally on the backend. And so no. Right? So this is something that may not be, the stakeholder might not even participate. That's what That's what we are saying, right? We don't have a role. Over time, mismatches could [01:48:00] emerge between organizational and department objectives and their stakeholders.

This. Right? I'll give you an example. Okay. So needs other, the stakeholder, this already discuss meeting, right? So you have what is called business need and you have what is called user need, right? Business needs is what I have to, let's say phone. I have to make a phone. So user needs, I need a phone. In my phone, I need the following.

And the user is actually asking something which is not in the interest of the business, right? Something that doesn't actually make sense. The guy running the business, but it's a need the user is asking. So that's a area for conflict, right? , the fellow is my customer is asking. The user is asking, right? So need refers to the requirements of stakeholders, which are to be fulfilled by the system and focus, right?

Fundamental needs. What is the fundamental reason, fundamental reason why the stakeholders are associated with this system? Why am I buying a phone in the first place? Why am I going to a hospital? Why am I logging into a website? Right? Your [01:49:00] purpose, actually, fundamental needs, needs. is, what is the purpose of using a website?

Why do I go to google. com? Look for something. Right? You search for something. Right? So, why is the stakeholder, why do I even bother opening a website? Right? That is the reason. Right? Operational needs. Related to existing responsibilities of departments, operational needs arise due to changes in fundamental needs.

Right? Explore this more. Okay. Now comes the important thing. Right? So I will start with the definition of the term alterables. So we have SNAC, we have stakeholders, we have the needs of the stakeholders and you meet the needs of the stakeholders by changing a few parameters which I am calling them alterables with a certain constraint.

I repeat, if you have a product or a service, lot of stakeholders are there and those stakeholders, there are many of them and each of those stakeholders will have needs. Right. There may be a coherent need. There may be a non-coherent need. What he ask, what I ask may be different. Right. We look at the combination, [01:50:00] right.

And those needs, I as a designer have to meet those needs by changing a few alters with a certain constraint. Understood. Right? So this is how you have to define an objective. I will ask you to write out 20 to 25 objectives for your proud statement. Okay. Later on, we'll see how to do that. Right. So I'll give you a template to fulfill something.

Right to fulfill the needs of this particular stakeholder with this alterable within this constraint. That is how you have actually formulate your objective, right? That give you the temperature, right? So an alterable can be a parameter events, processes that can be controlled or alter, right? It can be a parameter or process, right?

That can be changed, right? To fulfill the needs. Troubles are different from alternatives. One, alterable can have multiple alternatives. Don't confuse these two. They're not able to change. So, what is the constraint? Constraint, right, actually is an alterable. Constraint is an alterable, but [01:51:00] time factor is what separates a constraint from an alterable.

I repeat, a constraint is actually an alterable with a huge timeline to change. Sir, it will take a, if you have to widen the road, I have to destroy all these, pull down all these buildings, have to reconstruct the road. I can't change it, right, but what will happen? I have to go compensate all these people.

It will take a lot of time, lot of money. So, what is the constraint? It is also an alterable, but what separates the constraint from an alterable? It is the time factor that separates constraints from an alterable. Right? Then, limitations imposed by factors that are not controllable by the subsystem at focus.

Carbide is an example, right? Waste management I just said, right? If you want to talk about waste management, right? Size of the road, the size of the truck, right? Right. The number of people that work for, for the system, right? These are all constraints with image. I have to operate, like I gave the example, this is a constraint.

I cannot move my arm when I'm doing surgery right now. Inside I go, I do something inside. I change the design to restore some of that lost right externality. [01:52:00] Okay? Now you have your discovery metrics, right? As part of this week's assignment, right? And this together, I give the assignment. But these will be two separate, but the assignments, right?

So first 10 days. I'll give you 10 days time, and then I'll give time till next, uh, Sunday. Okay? What is first Thursday? So yeah, I'll give time till next Sunday, right? So you have the discovery metrics, right? So you take the discovery metrics. Now remember Thet example, what did we see? We looked at patterns.

So we are going to look at patterns. What are we going to do here to categorize the elements? Categories, the element right? So, this is, this is identified from the problem description, right? Who are the stakeholders of your, of your problem? Who are they? What are their needs and what can be changed, what are the alterables in your system?

And what are the constraints you have, right? So we are going to pose, right, like this. You can put, you can actually take your discovery [01:53:00] matrix, right? There are 1 log 3 and 1 log 4 different categories, you can take log 4 all different setup. You can take log 3 log 4, you can go on to log 5 log 6, you can go on to log 6, you can go to log 7, you can go up to log 10, you can go to log 11, you can go to log 12, you What are the alterables within which right and what are the constraints within which I have to look.

Got it? So I repeat because the discovery matrix, we have to diagnose the discovery matrix. We are using snack analysis to do that, right. So first thing we have to do is categorize the elements of our discovery matrix, right, from your problem statement into four categories, right. Stakeholders, what are their needs and what are the alterables and what are the constraints.

Then, I am going to, Look at it this way. Who are the stakeholders, right? And what are the needs? What are [01:54:00] the needs? And what are the SI can effect to get those needs ment, uh, der those needs? And what are the BLEs and within what constraints I should operate, right? So I can do that, right? So this will be an as asset.

As asset for right? Develop a list of system objectives by combining needs. Right? All troubles and constraints, like so, right, I will get back to this point in the upcoming slide, right? So, you have discovery matrix, multiple elements, right? What are the elements? For T, what did we say? We said multiple things, what are they?

What is the first thing? Form, color, how do you write? Smell, flavor, right? I can go like that. Then medium context content, right? Context content, right? You can keep going. These are the multiple right elements. Now, those elements you take and you see out of those elements, who are the stakeholders? Yes. Means stakeholder one, stakeholder two, stakeholder three, so on and so forth.

You can go on doing. Then what are the needs? [01:55:00] Stakeholder one has these needs, sir. Stakeholder, uh, two has these needs. Three has these needs. You can list out. Right. Do that. Then, what are the all troubles for my system within my boundary, that is the important thing. I cannot go out of that. Right. Then you list that down.

Then what are the constraints, right? Constraints for the system in focus. Right. So, this is about waste management. So, we are talking about streets, street size and layout. Right. So, that is a constraint. Then, what are the resources I have? Right. In terms of money, right, in terms of people, so on and so forth.

Right. So you can look at it this way. What is the need of a a customer in this case, clean Street. How do I get Clean Street? I have to improve collection. Okay, so what is another big, there's no health asset, right? I don't get, I don't fall sick, so I have to improve collection. I have to spread disinfectant.

So there are two things I can change. I can increase the number of times I clean or I can effectively clean, then I can spray disinfectant. Those are all things I can change. Elements or parameters we say. Right? So [01:56:00] that will result in right either. Two, it's, it's, it's affecting, right? This alterable, A three and a one is, is affecting needs of the first stakeholder.

So you can map like that, right? Then what is the constraint I have? How do I improve collections, sir, right? If you ask me to go 10 times on the road, this molecule, do it right? So this is impacted by the street size and layout and spray disinfected. I don't have enough money, so I can only do maybe once a day.

Limited resource, I don't have a lot of money. Limited resource also affects. Right. You understand how this flows. So you can actually, this will give you a much deeper insight of your product. You can say, what is the constraint, right? That constraint is gonna impact my is would impact my need that internet is going affect my stakeholder.

Stakeholder, right? So you have to actually look at the boundary of the system, right? So we call this boundary analysis, right? What is the domain of interest? Waste Management. Okay? Waste management is your boundary. What is your problem of [01:57:00] specifically. Okay. Waste management, sir, in a household situation, in an industrial setting, or in a, in a community setting, or I am talking about waste management.

I am going to only talk about waste management that a student generates, maybe in a, in a classroom situation. Very focused. What are the wastes I will typically generate here? I am doing it. So, so if you look at it this way, right. What is my domain of interest? Now, it can also come from a different area.

Guys, listen. I can start with base management. I could have also said classroom, improving classroom situation. And, I could have also ended up with chalk piece. See, there are different paths I could have taken to get to the same problem, right? So, sometimes, when you define a domain, right, you will end up here.

From a different domain also I might have ended up here, right? So, here, what happens? I am now worried about this. So, this is what is called, a, a, a, a, a, a, a, a, a, a, a, a, [01:58:00] a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a, a I write it on a, but physically right I have to sit there.

I cannot physically move. So I have it, I do not use it, right? Maybe once if I have class, right, once or twice we have done it, right? It is definitely better. I prefer that. But something if I can hold it or if I can draw it, that will actually be helpful. You understand? So how innovation right, this is how it springs.

You have to focus on the problem, right? Wake up your friend, he stole it. Write next text, So, you have to focus on the problem at hand, right. So, just in a span of two minutes, right, I am, I am, I am looking at multiple different problems and possible solutions. Got it? [01:59:00] Right. So, this is very important. What is your domain of interest?

What is your problem of interest? Right. Focus here. Then, stakeholders and needs. Are they diverse? Are your stakeholders diverse? Are they conflicting? Or are they concentrated? Or is there an alignment? Right. I have 10 different needs and every stakeholder has the same need. Is this a source of tension or is it a good thing?

Let's see. Right? And which stakeholders are most critical? I just told you in the beginning, 95th percentile. Right? I started the lecture with 95th percentile. Right? Don't forget this. In all of probability, right, this is my favorite, uh, concept. Right? Everything follows normally. Distribution, pretty much. I mean, there are few things that doesn't follow it.

Most are the natural things, right? Follow this. So, which means I am going to focus on right critical stakeholders, right? If I lose that guy, my business is finished, right? If I don't focus, if I don't produce a product for that, right? What happened,[02:00:00]

right? So. If I, if, if I let go, right? If I let go of the critical stakeholder, right? Sometimes, right. There are certain features of your service, which you will never, which you will never sacrifice. Why for intensive call quality can afford affordable? No. If I buy a cheap phone, I expect that's the primary purpose.

So stakeholder, it's a communication device, right? Um, and I need to get the code, I need, I need to get the code. Who is the customer, who can be involved, this [02:01:00] is a critical question.

Right? Now, let's look at the four stakeholders and each of those stakeholders have their own need. Yeah, how many of you are frequently asked for the IP address in the chat. So, what is this? Here we go. So let me, I will go ahead. So what is that? Right. Because what this guy needs, right, might impact the other one.

So this is something, right, which is problematic. This is preferable. There are few stakeholders, right. Third, this permutation is ideal. Why? My stakeholders are few, but needs are many. If I fulfill this need, it's fulfilling both. Right. You see, any need I fulfill, naturally it is impacting many stakeholders, right.

So this [02:02:00] is possibility of alignment, right. Stakeholders with high degree, possible. So, this is how. And this is the um, uh, transcript. Similarly, for alterables, we looked at slack first to S and N, now let us look at A and C. So, let us look at A and C. So, alterables, check out degree and indegree of alterables.

So, like multiple needs, multiple alterables, diverse needs, rethink system boundary, if you end up like this. I will show you how to do it. This will tell you maybe you are trying, you are not focused enough, you have to zoom in a bit, right, that is what this tells you, right. This is preferable. Why is this preferable?

I impact one alterable. That impacts many needs, right, All troubles with high outagree are not negligible. Now this is actually, right, Needs with high indegree, [02:03:00] right, this needs a multiprobability approach, right, you need to use different disciplines, different principles to actually solve the fear level of the system, right.

Now constraints, right, are the unique aspects of the problem Unlimited chain, right, are constraints within the system or is it outside, or is it in the n 1 right that is my constraint. If it is in my system, it is easy to control. If it is in the environment, it is difficult. Right? Look at this, uh, fly problem I was telling you.

Nobody can build a screen that can, nobody even would have thought of it. That's a, that's a thing. If you see, right, that's, that's something, right? Most, most of us would not have thought of it. Identify those which have high out degrees. Right? Those constraints which have got high out degrees. Check if they affect high out degrees.

So, I am going to show you how to do that. probably around 15 to 20 objectives. Why? Just do this as an exercise. Next week I will tell you. Formulate objectives by combining needs, alterables and constraints. [02:04:00] And then, you have to write multiple objectives, write one by one. Right? To satisfy need of a stakeholder, by modifying an hiccup within the given constraint.

This is the template. You start filling. So I want to satisfy need of stakeholder 1, by modifying this hiccup, within constraint 1. Then I have to satisfy need of stakeholder 1 by modifying a different order, right, within this constraint. Then I have to satisfy need of stakeholder 2, like that you keep go on writing, you will have 20, 25, right.

Once all combinations are formed, refine and reduce the set of objectives. Right, to about 20 to 25 most important words. Analyze this objective set to see if it provides clues about purpose of the system, its unique aspects and critical success factors. If you write down all these objectives, it will naturally come to existential need, right?

Why should the system, why should, why am I even doing this? There should be some common, common thread, [02:05:00] right? So that tells you, right, why is, why are we even bothered with doing this, got it? Okay. So, deriving inferences, right? So, Again, right. This is standard thing. You cannot judge a, a fish by its ability to climate change, right?

The problem solver or designer should overcome the pus rare consent as an excuse to avoid understanding the unique characteristics of their clients, right? You cannot say, right, Sarah, I have this problem. I have this problem. The point is, right to actually have the constraint within that constraint.

Classic example I'll give you, if you go to where guys go buy clothes. What mall do you want to go to? The Chennai mall. The Chennai mall. You go, have you ever tried doing that or you get it from home? Uh, Mall? Go to a mall, okay. Mall is expensive okay? If you want reasonable quality you go to TNagar. Have you been to TNagar?

How many of you been to TNagar? Right. Some of you, right? [02:06:00] Not all of you. Right. So if you go there, what will you see? Insane crowd, right? Right. I will go at 2 o'clock. Guys, listen. Why do I go at 2 o'clock? Peak sun I will go. Fine? That is when there is least crowd. So I will go when there is peak sun. Right. I will not go on a Sunday.

So, I will try to go on a, ideally on a non working day, on a working day, if possible, right. So, the thing is, right, so, if you go to a place like that, right, look at the job of, right, the municipality. What is their job? To ensure public safety. Diwali time, Diwali is coming. What will happen? Everybody will go shopping, right.

The system has got certain capacity, right. That road probably can be Maybe five people can walk. Right? That's the width of the road. Many, many streets of Hussain Deir ez Zor are very poorly planned. Right? And there's a lot of encroachment also. So within that what is the police person trying to do? He will say, Ok from today to next one [02:07:00] month it will be one way.

You cannot come here, parking will be removed. So what are they trying to do? That constraint is there, road size is still there. But within that, right, how best can they do? Right, so that is this whole point all about. So similarly for you, right, let's talk about it this way. Let's take your phone. Okay? What is the constraint?

What are the key constraints of your phone? What is the constraint? If you want the best battery, phone with the best battery, what do you do? Put a motor battery, right? Put a 10, 000 mAh, 20, 000 mAh. People have done that. There is one phone by NRJ, said you don't have to charge it for 10 days. Something like that.

It's like a brick. Would you be happy carrying a brick? No. No. Then what do you do? That's a constraint. So you strike a balance between Strike a balance between? Performance and Performance. Performance I am unwilling to sacrifice. What do I do? [02:08:00] So he says innovation. How do I innovate? Who said innovation?

How do I innovate? How do I innovate, Chris? So what do I do? He is saying power banks. No, no. I will give you the phone. Within that system, that constraint, you operate. Externally, if you say I will power externally, I can go run it, run it. Right? That is the answer I was looking for. Right? So what you have to look for is, right, what does it take to compute it?

Right? For instance, right? I will give you the simplest of example. How many of you can find determinant of a matrix ratio m? Oh, come on, man. This is everybody's issue. You would have, without knowing this, you could not have come here. Right? 3x3, can you do? How long it will take? 3 minutes. Huh? 3 minutes. He's saying 3 minutes.

Right? It's not an easy thing. Right? Standard [02:09:00] method, but I have to do a lot of multiplication, addition, right? Okay. I will give you a 4 by 4 matrix. Can you find the determinant? 10 right? And most likely you will make a mistake also. Right? If I give you a 10 by 10 matrix. I won't make a mistake. Impossible, right?

Your phone, guys, listen. CS guys don't think about this. That is why this example often I bring it. Take your phone. Do you know how many dots are there on your screen? Any idea? Uh, Just multiply these numbers for me. 2005. 1990. Right, I am talking full HD, right? 1080, yes or no? That's laptop, no? Okay. So, your phone has got how many dots?

Multiply and tell me what is the number? What is this number? Somebody quickly tell me. Punch in those numbers and tell me what is the Right? 2 million, right? Right? 2 million. [02:10:00] So one picture consists of 2 million, right? And every dot actually has got a RCP. Right, red, blue, red, green, blue, sub pixel. So it is actually into 3.

So it is roughly 6 million separate thing. And it is not on or off. Depending on whether it is a 8 bit, 10 bit. Okay, it can be, it can be that way. Rightness for, for now. Okay, let's keep things simple. Let's forget about the sub, right? Forget about this even. This is the matrix. Yes or no? Yes. What is your refresh rate?

120. 60, let's take 60. So your phone has to update every single dot, 2 million into 60. Right? Correct? In a second, what is your phone? Chumma doing nothing. [02:11:00] Imagine the computation. Now can you appreciate what is going inside your phone? Sir, there, there are adaptive refresh rates. Wait, wait, wait, wait, wait, wait, wait.

I'm saying 60 hertz. Okay. If you want, I'll get there. So what is happening here? For your processor, look at the workload. What does that fellow has to do? This pixel, okay, he's crawling up. Oh, he's viewing a webpage. Okay. It has to see, Okay. Oh, fine. So now this picture is black. Let me turn it on. White. Got it?

This I am talking about a monochrome display. I have not even gotten into Uh, black and white display with varying grain levels. I'm talking about a monochrome display where I can turn it on or off. Right? If you have a high density display, this is how many times your screen has to update, on or off. Now we are talking levels of on or off.

Let's say 256, 2 power 8, 8 bit. It can be that many states. And in [02:12:00] 2, 3. You understand why your phone sucks so many power? And what is it doing? It is actually updating a matrix. Spatially. Temporally. You look at it temporarily. Right? Time wise. 0. 0 second. 0. 001 second. Ok. Updated. Next. So you can actually construct a 3D cube of a matrix.

000111. You understand? That is what your phone is doing. So, right. And this involves computing determinants. This involves inverting the matrix. Understand, all the linear algebra you are, you are learning actually is whenever you are watching a 4k video. Now, when I look at this, right, sometimes, right, if you actually study the numerical methods, if you understand, right, in the final moments if you study this problem, right, I mean, it is something, right, you really have to do it to fully appreciate the level of complexity that goes on, right, in terms of computation power, right, once you fully understand this, right.

[02:13:00] Now, what differentiates a bad processor and a good processor, right? You can do, you can find. So, this is where we are going to start. This is where mathematicians, right? They come into picture. What, what do they do? They sit and ask that question. Oh, you want to find determinant? This minor, right? Forget all this.

I have come up with a new method where you add these rows, multiply it, I can do it in half the computation. Different method of finding a determinant. Some mathematical guys figured it out. Which means what? By the strategy, by the algorithm to find itself has changed. Now what happens to battery life?

Goes better? I have not changed the hardware. Now you understand the role of CS engineer. To improve, right? Like this, right? We can go on, right? So many people have done all this. I am talking ten years back. So constantly, even now, they are, now they have AICT and figure out all this. Right? It used to be some guy who spent 30, 40 [02:14:00] years, right?

I have some of my friends, right? Who can compute 4 by 4 matrix determinant in their head. I cannot do that. I cannot do for a 3 bit. That fellow can. He will say LU decomposition. Have you heard of it? He will do it in his head. He will say, This is determinant. I am like, ah, chuma you are bluffing. Right? I have some of my friends who can do that, right?

Some crazy fellows who have, like, played with numbers all their life, right? Then you can appreciate, right? Maybe this guy is, like, 10 percent of Raman or something. I should not do that, right? You understand? So, get the point, right? So the point is, right, not just innovation, somebody said innovation, na? It is, what is innovation, right?

You can look at it from a hardware point, you can also look at it from a software point, right? And constantly looking at new algorithms, new ways of doing this, right? How can I do that? Got it? Sometimes, right, this is how your MPEG 4, right, look at all these containers, video containers, MPEG 4, uh, Uh, you are, what is the latest?

Uh, this thing? MP four. What is that? I forget. The [02:15:00] extension. HV I, efficiency, high efficiency video product, right? All this, right? It supports your 10 bit. Now they want a 10 bit from you, right? So all these crazy things is going on. That's why your phone hits up so much. It is doing so much matrix, multiplication.

All your processor is doing is. It is doing matrix multiplication. That is it. It is multiplying, multiplying and adding matrices. That is all you have to do. At the processor level, that is what it is doing, happening. And you have algorithms, right, that translate it and finally you will see it as an image.

The processor does not even understand it is an image. Got it clear? So, if I, what am I talking about? Constraint. So that is where a company like Apple excels. Why? They do the optimization. They'll say 2GB RAM. Right? Because they work at the kernel level. Android doesn't have the flexibility. Because Samsung will use it.

Huawei will use it. Right? There are thousands of manufacturers who will use the operating system. Which means You can see, this is a [02:16:00] script, this is a script, You can see, this is a script, this is a script, system. Which means. There are choices that Google makes, knowing well, for the sake, for the intention of having wide compatibility.

Understood? Apple shines, you'll say Apple is no. Apple has got fine control. He's making the hardware. He's writing the software. I can now do it. If you ask Android, right, say, at the kernel level, can you write for Samsung? You can do a beautiful job. But I cannot do it elsewhere. Right. If you go to the system level, right, a lot of optimization, still, right, even within that space, they are improving.

Yes or no? Right. So, that is the constraint space we are talking about, right. So, I read this again. Very important, right. Don't complain about problems. Often times, right, especially for CS engineers, there is a lot of revenue for you to actually add, right, improve battery life, right. Camera. Google has not updated their sensor for [02:17:00] the last 3 or 4 pixel X rays.

They are using the same sensor outcome. Right. Photos are getting better. Okay. Image process, right? Computation photography, right? Same sensor, but my warranty goes up with every subsequent you're sitting right on a night site. All the different things water is doing. Right? Again, not the medical , right?

Single processing. All. Right. Interactions with stakeholders and more fine grained observations of their everyday work can help questions. Right. Can help question the obvious and explore alternatives. Right. So, so this is the key thing. Right. This is more of an open ended work. Right. You can have your own view.

Right. So what I want is, right, please don't go. I will go post the assignment. Don't write, right, big, big stories. Right. Impossible. Right. You have 163, mechanical there is 105 or something. So we have 270 students roughly. Right. It is not possible for us to sit and spend hours on every assignment. I will probably spend 2 minutes, 3 minutes.

Right. Right? That's all I can spend. If I spend [02:18:00] three minutes for two hundred shorts, right? You can see I'm spending six hours, entire day, doing one assignment, right? Simply don't have the bandwidth. So you make my life easier. Give me all the information, right? Properly highlight, use illustrations, pictures, right?

Give a key thing, right? You, you have to, of course, I'm not saying don't refrain from writing, but don't write only stories, right? Makes our lives extremely find. So last thing, right? So case study. What is this case study, sir? Right? I have to give you some background so all of you know about all this male, uh, ships.

You have all these different ships, right. Now often you will see, when you guys go for a break in summer, what do they do? Right, they come and do servicing, this fan is not working, remove it, that light is gone, fused, change it, right, AC is not working, fix it. This table is broken. Fix it right. During breaks is when you can actually do any maintenance [02:19:00] activity.

What about the ship? Ship is always in the sea. Right? And I have to, I cannot just go perform repairs of a ship when it is in the sea. I have to bring it to what is called dry dock. What is I have to bring the ship, put it in a place. and then do a lock, put a door and drain all the water. Otherwise side and all, how can I go access.

It is inside the water. So, we have to, so what they call as a dry dock. Any maintenance activity, any what is called scheduled maintenance, right. It will rust. Sea water, right, salt will corrode everything, right. It will destroy everything. So, you have to paint the shoe. Bare minimum. You have to change a lot of spares.

So, when do they do it? Any idea? When can I do this? Different ship has to be in C all the time, right? Chinese ships are there, right? You have other, uh, ships that are constantly warming, so you need to keep your ship also floating. So when can, when will you get the opportunity to actually bring the ship to a dry dock, fix it, and then put it back into service?

Huh? Huh?

Nighttime's [02:20:00] thinking ship has like a scooter ship takes right? Several weeks to bring and then. It is not like night, I can bring fix and then pull it back, right? Typical time of service is like 2 to 3 months, please understand. That is how long it takes. If I have to take a ship, put it, repair and put it back, it is 2 to 3 months of down time.

Which means the Navy will not give all the ship all the time. They will keep some in service. So, I am going to show you how to do this. So, you can see that, you can see that, you can see that, you can see that, you can see Right? This, uh, we got it, right? So, I will just leave it in the slide. I'll just, quickly touch on key places, right, for you to understand.

[02:21:00] So, a SNACC analysis has been made for this. And the person who is doing it, you can say effectively, it is the same with the other guy. But the, but the, but the the reason, the reason for doing it is, is the, is the people who are doing it, the people who are doing it, the people who are doing it, there is So, I am going to talk about the, the, the, the, the, the, the, the, the, the, the, the, possible.

Alright, let is see. The best you can do is go to the A U M, A C U. If you go to A U M, A C U, right, go to the A U [02:22:00] M, A C U. It is The transcript that is the, I dicussed it in the class at the one minute also but I used I used the transcript What is the ting you are just looking at, The action file motioning?

This is the continuity issue Did I just shift into a dash mode? Yes, this is the Right. So non industrial workers, industrial workers, what do they want? Due consideration for experience. Higher responsibility for training. Right. Expect from younger service officers. This is something. This is one of their needs.

Right. This is where they said you have to clip certain needs, clip certain stakeholders. Right. So now we have, in SNAC we have stakeholders and needs listed. So this is how you have to list for your thing. Please understand. This is how I want to do it for your problem. Understood? Next.

Okay. All troubles. What are the all troubles? We [02:23:00] have a huge list of all this, right? Material planning. What is material planning? Okay, I will give you an idea. Okay, ship needs to be painted. So, I need thousands of litres of paint, not hundred, thousands of litres, which means this monsoon, right, Navy would have, uh, the, like the, sorry, the shipyard, it is in Mazangon, Dhaka, right?

So, it is near Bombay, right? So, they might have planned to do. Let us say 10 ships. Each ship needs probably 5, 000 litres of paint. If I have 10 ships I need 50, 000 litres of paint. I cannot just go and place an order. I have to plan what colour. It has to be again, uh, naval worthy, right? It is not random Asian paints, right?

You have to have something specially formulated for that. So, I need to plan and if I buy all paint at once, where will I keep it? 50, 000 litres is what? It will take up probably like 10 times this room, right? Probably I will buy it in Small patches. Patch 1. Initially I'll buy maybe 10, 000 litres. I'll finish 2 shoes.

[02:24:00] Then I'll place order for more. Which means, I have to plan. Ok. September 15th. I need 5, 000 litres. By September 30, I need another 5, 000 litres. Next, October 15, I need probably 10, 000 litres. I have three ships coming. Right? Which means, you understand, this is what is called supply chain management. You have a lot of supply, right?

I have to manage all this, right? So that is what material planning. I am just giving you an example of a paint. This will be bolt, wires, specific spares, so many things. Ok. Maintain database of past products and refit and material used. Right. These are the things I can change. I can change. I can buy 5000 liters today or I can buy 10, 000 liters.

That is what I can, I can change it. Right. So that is an alternative.

So, I can do it manually, I can do it, I can use automation also. Right. So, likewise, right, prelocation of people, facilities planning. We go through each and everything, right, budget, mode of appraisal, right, uh, quality guidelines, right, so on and so forth. These are the [02:25:00] things that can be changed. What are the constraints?

So, What are the constraints? Lack of documentation on foreign equipment and material. We buy equipment from Russia, from Israel, probably that fellow doesn't give you how to repair the ship. I have to sit and figure out. That's a constraint. That is something I cannot change. That's a, so understand, constraint I was referring to, physical constraint.

It can be in a different form also. Next. Actual material requirement not known till the opening of the equipment at dry dock. This is a big problem. Why? Right? Until I park the ship, I take out the water. I don't know what and all I need to change. I know I need to paint it, that much I know. I know a few seals would have gone, that I can keep stock.

Suddenly I realized, okay, this motor is gone. Now, uh, that motor, I have to come from Siemens, Germany. It'll take another two weeks, sir, or two months. I have only two months. Now I've parked the ship. Right? I don't have a spare. And, uh, I have to finish this, I have to send off this ship, not like night time I can fix, it doesn't work that way, right?

I have, I have one week or ten days or probably a month to fix this [02:26:00] ship. Then the next ship is in line. If I delay this, that is also getting delayed, okay? So, I cannot rush through, right? I have to meticulously plan, right? So, if you talk to people in L& T, right, in Chennai, one of my friends used to work.

Sunday night he'll be sitting and working like a madman, like, what are you doing? Tomorrow, it's delayed by two weeks. I am trying to figure out, right? Sometimes he himself used to travel, right? Get the component, physically drink it. Because if he put through DHL, sometimes they missed it. One component, they missed it.

So he had to go buy a spare. Why? Because of that one chota component, what will happen? Get a ship, I cannot move. So these, so if you talk to people there, they'll be in very high stress.

That is what is called the unstructured form of the system. So that is why we have created this mechanism, ok. [02:27:00] So this is the type of mechanism that we have created. No problem. Standard size. Now ship has got Right. Different, different components which has to be custom ordered. It is not like I can go change the battery.

Right. So it has got very specific thing which is actually imported from some other country. Probably we may not even, indigenously we may not even have the capability to do it. Right. You have to buy it from someone else. Right. Like this. There is so many. Look at the constraints. Fine. This is fine.

Everybody is following this. Right. Go through it in detail. After you do this. Right. So, you write down, right, sample system, right, this is sample system objectives, right, which means the, just, to abide, what did I say, to fulfill some, uh, customer who is my stakeholder, right, within, by changing some alterable and within a constraint, right, that is what, to abide by NHQ policy prevalence, right, [02:28:00] to improve flexibility in maintaining balance of forces.

So, I am going to show you how to do that, how to do that, how to do that, how to do Right. Then, you actually go for inference, see for a pattern in those objectives, ask the question, what is the purpose? Right. Once you see, right, banking of process, right, planning and production, it comes around to that.

Right. Most of it is, it might appear as physical work, but it is much more profound, much more implicit is, that is not openly stated, it is planning. This ship is going to come this day, from here to here it is there, it may need this many people, blah, blah, blah. Next ship is going to come on this day, and imagine, I need to keep some buffer.

Right. Suddenly something goes wrong. Some, uh, stand breaks. Hip goes to duck. Now I have to correct it, take it out, right, all these problems are there, so I need to leave some buffer also in between. It is like you studying for exam, I have 10 days, ok, I was playing video games, now I have 10 days, how do I prepare?

I have 6 exams, I do 2 days, now I need to relax also, maybe watch a movie in [02:29:00] between, ok, keep some buffer time, or if I am over stressed, right, I want to sleep also, right, you, that is how you plan, right, you keep buffer of 1 or 2 days, sometimes you will end up overshooting the buffer, right, which is what happens in actual also.

Sometimes, right, I am going to be doing that in a minute. Yeah. So, I will be talking about one of the most fascinating things that happens with the, planning, production and HR process, just these two. Okay. Indicating the critical and overall improvement. If I have to improve the efficiency of a dock, where should I focus first?

Two processes, planning and production. Human resources, right? I can talk about information system, quality, assurance, costing, and auditing. That's all fine, but if you have to improve the efficiency, if that is my broad objective, right? I have to touch these two things, right? So similarly for your product statement, right?[02:30:00]

You do the standard analysis. So I have given you a lot of examples and case studies also, right. Once you do this, you will not get it right, right. Don't worry about getting it right. The point is not to worry about getting it right. The point is to do something, it will actually open your brain, right. It will change your perspective.

That is the whole point. You may not even, you may even do it wrongly. Got it? You may not even do it correctly. But point is you, the very process of you doing it, it will change your perspective. will actually question, make you question things from a different perspective. Who is my stakeholder? Oh, I didn't even think about this fellow.

What are the alterables? You go back and, oh, I totally missed it, man. You understand? You can go back and say, oh, discovery matrix, it changes, sir. Sometimes what happens, one guy, after 9th class, he said, sir, can I change the discovery matrix? He's like, okay, you can change it. I totally missed an important point.

He went back, re did all the assignments. But it took him a day. It literally took him a day. Right? Then he re submitted everything. You understand? So that is also right. [02:31:00] Right? So, with that, right? So I wrap today's class. Right? Can somebody summarize it? Then we'll call it quits. Anybody give, you can give me a summary of today's class?

And mind you, today I'm going to post two assignments. Assignments three and four. Snack analysis and discovery matrix. So two big assignments I'm going to give you. Right? The reason I'm giving you together is, right, if you know this, right, you can go back and rework the discovery. Last time I gave it two separate assignments.

Right? So here you'll have the option to actually change it if you make a mistake. Right? So I'll give you time till next time. Sunday, right. Namaste. So, right, 10 days you take. Okay. So, let's see. Can somebody summarize it for me? I'll give you a mark. Today's course. Whatever we covered in class.

Not one volunteer. Yes. Don't say you talked about, right. So, what did we learn? What are the takeaways from today's class? [02:32:00] We have learned, uh, 95th percentile, what is the concept in that. And we No, no, no. Don't jump there. That's like So, so I spoke, I spoke about, right? Not being able to fulfill all the needs.

That's the important thing. 95th percentile is one way you can do that. Okay. Now this is the danger of teaching any So matrix, you saw, let us go over this first, beta square, 1, 2, 3, 4, 8, knock knock, is the This is one way to do it. I'm not saying it is THE way There is no THE way. There is no correct way.

Okay? Typically, it's like, guys listen. In a democracy, what do we strive for? Freedom. Democracy is like a system, right? This fellow will ask, I need a holiday on Saturday. I need four working days only and work, sir. Yes or no? I want to chill out, sir. Somebody will ask something else. I don't want to work at all.

I want government to give me money, 30, 000. Right? That will be some, somebody's stakeholder. [02:33:00] Somebody will say something. Now, what is the role of the government? Can you appreciate, right? There are 1. 4 billion people. We are asking 1. 4 billion things. That many stakeholders are there. And their needs are, they are varying.

How do I ensure convergence and coherency? Right? So, which means, I look at, okay, majority. What is majority? So, 95 percent is one place to start. It is not, right? So, what I meant is, Domain, fix your domain. Right. Stakeholder, right. High priority stakeholder. That's all I meant. Okay. Then, then we have learned, uh, who are the stakeholders and we have to find what are their needs and we have to see.

Snack analysis. Okay. Then, uh, we have to clear those needs maybe by using.[02:34:00]

Yes, sir. If it cannot be done in the shouting, then we have keep that as a constraint and we have, what I meant is right. What differentiates a constraint from an alterable? An alterable and constraint is differentiated. What is an alterable? It's a parameter or it's an event. Right. Which can be changed.

Which can be changed. You have the freedom to change. Here, what is the example, right? Look at the alterables. What are the alterables? Material planning. I can change. How I plan, I can change. Right? Relocation of people. This fellow, you go work in that department. I can change that. I have that freedom. What is the constraint?

Right? Non standard nature. Right? Tri dog facility. This is the size of the dog. I cannot put a ship bigger than this block. That is a constraint. You understand? So you do not define it. Constraint is there already. And within that constraint is what you try to work. Then? Right. [02:35:00] So,

Let me quickly summarize, two minutes then we will, we will, we will draft it. Okay. So, guys listen. What did we start today's lecture with? We started with moving from discovery to diagnosis. Right? So, here, specifically we saw, right, the life cycle of a product. Right? So, typically, right, when somebody wants to put something together, you have a dip.

And something like an incubator, right, we have made it here, who will spring it, help you financially, help you with the resources to actually build a prototype and take it to the market, right. So again, here we saw, right, how do you go from problem space to solution space or solution space to problem space and which is preferred?

Going from problem, always think about the problem first, then the solution, right. That will be more organic. is positive, but if you have many streaks, maybe it is just a random sequence on their bios, okay. It is possible that a lot or another sequence can be [02:36:00] of course, a, b, c, but if you have many streaks and, and between basic a and an cluster of streaks, right, that is something 65?

I 65.

So, what's your name? Nithyanand. Nithyanand. Right, so, Right, so, We took the example of D, right? If you are bombarded with data like this, it makes no sense. So what are we trying to do? We are trying to suggest, get more insight. How do you get more insight? You will try to look for patterns, right? How do we look for patterns, right?

You can classify them into different categories and when are they consumed, using time as a, another way to classify. Then looking at who takes that, right, that gives you much more insight, right? Then you are going to look for patterns. Similarly, right, your discovery matrix, right, you are going to probe much [02:37:00] further, right, look for these relationships, right.

Now, there are three methods, right, which is stakeholder analysis, feedback analysis, and network analysis. Now, for SNAC is concerned, specifically, right, right, so

SNAC is concerned, what is SNAC? Stakeholders needs vulnerable and constraints. Who are the stakeholders? They're individuals, groups, or agencies who are a stake the outcome of the system, right? So your need refers to requirement of the stakeholders, which are to be fulfilled by the system in focus, right?

Alter all troubles and constraints, right? So, and Alterable. Constraint is differentiated by time factor. Time factor is what separates the constraints from an algorithm. From something I cannot change in a small time. Given enough time and resources, I can change, it becomes a, it becomes a constraint. Okay.

If I give enough time and, okay, something I can change it, but I cannot do it now. So it is a constraint for now. Dock, right, size of the dock. [02:38:00] I can make it bigger, but I have to change a lot of things. For now it is a constraint, right, not the other way. Got it? Right? Okay. So you can see the, the, the, the, the, the, the, the, the, the, the, the, the transformation is happening.

And what are the alterables and what are the constraints, right? So then we saw different permutations that are possible, right? Then I said, use this statement to satisfy need of a stakeholder by modifying alterable within a given constraint. You have to construct probably 20 to 25 such objectives. This will give you the purpose of a stakeholder.

the function is going to be not in the right direction. Is it not? Is it not? Is it not? Is it not? Is it [02:39:00] not? Is it not? Is it not? Is it not? Is it not? That's it. So we should do the diagnosis first and then do the discovery. No, do the discovery first. How can you? It's like, I need a patient to do diagnosis.

Right? How can you do discovery if it is not there? How can Columbus discover America if America is not there? So, guys, so, uh, again, more confusion. Yeah. I do not know why the confusion came in the first place. Guys, listen. First, you have to construct the discovery matrix and you perform diagnosis on that.

You cannot do the other way. If I start the diagnosis, I have got nothing to diagnose. I need a patient to diagnose, right. He is asking, can I do ulta? How can you do ulta, right? That, that, that, that is not possible, right. So, first you construct the discovery matrix. Then, this is one method, network analysis I said, right.

There are other methods also, right. This is a very [02:40:00] powerful tool, right. So, any questions? So, let's meet next week, right? But make sure you submit the assignment, right? I'll give you 10 days time, start working on it today itself and go on post assignment. Okay, yes, sir. Will he come? Didn't you say he'll come?

Maybe. Maybe. Maybe. Maybe. Maybe. Because it is supposed to be on time for Monday.

I'm going to the cafe. I'm going to the cafe. I'm [02:41:00] going to the cafe. Why are you taking the bag?

I'm not attending. Okay, bro, go. I don't understand. Bro, he'll take attendance. You sit. [02:42:00] He'll take attendance. Tell me

I don't.

I'm going back. I'm going back too. Let's go, let's go. Let's go, let's go. Let's go, let's go. There's time to order here. Look at the boys, look at the boys. Octavio is your name, actually. No, actually I am using Nord's name. Is that our [02:43:00] class? Ya. Oh, wow. Ya. We have class, no? No, we have at 5. 5 to 5. Bye. No, no, you are the friends last day.

Ya, over. Sandhariya Mankar Sandhariya Mankar Sandhariya Sandhariya Tera Sandhariya Mankar Sandhariya Mankar Sandhariya Mankar Is the class over? Yes, bro Is it going on? There's another class Ok, let's go If he's here, he'll run away

Let's keep the bag outside. Attendance, bro. If Hemant comes, he'll take attendance. He took attendance in the morning. But that's a different kind of attendance. Hemant keeps the papers hidden. The papers are missing. The attendance is [02:44:00] missing. He hid the papers there. He hides the papers under the mic stand.

He takes out the attendance and puts it in his room. Did you cancel the class? No, bro. Going? Yeah. Bro, Sriyank mentioned it again. Cancel the class. Yeah, I have to cancel it for you. Not for me, it's for everyone. Neutral consensus. Okay.