IIT Madras

ONLINE DEGREE

Computational Thinking
Professor Madhavan Mukund
Department of Computer Science
Chennai Mathematical Institute
Professor G. Venkatesh
Indian Institute of Technology, Madras
Concept of class and its instance called object

Professor. Madhavan Mukund: So, last time we were discussing this idea of having encapsulation and these objects and doing our procedures in the context of these objects. So I think it is called object oriented. So, the procedures are inside the objects.

Professor. G. Venkatesh: inside the objects.

Professor. Madhavan Mukund: And we were also asking this question about what is the level at which we classify an object, is it collection of cards, is it is one card, and we said it depends on what we want.

Professor. G. Venkatesh: Context? This are they make sense only if…

Professor. Madhavan Mukund: If there is some structure and,….

Professor. G. Venkatesh: And lot of interesting things that we can do with that object.

Professor. Madhavan Mukund: Correct.

Professor. G. Venkatesh: Otherwise, it does not make sense.

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Professor. Madhavan Mukund: So, here we have our other datasets. So, here we have actually two natural collections. So, we have this trains and stations.

Professor. G. Venkatesh: Trains and stations. It can be an object. So, trains can be an object. These whole trains can be an object like a timetable of it. This is another stations object, so two objects.

Professor. Madhavan Mukund: And we also know that internally they kind of indirectly refer to each other.

Professor. G. Venkatesh: That they talk to each other? I do not know.

Professor. Madhavan Mukund: Yeah. So, no no I think the information that we have in the card.

Professor. G. Venkatesh: They are inside itself is that you are saying.

Professor. Madhavan Mukund: Yeah. So, we could ask some questions and see how they whether they need to ask each other. So, for instance, if first question we asked, I want to go from say,..

Professor. G. Venkatesh: Chennai to Bhubaneshwar I think.

Professor. Madhavan Mukund: Chennai to Bhubaneshwar or some place.

Professor. G. Venkatesh: Some

Professor. Madhavan Mukund: So, let us say supposing we wanted to say if the direct train from, let us say from Vijayawada to Bhubaneshwar, is there a direct train?

Professor. G. Venkatesh: So, whom do you ask that question? Is there how you have to think now?

Professor. Madhavan Mukund: Yeah. So now we have

Professor. G. Venkatesh: Everywhere else you just could take the problem as working, now we have to ask…

Professor. Madhavan Mukund: Bhubaneshwar to Vijayawada, so Bhubaneshwar is station, Vijayawada the station, so we can ask Bhubaneshwar station, can you, if I start from you will I get to Vijayawada or not?

Professor. G. Venkatesh: So, you are asking Bhubaneshwar station, but Bhubaneshwar is not a object?

Professor. Madhavan Mukund: It is not an object. So,…

Professor. G. Venkatesh: so, I

Professor. Madhavan Mukund: as a station object tell me, I am asking the stations, selections of stations, tell me whether…

Professor. G. Venkatesh: You are asking this fellow.

Professor. Madhavan Mukund: Tell me whether I can go directly from Bhubaneshwar to Vijayawada.

Professor. G. Venkatesh: So, giving in two stations and saying…

Professor. Madhavan Mukund: find me connection.

Professor. G. Venkatesh: So, this box is now going to do something, what is it going to do?

Professor. Madhavan Mukund: Well, obviously it has to look at one of these stations to be ….

Professor. G. Venkatesh: Should we go to trains or it can do it itself?

Professor. Madhavan Mukund: I think let us see, if I look at, so let us look at Bhubaneshwar, what, let us first obvious thing is to look at one of the stations.

Professor. G. Venkatesh: Here, what are you doing, Bhubaneshwar to Vijayawada?

Professor. Madhavan Mukund: Vijayawada. So, let us look at Bhubaneshwar.

Professor. G. Venkatesh: Bhubaneshwar, there is a train? I do not know. Find out.

Professor. Madhavan Mukund: Okay. Here is Bhubaneshwar. So, lets see. So, Bhubaneshwar…

Professor. G. Venkatesh: There are bunch of trains on this card.

Professor. Madhavan Mukund: So, if there is a direct train to Vijayawada, then maybe one of these…

Professor. G. Venkatesh: then we need to go and look at the trains.

Professor. Madhavan Mukund: Well, now think of Vijayawada. So, Vijayawada will also have a list of trains.

Professor. G. Venkatesh: Yeah, Could you take it out.

Professor. Madhavan Mukund: Yeah.

Professor. G. Venkatesh: Anyway, We are looking for direct trains, we do not need any other cards, correct?

Professor. Madhavan Mukund: Yeah.

Professor. G. Venkatesh: So, I have this other card which is Vijayawada.

Professor. Madhavan Mukund: Now, if there is a train which goes from here to there, it must appear in both these list because it departs in one place or leaves.

Professor. G. Venkatesh: True, that is correct. It should shown both cards. So, all we have to do is check whether it is a common train?

Professor. Madhavan Mukund: Yeah.

Professor. G. Venkatesh: Okay.

Professor. Madhavan Mukund: Maybe there is not. So, we have to check, so these 2201 is not there, 12281 is not there, we are close, we have 22, so here it is, so we have 2246.

Professor. G. Venkatesh: Is it there?

Professor. Madhavan Mukund: And we have 2246.

Professor. G. Venkatesh: so, that train 02246,

Professor. Madhavan Mukund: it leaves from Bhubaneshwar at 10 o' clock and then presumably it reaches Vijayawada at 10pm, 10:20 pm and in the reverse direction we have a train which leaves from 4:25 in the morning and here it reaches at 4:50 in the evening. So, roughly 12 hours.

Professor. G. Venkatesh: 12 hours it takes.

Professor. Madhavan Mukund: So, that is what, so basically this is happening inside that object.

Professor. G. Venkatesh: So, when you ask, so what have we done? We have taken this stations object, we told this guy tell me, we gave it two names of stations, these Bhubaneshwar and Vijayawada.

Professor. Madhavan Mukund: Yeah.

Professor. G. Venkatesh: And said hey, tell me whether or not I can go from Bhubaneshwar to…

Professor. Madhavan Mukund: Vijayawada without changing trains, in the same train.

Professor. G. Venkatesh: In the same train. So, what did he do inside, he looked inside. He did not have to go to trains.

Professor. Madhavan Mukund: Yes.

Professor. G. Venkatesh: He could find the answer from inside only.

Professor. Madhavan Mukund: Yeah. So, it could basically….

Professor. G. Venkatesh: Basically, he could find it here, he does not have to go to trains. O, within himself itself, he just looked inside Bhubaneshwar, the card he took the Bhubaneshwar card, took the Vijayawada card and he looked whether there is a common train?

Professor. Madhavan Mukund: Correct. He looked at this two lists of trains.

Professor. G. Venkatesh: And then he return back saying that, yes there is a train, if you are going from Bhubaneshwar to Vijayawada, take 02246 departing 10 o' clock and you will arrive at Vijayawada at 22:20 or something like that, yes?

Professor. Madhavan Mukund: Yeah.

Professor. G. Venkatesh: Smart. Okay. So, this is nice. Now question is can I ask that to the trains, same question?

Professor. Madhavan Mukund: Yeah. Of course, you can ask it, we can ask because but it will give you, it should give an answer and but that question if I ask the trains, can you do it without asking the stations?

Professor. Madhavan Mukund: Well, now of course, if there is a direct train, then the train that connects would have both the stations. So, let us do that.

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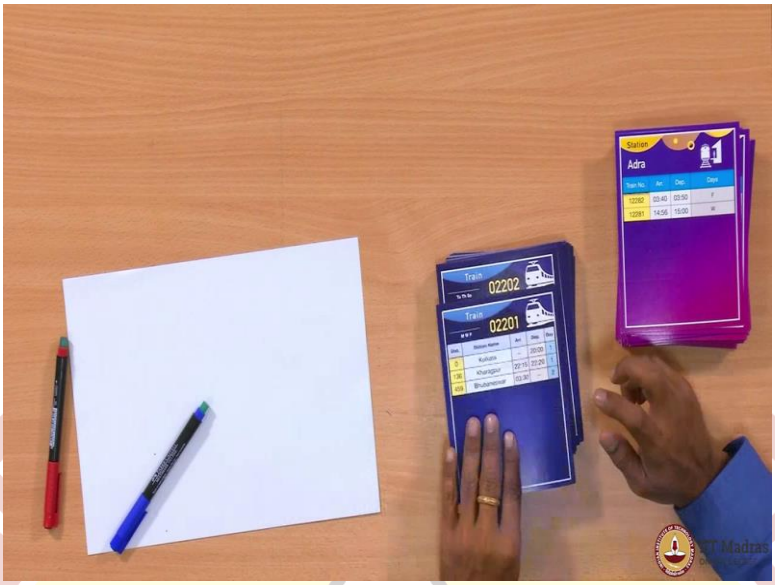

Professor. G. Venkatesh: Suppose I ask this guy tell me how to go from, is it possible to go from Bhubaneshwar to…

Professor. Madhavan Mukund: Vijayawada.

Professor. G. Venkatesh: How do I do that?

Professor. Madhavan Mukund: So, it will basically search for a train

Professor. Madhavan Mukund: I think right now it is no other option.

Professor. G. Venkatesh: So, this is more painful than that one.

Professor. Madhavan Mukund: Yes.

Professor. G. Venkatesh: That was fast.

Professor. Madhavan Mukund: Yeah.

Professor. G. Venkatesh: There I just took two cards and checked. Here,…

Professor. Madhavan Mukund: I have to keep looking at all the cards and of course if there is no train I will …

Professor. G. Venkatesh: So, I have to keep on looking. So, here is a Bhubaneshwar but it is going to Kolkata, that is why I have to keep looking every. Here also Bhubaneshwar, but this is going to Vijayawada.

Professor. Madhavan Mukund: So, fortunately it was early in the list but it could have been…

Professor. G. Venkatesh: it could have been later. So, I have to search all the cards till I find one card which has both Bhubaneshwar and Vijayawada.

Professor. Madhavan Mukund: Correct. So, this asking the train this question seems to take inefficient.

Professor. G. Venkatesh: Yeah.

Professor. Madhavan Mukund: But asking the stations these questions seem to be efficient.

Professor. G. Venkatesh: some questions the train will be more efficient presumably.

Professor. Madhavan Mukund: Yes. Like something which refers to train number, can I go using this train number,..

Professor. G. Venkatesh: then if I go there I have to search all the cards to find the train number, is not it?

Professor. Madhavan Mukund: Yes.

Professor. G. Venkatesh: So, depending on the question you have to decide where to ask this question because it is a question about stations, it is better to ask the station guy, no point asking train guy. I see okay.

Professor. Madhavan Mukund: So supposing I was in the Bhubaneshwar train and I ask where all can I go on this 02244

Professor. G. Venkatesh: 45.

Professor. Madhavan Mukund: Then it will be very painful for that guy to…

Professor. G. Venkatesh: Because I have to search all the cards for that.

Professor. Madhavan Mukund: And see where all this appears and then it will tell me all these stations appear on this card.

Professor. G. Venkatesh: But you can just simply ask the train, tell me where all you going?

Professor. Madhavan Mukund: Correct.

Professor. G. Venkatesh: One card only all answer will come out. So, depending on what you are doing, you may ask the right object, right? You may decide to ask the correct object?

Professor. Madhavan Mukund: And the answer may be easy to determine just from that object along.

Professor. G. Venkatesh: Or it may be go and ask someone.

Professor. Madhavan Mukund: Sometimes it may be better for that object to ask this object for some extra information and then refer it back. So, it depends so that is why we were saying that objects might call other objects and ask for information. So, if they feel that they need more information, they are free to ask, but it is the same way as anybody else asking. So, there will be some fixed procedures and they can call any of those procedures with the appropriate parameter and it will answer that question.

Professor. G. Venkatesh: So, this is nice I mean I like this business of these trains and stations. But one thing that I was just observing, train itself can it be a object?

Professor. Madhavan Mukund: Last time.

Professor. G. Venkatesh: Because train looks, it looks like object, it is a, one station is an object, I mean it look, but we may not I don't know what we will do there, but train is moving.

Professor. Madhavan Mukund: Yeah.

Professor. G. Venkatesh: This train thing moves?

Professor. Madhavan Mukund: Yeah. This train thing move.

Professor. G. Venkatesh: So, it looks like a nice thing to represent as an object.

Professor. Madhavan Mukund: Yeah. And but there is one more thing, right? So, there this train thing moves of course so in times, so at different times of the day it is a different places, but it also runs at different times of the week.

Professor. G. Venkatesh: What is that?

Professor. Madhavan Mukund: So, we have these Monday, Wednesday, Friday. So, the station is the station every day of the week, every day of the year station is station.

Professor. G. Venkatesh: This is for train or what is this?

Professor. Madhavan Mukund: So, this card…

Professor. G. Venkatesh: This card is not train.

Professor. Madhavan Mukund: Is not like say a student of a shop or something, a shopping bill.

Professor. G. Venkatesh: What is this?

Professor. Madhavan Mukund: So, this is actually like a it is like a template, it is like some kind of way of describing train.

Professor. G. Venkatesh: so the actual train, the physical train which runs from Kolkata let us say to Bhubaneshwar is running is actually the train which started on some one of these days?

Professor. Madhavan Mukund: It has to be one of these days.

Professor. G. Venkatesh: So, the Monday train…

Professor. Madhavan Mukund: is going to be going to say in this case Calcutta to Bhubaneshwar and then the Wednesday train….

Professor. G. Venkatesh: I do not know whether it is the same train.

Professor. Madhavan Mukund: It could be a different physical train.

Professor. G. Venkatesh: physical train running on Wednesday. This guy may have come back, we do not know about that. But in principle we have to assume that it could be a different.

Professor. Madhavan Mukund: Definitely.

Professor. G. Venkatesh: So, this card is not one train?

Professor. Madhavan Mukund: This is not one train.

Professor. G. Venkatesh: This is a template for..

Professor. Madhavan Mukund: It is a template for generating trains.

Professor. G. Venkatesh: You can generate, this one can generate 3 trains.

Professor. Madhavan Mukund: Yeah.

Professor. G. Venkatesh: One train on Monday, one on Wednesday, one on Friday.

Professor. Madhavan Mukund: Yeah.

Professor. G. Venkatesh: All of them go from Kolkata to Bhubaneshwar, same time and all?

Professor. Madhavan Mukund: Yeah. But on different days of the week.

Professor. G. Venkatesh: But on different days.

Professor. Madhavan Mukund: Yes.

Professor. G. Venkatesh: Yeah?

Professor. Madhavan Mukund: Yes.

Professor. G. Venkatesh: There could be more than one of them at any given point of time.

Professor. Madhavan Mukund: Yeah. So, here maybe they, you do not need it but they will be…

Professor. G. Venkatesh: The Monday guy may have died because Monday guy starts at…

Professor. Madhavan Mukund: Yeah. Because these are very short trains..

Professor. G. Venkatesh: He got alive on Monday at 8 o' clock and by Tuesday he reached.

Professor. Madhavan Mukund: But early, he reached early morning so probably the…

Professor. G. Venkatesh: By Tuesday he reached early and

Professor. Madhavan Mukund: And in fact if we look at the next train, the pairing train,

Professor. G. Venkatesh: But principle I will once he has reached the one assumes that train is dead.

Professor. Madhavan Mukund: That train is dead. So, the same physical so we are not into…

Professor. G. Venkatesh: Then another train becomes alive on Wednesday and then dies again on Thursday, another became alive on Friday and dies. So, this guy is a template for 3 trains, each of which live for a short period of time.

Professor. Madhavan Mukund: Yeah.

Professor. G. Venkatesh: Like this flies, they are alive for one day and they died, so like that. 8 to 3:30 it lives and then he dies.

Professor. Madhavan Mukund: Yeah.

Professor. G. Venkatesh: Are there any cards which can generate two living things at the same time?

Professor. Madhavan Mukund: Well, we should look for trains which say leave on….

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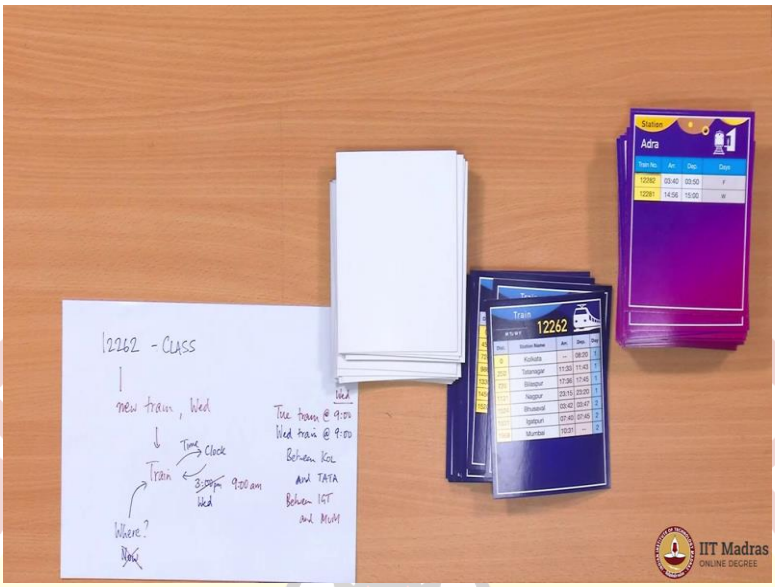

Professor. Madhavan Mukund: so, first of all let us look for trains which have long distances. So, and which kind of a frequent. …

Professor. G. Venkatesh: Multiple days or something,

Professor. Madhavan Mukund: Which have many days. So, I think if we go down and this Delhi.

Professor. G. Venkatesh: This is Delhi.

Professor. Madhavan Mukund: Calcutta, Mumbai, so this might work. Let us look at this one. So, this leaves on Monday, Tuesday and Wednesday from Kolkata.

Professor. G. Venkatesh: Okay.

Professor. Madhavan Mukund: And it takes so the Monday fellow is, it leaves at 8:20 in the morning and by the time it reaches Mumbai is 10:30 the next morning, so it is running for 26 hours.

Professor. G. Venkatesh: 26 hours.

Professor. Madhavan Mukund: So, clearly the train which left on Monday at 8:20 is not even in Mumbai,

Professor. G. Venkatesh: by that time another train has arrived.

Professor. Madhavan Mukund: The train, second trains, so it has to be a physical.

Professor. G. Venkatesh: dual train, physical different train.

Professor. Madhavan Mukund: Yeah. And similarly if Tuesday…

Professor. G. Venkatesh: They has to be different from Wednesday guy. Then Wednesday is different from we do not know. That we do not know.

Professor. Madhavan Mukund: that we do not know, but certainly…

Professor. G. Venkatesh: Monday is different from Tuesday that we know definitely. And Tuesday is different from Wednesday, we do not know whether Monday and Wednesday are the same. Physically, but we do not care.

Professor. Madhavan Mukund: Yeah.

Professor. G. Venkatesh: So, this guy is a template for 4 different trains.

Professor. Madhavan Mukund: trains.

Professor. G. Venkatesh: So, what do you call, I mean this is not a train.

Professor. Madhavan Mukund: Yeah.

Professor. G. Venkatesh: So, if we want to make this into an object, then it is not an object.

Professor. Madhavan Mukund: Yeah. You have to kind of, so, this is like a design for an object.

Professor. G. Venkatesh: This is like a template or design for an object.

Professor. Madhavan Mukund: Yeah.

Professor. G. Venkatesh: is there a name for this thing? So,

Professor. Madhavan Mukund: So, I think this template is like a it is represents a group of objects, a class of objects.

Professor. G. Venkatesh: Class.

Professor. Madhavan Mukund: So, I think sometimes we call it a class. So, it is not an object itself, but it is like a category of objects or a class of objects.

Professor. G. Venkatesh: So, it is a class, so this card if I want to represent it as an object, I cannot. Actually I have to represent this as a class or as a group or whatever it is in class which is a template for specific…

Professor. Madhavan Mukund: So, instances.

Professor. G. Venkatesh: instances.

Professor. Madhavan Mukund: So, let us say there is this class which is,

Professor. G. Venkatesh: so 12262 is a class now.

Professor. Madhavan Mukund: Yeah. 12262 has

Professor. G. Venkatesh: it is a class.

Professor. Madhavan Mukund: Yes.

Professor. G. Venkatesh: So, suppose I write 12262 is a class.

Professor. Madhavan Mukund: Yeah. Now, …

Professor. G. Venkatesh: Specifically what can I do with this class? Is there anything that I can do with this class?

Professor. Madhavan Mukund: Well, you can create an object of this class for example.

Professor. G. Venkatesh: We can ask this class for giving me train.

Professor. Madhavan Mukund: Yeah. You can tell it give me a train leaving on a Wednesday.

Professor. G. Venkatesh: On a Wednesday. So, you give, you tell this class, 12262 class you tell him give me a train starting on say Wednesday.

Professor. Madhavan Mukund: So, let me so give me a new train.

Professor. G. Venkatesh: new train.

Professor. Madhavan Mukund: which is starting on a Wednesday. So, we will have to decide how we want to write this, but..

Professor. G. Venkatesh: We tell this class,

Professor. Madhavan Mukund: Yeah. So, this is like an abstract like a procedure like.

Professor. G. Venkatesh: So, he is in a box, you ask this for give me a train and he gives you back a

Professor. Madhavan Mukund: train

Professor. G. Venkatesh: train object.

Professor. Madhavan Mukund: And now you can ask that train object some questions.

Professor. G. Venkatesh: Yeah. So, you ask the class to give us a train, he gave us a train.

Professor. Madhavan Mukund: So, this gives us a train.

Professor. G. Venkatesh: Now, what is this train, this train is that 12262 train but starting on a Wednesday.

Professor. Madhavan Mukund: Specifically.

Professor. G. Venkatesh: Specifically, Wednesday with a specific date also.

Professor. Madhavan Mukund: Yeah. On a specific date.

Professor. G. Venkatesh: Because one Wednesday, next Wednesday maybe another train.

Professor. Madhavan Mukund: Correct.

Professor. G. Venkatesh: So, on a specific date which is Wednesday, that must be Wednesday, on that date, that 12262 started on that date, now I can ask the train some question.

Professor. Madhavan Mukund: Yeah.

Professor. G. Venkatesh: I can ask you, ask it.

Professor. Madhavan Mukund: What kind of thing you can ask it? For sure, you can ask it simple questions like how many stations will you go to? Some facts about this which will be the same whether it is Wednesday,

Professor. G. Venkatesh: Whether it is Wednesday or Monday.

Professor. Madhavan Mukund: Monday of Friday so it does not really matter. But I can also ask it where will you be on…

Professor. G. Venkatesh: Where are you?

Professor. Madhavan Mukund: Where are you for example.

Professor. G. Venkatesh: Suppose I ask this card 12262 starting Wednesday, hey where are you I ask? So, I could tell it,

Professor. Madhavan Mukund: Tell it time.

Professor. G. Venkatesh: But it may know the time, it can also look for time.

Professor. Madhavan Mukund: So, you can assume that when we ask the question there is a clock like in a computer we see,

Professor. G. Venkatesh: So, what is this clock thing? Clock is what? It is an object.

Professor. Madhavan Mukund: Yeah, clock is an object. Except, we do not do anything we except read the time I suppose.

Professor. G. Venkatesh: So, there is an object called clock, so we can also look at clock and look at the time, as we do.

Professor. Madhavan Mukund: Yeah.

Professor. Madhavan Mukund: Or even our phone or whatever it is, We cannot do anything to it except…

Professor. G. Venkatesh: So, I say now its time, so it is 2:30 or 3 whatever it is, I can say, hey train, time now is 3 pm, where are you? But I can also ask the train, hey where are you? And the train then ask the clock, the clock says, hey it is 3 pm now, then the train says okay, now it is 3pm, but till how does it found out very easy.

Professor. Madhavan Mukund: Yeah. So, the train ask the clock the time and that this guy says maybe 3 pm and it might give him a day also, Wednesday say. So, then you have to go down here and figure out where you would be at 3pm as per the data that is…

Professor. G. Venkatesh: This is Wednesday train.

Professor. Madhavan Mukund: Yeah. So, the Wednesday train would have left at 8:20 in the morning at 11:33 it reached Tatanagar and at 5:37, and at 5:36, 17:36 it is going to reach Bilaspur, so if it is 3pm, it is somewhere between Tatanagar and Bilaspur, that is what it is say. It will say I am on my way from Tatanagar to Bilaspur.

Professor. G. Venkatesh: It may not give kilometre or something?

Professor. Madhavan Mukund: Yeah. Roughly you could say, certain roughly 500 kilometres away from Kolkata.

Professor. G. Venkatesh: So, if that and all it can look at his card and say, hey I am now between Tatanagar and Bilaspur.

Professor. Madhavan Mukund: So, the clock tells it which row it is supposed to be looking at and between which rows it is, so the clock information tells it where it is on this journey and then it tells us with respect to where it on its journey, it is best guess for that. So, if I had instead of 3pm, if it happened to be 5:36 pm, then it would tell me I am at Bilaspur,

Professor. G. Venkatesh: I am sitting in Bilaspur it will say. It may be late are whatever

Professor. Madhavan Mukund: Yeah. That also assuming that…

Professor. G. Venkatesh: So, it knows where it is currently and all that. Which late is late is knows that.

Professor. Madhavan Mukund: Correct.

Professor. G. Venkatesh: And you ask it, it will do all that jugglery, it will look at its schedule and if it is late, it know how late it is, it know all that informations got, all that it leaves and it will tell me and now just reaching Bilaspur, 5 minutes away from Bilaspur.

Professor. Madhavan Mukund: Correct. So, we do not have to ask it now. So, now it finds out, so we just have to ask it where it is? So, where are you is the question and implicitly it is where are you now?

Professor. G. Venkatesh: But I mean, where are you is all these trains, every train that got generated from this class will give same answer?

Professor. Madhavan Mukund: why?

Professor. G. Venkatesh: No.

Professor. Madhavan Mukund: Now, supposing it is 9 o’ clock in the morning, so supposing it is not 9 o’ clock in the morning on a say a Tuesday or a Wednesday, same thing.

Professor. G. Venkatesh: Okay.

Professor. Madhavan Mukund: Let this day at 9 o’ clock. So, this train has left at 9 o' clock on Wednesday, so we ask it where I mean 8:20 on Wednesday, we ask it where are you at 9

o’ clock, it will somewhere Kolkata and Tatanagar. But at the same time we could have also created trains before this on Monday and Tuesday.

Professor. G. Venkatesh: Okay.

Professor. Madhavan Mukund: Let us say we created a Tuesday train, so supposing there is a Tuesday train so the Wednesday train tells us this.

Professor. G. Venkatesh: Wednesday train says Calcutta

Professor. Madhavan Mukund: Between Calcutta and Tatanagar. Yeah, Wednesday train at 9 o' clock on Wednesday.

Professor. G. Venkatesh: On Wednesday.

Professor. Madhavan Mukund: This is between…

Professor. G. Venkatesh: That is a interesting thing.

Professor. Madhavan Mukund: Calcutta and….

Professor. G. Venkatesh: We can ask this Wednesday question to a Tuesday train?

Professor. Madhavan Mukund: Yeah. But now it is a question of now. So, if I ask the Tuesday train the same question, what does this say? So, this is at 9 o’ clock on a Wednesday, this is on Wednesday.

Professor. G. Venkatesh: On a Wednesday at 9 o' clock I am asking the Tuesday train, where you are?

Professor. Madhavan Mukund: So, now it turns out that it has not yet reached the station.

Professor. G. Venkatesh: still not reached Mumbai.

Professor. Madhavan Mukund: So, this one will say between Igatpuri and Mumbai.

Professor. G. Venkatesh: So, it give you answers.

Professor. Madhavan Mukund: So, depending on which object you ask this question, you will get…

Professor. G. Venkatesh: Though it is not from the same class.

Professor. Madhavan Mukund: Same class because they are internally at different,

Professor. G. Venkatesh: So the objects are actually different?

Professor. Madhavan Mukund: This is not like asking which station…

Professor. G. Venkatesh: They look the same because they have the same stations they are visiting on.

Professor. Madhavan Mukund: so, this is not like asking something which is common to all of them like how many stations do you visit? That will give you a…

Professor. G. Venkatesh: That is the same answer.

Professor. Madhavan Mukund: But this is really time dependent because this is a different, so this is something which distinguishes these objects.

Professor. G. Venkatesh: So, this is very I mean very very different. So, what we have done basically is we have created a thing called a class which is like a template for trains.

Professor. Madhavan Mukund: For trains.

Professor. G. Venkatesh: And we name that class, this how much is number, because that number does not represent one train. It represent enough trains.

Professor. Madhavan Mukund: Correct.

Professor. G. Venkatesh: And then we ask this class, give me a train. Then the class said, okay give me a train when, which date? So, you say, okay Monday or Tuesday whatever, on say Wednesday. Then it gave you a train starting on Wednesday. Then that train objects, so you got an object.

Professor. Madhavan Mukund: Yeah. Got back an object to which I can ask more questions.

Professor. G. Venkatesh: Now I can ask more questions to the objects now.

Professor. Madhavan Mukund: Yeah.

Professor. G. Venkatesh: That question I can ask to the class. If I ask, where are you to the class, what do you mean by that?

Professor. Madhavan Mukund: Correct.

Professor. G. Venkatesh: It is not a question for me. You give you ask me whether I can ask me for a train, I will give you a train that is it, right?

Professor. Madhavan Mukund: Yeah.

Professor. G. Venkatesh: So, the class cannot ask that question, but the object can be asked. So, from the class you created the object and then you ask the train where are you?

Professor. Madhavan Mukund: Where are you? So, it ask the clock.

Professor. G. Venkatesh: It ask the clock what is the time now?

Professor. Madhavan Mukund: What is the time now?

Professor. G. Venkatesh: The clock says yes sir, Then it use the time to…

Professor. Madhavan Mukund: Figure out from its timetable where it is.

Professor. G. Venkatesh: Getting more and more interesting. This is beautiful we are doing thing, is not it?

Professor. Madhavan Mukund: Yeah.

Professor. G. Venkatesh: I mean earlier we were just messing up all the thing, data compared to this.

Professor. Madhavan Mukund: So, everything that we ask is tied to a particular source of that information and we ask that concrete source of the information to give us the answer and we pass this answer around as and when we need it.

Professor. G. Venkatesh: Now, suppose I ask, I mean other than this, suppose I say, when will you reach some station? Can I ask that question?

Professor. Madhavan Mukund: Yeah. You can ask that question.

Professor. G. Venkatesh: So, if I ask a train, when are you going to get to Bombay? That is more interesting for me, wherever use, I mean where it might be interesting for somebody who wants to display map showing where the train is?

Professor. Madhavan Mukund: Yeah. Correct.

Professor. G. Venkatesh: You can ask the train, train will say I am here, so he marks it on the map, so people can see where it is, but I am more interested in knowing, I am waiting for a relative who is coming from Kolkata, I am at Mumbai, who would know when this train is going to reach Mumbai?

Professor. Madhavan Mukund: Yeah.

Professor. G. Venkatesh: So, I can call the train and say, hey train, when are you going to reach Mumbai? And based on its calendar and it delay and all that…

Professor. Madhavan Mukund: so, it can find out where it is.

Professor. G. Venkatesh: Where it is and then it can tell me whether it is going to reach Mumbai at what time and give me an answer, it will be normally 10:31.

Professor. Madhavan Mukund: But it could be delayed. So, supposing it knew that the last station it passed through, it passed through after 20 minutes extra delay, then it could say instead of 31, it will say 10:51 is when I am….

Professor. G. Venkatesh: Expected time of arrival or something like that?

Professor. Madhavan Mukund: Correct.

Professor. G. Venkatesh: So, it will say, I expect to arrive at Mumbai at around 10:51. So, that is useful because I know basically where to start from home.

Professor. Madhavan Mukund: Correct.

Professor. G. Venkatesh: So, I have to ask the train the question, that is interesting. So, object can become very interesting, you can ask all kinds of interesting questions to it.