



IIT Madras

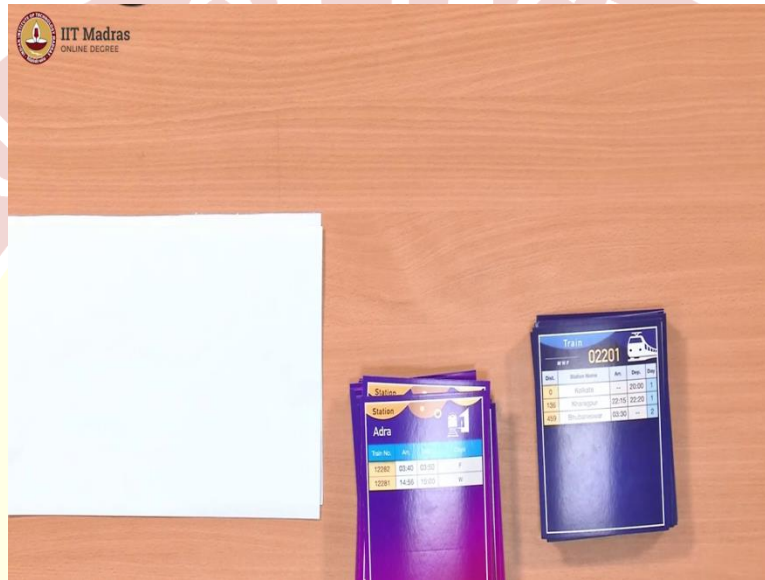
ONLINE DEGREE

Computational Thinking
Professor Madhavan Mukund
Department of Computer Science
Chennai Mathematical Institute

Professor G. Venkatesh
Indian Institute of Technology, Madras

Dictionary comparison to find common elements in them

(Refer Slide Time: 00:26)



Professor. G. Venkatesh: So, let us come back to our train.

Professor. Madhavan Mukund: They have done much with this yea, okay.

Professor. G. Venkatesh: This is a very interesting data set. So, what we said is that every train goes through some stations.

Professor. Madhavan Mukund: Correct, correct. Yeah, yeah. So, a train in some sense is a sequence of stations or a list.

Professor. G. Venkatesh: Is a list of stations train seems to be a list of stations and then for instance, if you want to know what happens at Kharagpur station, then we can and then we can look up Kharagpur in this list, for instance, and it will give us a list of trains.

Professor. Madhavan Mukund: So, it looks like this is a dictionary, because you know, this is a list of items, each of which indexes it this year. So, this is like a dictionary, this is one dictionary

this is another dictionary looks like to me. Yeah. So, these are the keys, the train number is the key or the station name.

Professor. G. Venkatesh: So, what we have are two dictionaries, right this is one dictionary, dictionary which is indexed by the train number and this is a dictionary indexed by the train station name. And from here we get.

Professor. Madhavan Mukund: And there a train itself is a list of entries into this dictionary and the this one itself each station a list of entries into this dictionary, correct. So, what we have is may be we should draw it, it looks like an interesting thing you have two dictionaries.

Professor. G. Venkatesh: Yes.

Professor. Madhavan Mukund: Each one is a list, each one entry has a list. Yes, right? Yes.

Professor. G. Venaktesh: List of entries into other one and that one has a list of entries into this one. Correct. So, mutual linked, right? Yes.

Professor. Madhavan Mukund: And we can go back and forth, go back and forth from a train you can go to a station, station, you can go to train.

Professor. G. Venkatesh: Yeah, like that back and forth. So, let us see if we can use that information. So, we saw last time how to check whether you can go directly from one station to another.

Professor. Madhavan Mukund: We saw that yeah.

Professor. G. Venkatesh: So, we said that we will take the starting station supposing we were. I forget where we started from but supposing we were starting to buy something, some Chennai to Bhubaneswar. Then we start with Chennai's card, look at the trains that Chennai has connected to and for each of these trains, we see Bhubaneswar appears on that list. If so, that is a direct train from Chennai.

Professor. Madhavan Mukund: So, what we are doing is we are taking Chennai, Chennai station, we know that Chennai is an index into this dictionary, yes. So, you go to that particular index

element that is storing a list, a list of trains and for each train, we index into this dictionary and look up which stations it goes to which station that has again is a list. Yeah.

Professor. G. Venkatesh: And Chennai will be one of them because we know that it yeah, Chennai passes through.

Professor. Madhavan Mukund: You want to see whether in that list there is a Bhubaneswar, Yes, if that Bhubaneswar does not occur in that list, discard it and go back to the next train,

Professor. G. Venkatesh: yes,

Professor. Madhavan Mukund: Keep on doing that, till we find the train which has, if there is no train then you will find at the end of this process you will find.

Professor. G. Venkatesh: Every entry in the Chennai dictionary there is in that Chennai list there is the train does not pass through Bhubaneswar then we cannot go directly, cannot go directly in which case you have to so now Yeah, so, the obvious next step is can we go by changing one train?

Professor. Madhavan Mukund: Changing one train is we discussed again this idea of a junction,

Professor. G. Venkatesh: Yeah. So, we have to go to a station which has which has two different crossings? Yes,

Professor Madhavan Mukund: Like that right. So, basically, it seems that the train has neighbors, neighboring stations, which are different, which are different, we did that right we did that exercise and we found some interesting yeah, we looked at some interesting marks, like Kharagpur, right? No, no. So, yeah.

Professor. G. Venkatesh: So, now let us try to see for instance, let us see for instance, whether we can go from Mangalore to Pune, Mangalore to Pune. So, I doubt that there is a direct train. So, first let us check with that direct train.

(Refer Slide Time: 03:54)



So, here I find Mangalore so right so Mangalore is got now these four trains so you indexed, what did you do, you indexed into this and picked up the Mangalore list? Yes, this list this is a list. Okay. Now you are going to read out one by one in that list and then I will, you will index into that. So, I start with 02283. So, that is the first train. That is the first train, so, I am going into this dictionary and picking out 02283 right, which is this one, right? And now we go down that list. So, this is a list again, list of stations.

Professor. Madavan Mukund: Yeah.

Professor. G. Venkatesh: And we see if Pune is one of them and it is not there, okay, so 02283 does not take us to Pune, okay, the next train is 12224 I guess a computer will go directly we are searching. But yeah, it will go directly, so 12224. And this again is a list

Professor. Madavan Mukund: Yes.

Professor. G. Venkatesh: And again it has Mangalore because we started in Mangalore. But there is no Pune there is no Pune.

Professor. Madavan Mukund: So, these first two, do not pass through and of course the other trains are be said that they are in pairs.

So, if we look at 02284, it will be the opposite direction of 2283 normally, so you do not need to really check it, but they will do that. So, you can check it just to make sure yeah, yeah.

Professor. G. Venkatesh: So, this is 2284 which is going from Delhi to Ernakulam whereas the other one was going Ernakulam and again Pune does not occur in this and finally, 12223 which is this train Yes. So, this again is going Mumbai to Ernakulam opposite direction. Yeah. And Mangalore appears Of course, but no Pune. We know we cannot go. So, now the question is can we somehow change train somewhere and go by a changed train?

(Refer Slide Time: 05:47)



Professor. Madavan Mukund: Mumbai seems to be the place we do not know Okay, we will find out.

Professor G. Venkatesh: So, what we are saying is that we can go, can we go from Mangalore, Mangalore to Pune so we want to first go somewhere junction which will be a junction and then from that junction we want to go to Pune. Is it possible to do this, this is what was asking. The way of doing it is that you find from Mangalore where all you can go yes yes right yeah. So, that we can decide for each of these trains. So, we had where all we can go Yeah,

Professor Madhavan Mukund: But you do not need everywhere because we need only junctions where you will find out first where yeah so we can go.

Professor G. Venkatesh: So, if you if you take this train for instance then it gives us a list of places we can go so I have a list of places and if I take the next train then I have another list so these are all the places I can reach from Mangalore I got all this together in one place, yeah and then from each of these I will have to check again by looking at all the trains that pass through that station too much.

Professor Madhavan Mukund: I do not want to do how do, I do the same thing for Pune? No. Why we do not do the same thing for Pune, this time I do the other way but yeah.

Professor G. Venkatesh: That is because we know that these trains actually are cheap. Even if they do not match I can find all the trains which enter into Pune coming from the opposite direction at you know, there is all sorts of ways Okay, so we can do that. Okay. So, let us do that. So, we start with the Mangalore list. So, we have one list.

Professor Madhavan Mukund: So, we will this find all the train stations you can reach ideally you want to find all the junctions in advance find all the stations first Yeah, so you have Pune now.

Professor G. Venkatesh: So, Pune has more trains okay. So, we will have to look at each of these trains and see where all you can go way which all trains will get you to Pune you want to see, Yeah, which all trains will get us to Pune. So, these are all the trains passing through Pune passing through Pune. So, we have to find out from where all you can enter Pune, okay.

So, we do not know which direction we are coming from. So, let us just take all the stations you can see all the stations you can reach from Pune. Lets see all the stations. Should we first write down the list of stations from Mangalore? So, let us go to Mangalore. So, let us go back to this. 02283 and write down all those stations 02283, yeah. Okay. So, here is the 02283, okay.

(Refer Slide Time: 08:16)



So, you make a list. So, presumably you should look after Mangalore. No, because it is Ernakulam, Kozhikode, Bangalore so afterwards. So, only trains which are after Mangalore in this list, okay, so, so Madgaun, Ratnagiri, Mumbai, Vadodara, Ruthlam, Kotha, Yeah. New Delhi and Kolkata. Calcutta, this is a crazy train. We cannot go to Calcutta. I think there is a mistake.

Professor Madhavan Mukund: That I think 1916 is wrong. Yeah. So, let us I think it must be going into this. So, let us assume that that's wrong. Yeah. Because if you look at this train it the pairing train starts at New Delhi. So, I think that entry for Calcutta is wrong. Okay. This is an error. We found an error in the card, sanity check. type checking. Okay. So, yeah, so it ends in New Delhi,

Professor G. Venkatesh: And 0284, which is the third train Yeah, you can see that the same stations are there in reverse. So, we do not have to write again. So, this was the first train. So, this was this. Basically 02284 is the same station three and an alternating 284. So, we do not have to make a second list. And then we have the other pair which is 122.

Professor Madhavan Mukund: The one was this this thing tells you, no this actually this is important because this tells you can go from Mangalore to Kozhikode and Ernakulam. Yes, you can that sense you can. Yeah.

Professor G. Venkatesh: So, maybe we should write all the stations. We should write Kozhikode and Ernakulam okay so let us just add that here.

Professor Madhavan Mukund: I can go from Mangalore to Kozhikode using this 2284 train I do not know whether from Ernakulam we will reach Pune but anyway we find out.

Professor. G. Venkatesh: Okay so there we have this all the stations which you can reach by these two trains from Mangalore and this is other pair 12223, okay? And what is the pair for that? 12224 sorry.

Professor Madhavan Mukund: So, this is a shorter and shorter route want to keep it in order. Okay.

Professor G. Venkatesh: So, here we have the two trains, again they start at the same place. So, Ernakulam is already there Kozhikode is already there Mangalore is already there, Madgaon is already there, Ratnagiri. So, actually this is a subset of the other one because we have Ernakulam Kozhikode, then Mangalore itself of course, Madgaon, Ratnagiri and Mumbai, okay, so we do not get any new stations or does not help us.

Professor G. Venkatesh: So, now we know where we can go. So, this is basically you have done the Mangalore? Yeah, so I will just put a tick here saying that we have got no new information, but we could have written out the list and that so now we go to Pune, okay, and we want to do a similar exercise for Pune.

(Refer Slide Time: 11:34)



Professor Madhavan Mukund: So, we do, I think the pair is 12219 and 12220. So, 12219 and 20. Okay, so here are the two trains 19 and 20. So, Secunderabad depending on which one we are looking at first Secunderabad, Sholapur, Mumbai, okay does not help because I think none of those are current that well, Mumbai is there actually, oh, Mumbai, oh, so you found something but let us continue and do the whole thing.

Maybe there is more than one way because we might want to find a better way also, so you are going from Mumbai, yeah. Mangalore to Mumbai, and then from Mumbai to Pune using the Ernakulam train Ernakulam Mumbai train, and then Mumbai Pune using the Mumbai Secunderabad train. Yes. That is one way. That's one way to go.

Professor. G. Venkatesh: And have one two two next to 21 and 22, Okay. All right. So, this is Pune to Kolkata. Okay. All right. Okay,

Professor. Madavan Mukund: So, you have Dhund Manmad, Okay, Bhusaval. Nagpur, Billaspur. So, this is going in the wrong direction. So, I do not think it is going anywhere. tatanagar? Kolkata. Kolkata. Okay. So, this is not very useful to go the same stations in the other directions so we do not need to write the station again.

Again. This is no use because it's not. Yeah. Geographically is going wrong direction. Yeah. And then we have 12264 all right and 63, yeah right. This is Pune to New Delhi. Okay, this may be

not likely. Not likely, I think let us see, I think Pune. So, Lonavala Okay Mumbai, Okay, Vadodara ratlam. Okay, so there are all these stations which are in common now. It is following the same route as that one. Vadodara Kota ratlam Kota. Kota new Delhi. And the other directions is the same, same stations. Okay. Okay, what we find.

So, we find that basically this route is following the first route beyond Mumbai, if you remember it continued to New Delhi. So, we have Mumbai, Vadodara Ratlam, Kota, New Delhi. So, all of these places are potentially positive. Yes. But you will likely come back it is not a very efficient, because you will go along the same route to Mumbai. So Mumbai is probably the best place to change.

Professor. G. Venkatesh: Yeah. And there's one more train if you just want to look at that as the last one. So, 12297 98 Let me put this back 63 64 97, 97 and 98 this is a short one. Ahmedabad Mumbai Lonavala, Pune. Mumbai is there. So, yeah, so we have actually repeated some of these but.

Professor. Madavan Mukund: So, the important thing is that we have found that there are these common Mumbai is one. Yeah, and of course, these are also common Vadodara ratlam Kota, New Delhi, but that is because they are really in the same direction okay. So, ideally one would go to Mumbai, but what we have saved is by approaching this problem from the two sides.

So, instead of what we would have done otherwise, is look at Madgaon, look at all the trains in Madgaon and see from each of them does it go to Pune? If not, then we go to ratnagiri then check all the trains in Ratnagiri, they call the stations at customers time. So, that would be like a nested iteration that we are doing for every train station that I can reach from Mangalore. You are saying what are the stations you can reach from there and does that include Pune whereas here we are just doing both sides two ends? Yeah, two iterations, one after the other one, all the trains in Mangalore and then all the trains

Professor. G. Venkatesh: You should find all the junctions in Mangalore yeah, so that would have been more reduced.

Professor. Madavan Mukund: May be then we would remove, say for example, this Vadodara Ratnmandal may not be junctions, I don't know whether they are junctions are not. Probably not.

They may have gone away and Mumbai would have left. Yeah. And even something like Sholapur may not be a junction so it would have come out. And we will be left with much smaller number of stations, so we can compare to compare this list to this list, we would have had fewer things to compare.

