



IIT Madras

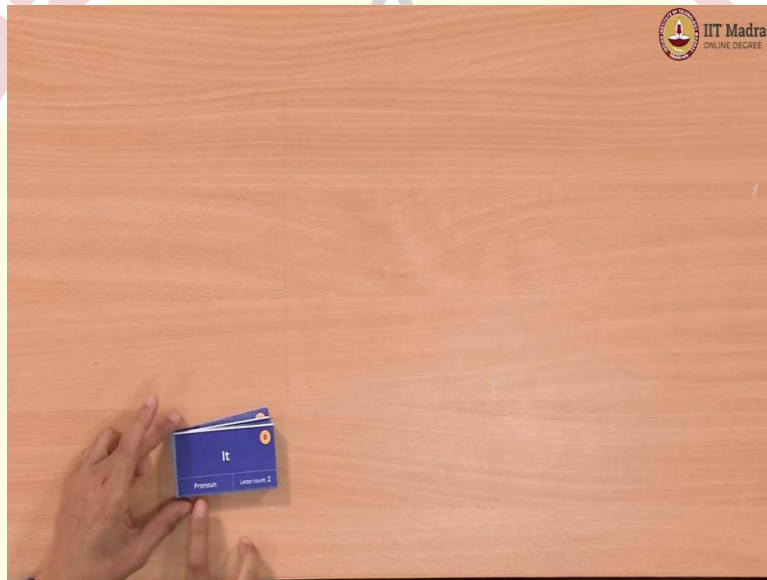
ONLINE DEGREE

Computational Thinking
Prof. Madhavan Mukund
Prof. G. Venkatesh
Department of Computer Science
Chennai Mathematical Institute
Indian Institute of Technology, Madras

Lecture - 4.7
Procedure to resolve pronoun with its equivalent matching noun

So, let us look at these, this paragraph that we had. So, we have each word.

(Refer Slide Time: 00:21)



And, we have the word and we have the type of speech it is pronoun or noun or verb. And of course, we have the count of letters.

Yeah.

So, I have a question now. So, these pronouns in grammar are actually standing short forms like he or she which stand for something that we know. If I just say he said something you will have no idea who I am talking about, but if we have been discussing some individual and I say he or she said something you know that the he or she refers to that person, right.

So, usually, pronoun; so, I mean you do not use he to start with you will usually start with somebody's name.

Exactly.

Say Madhavan said this, he also said that.

Yes, and then you know that.

Then, you know that he means Madhavan.

Yeah. So, it is.

Because.

Yeah. So, for example, if we go through this, so let us just quickly look at this. So, it was Monday morning. So, that is the first sentence.

Swaminathan.

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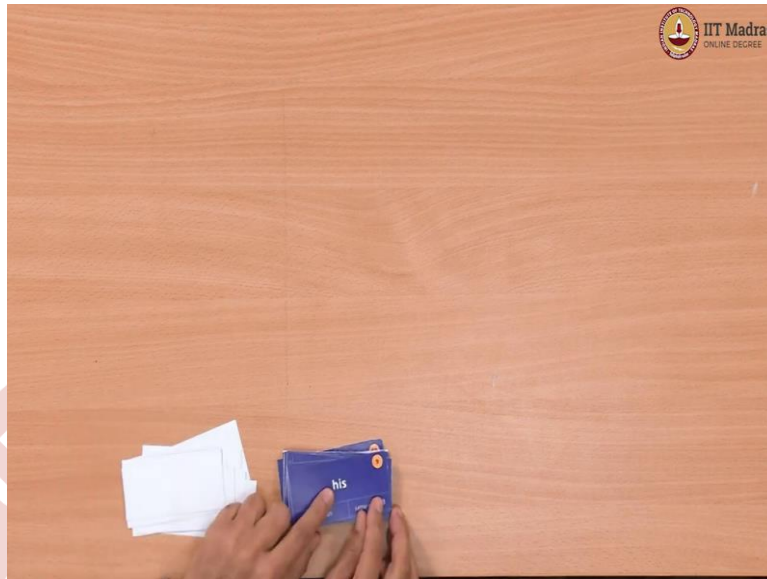
So, Swaminathan is a person.

Is the name Swaminathan was reluctant.

Swaminathan was reluctant to.

To open.

(Refer Slide Time: 01:19)



His.

His.

Now, you see this his and.

His Swaminathan.

We understand that the name only name we have seen so far is Swaminathan. His refers to Swaminathan right. So, this is a question which we might ask.

But you know the, I mean this is for a human being this is alright, computer.

Yeah. So, how do we?

It is a struggle. So, you have to.

Yeah.

Somehow, you have to take that his and.

Yeah. So, supposing I will go further down and look somewhere.

So, not all pronoun; see this pronoun. So, this his, her.

Yes.

These are personal pronouns.

Yeah, they refer to persons.

They are persons.

Yes.

So, he.

Now, for (Refer Time: 01:55), so if I go down.

He is there.

And, I come to this word number 40 and there is a word he, right.

(Refer Slide Time: 01:59)



Who is he?

Now, how do you determine, who is the he? In this case yeah right.

It has to come before, I presume.

Yes.

So, you will have to look.

So, we will have to go back and look for a name which is (Refer Time: 02:15).

I would say that the first name.

Ok.

First name, first name means the way you put it you put it the other way.

Yeah.

So, I can start from here.

Yes.

Because this is the.

Previous.

Card just previous to this. So, let us say that as I go back. So, in the paragraph probably you go forward you read forward. But, when you see he; I want to go.

Backward.

Backward.

Yes.

Read backward in the paragraph. So, which is like going in this from going like this.

Yeah. So, actually (Refer Time: 02:46).

And, I keep going like this.

Yeah, we could have done that actually without turning it over. So, I have what I could do is so, I come back to the start, right. So, now, if I say it and I just move it to the side. So, this is the last word I write.

Ok.

This is the current word, then I move this on top of this.

Ok.

So, this is the third word and this is the second word.

Ok.

If I move one more than the; so, each time the previous word is one that showing and if I go down the stack I am going in.

Reverse order.

Reverse order.

So, yeah. So, let us say we do this.

Yes.

That is you move the card like this to a different pile one after another like what we have been doing so far, but now this is a changing the order and then what I do is if I see a he.

Yeah. So, for example, we will go until the first pronoun that we see.

First personal pronoun you will see his.

His.

So, now I have to find.

What you have to do is to go down the stack.

Yeah.

Like this the same order.

Yeah.

And, look for a name.

Yeah, but now the problem is that if.

Name not a noun, name noun.

Yes yeah, but I do not want to disturb the cards for the future. So, I will put this back here and go back, but then I have lost that position no.

The where you otherwise you will come back and you will do again.

Yeah. So, I will not know where I mean you know I have to remember that number. So, let me mark it right. So, this was the pronoun his that we were trying to find the reference.

Ok.

His noun which person this belongs to. So, I will put this like this sideways maybe just to mark the position.

And, all other cards also you put side this.

And, then I will put back until I find a name. So, I am going backwards in my text.

You got a name, isn't it?

I found the name.

Ok.

Now, I know that the, his at position 9 refers to Swaminathan position at 4.

So, once you ok. So, what we do? Basically, we first went down the card list to find the pronoun.

Pronoun and then we. Then, we found a pronoun.

And, then you found.

You went back.

Backwards.

So, you are going forward till you found a pronoun once you found a pronoun you went backward till you found a noun.

Yes.

And, once you found the noun you do not want to go forward again, we have already seen everything.

Yeah.

You straightaway jump to the.

Yes. I would like to jump to that and then.

Pronoun and then continue from there.

So, without.

What is the jumping business?

Well, I will just put these cards back again.

Back again.

Until I reach this. And, now I know that this pronoun is done.

So, moved here.

So, now, I look for the next pronoun. So, now, I go to eyes and I see another he.

Ok.

Now, what do I do?

So, again.

Again turn it around.

So, I will turn it around.

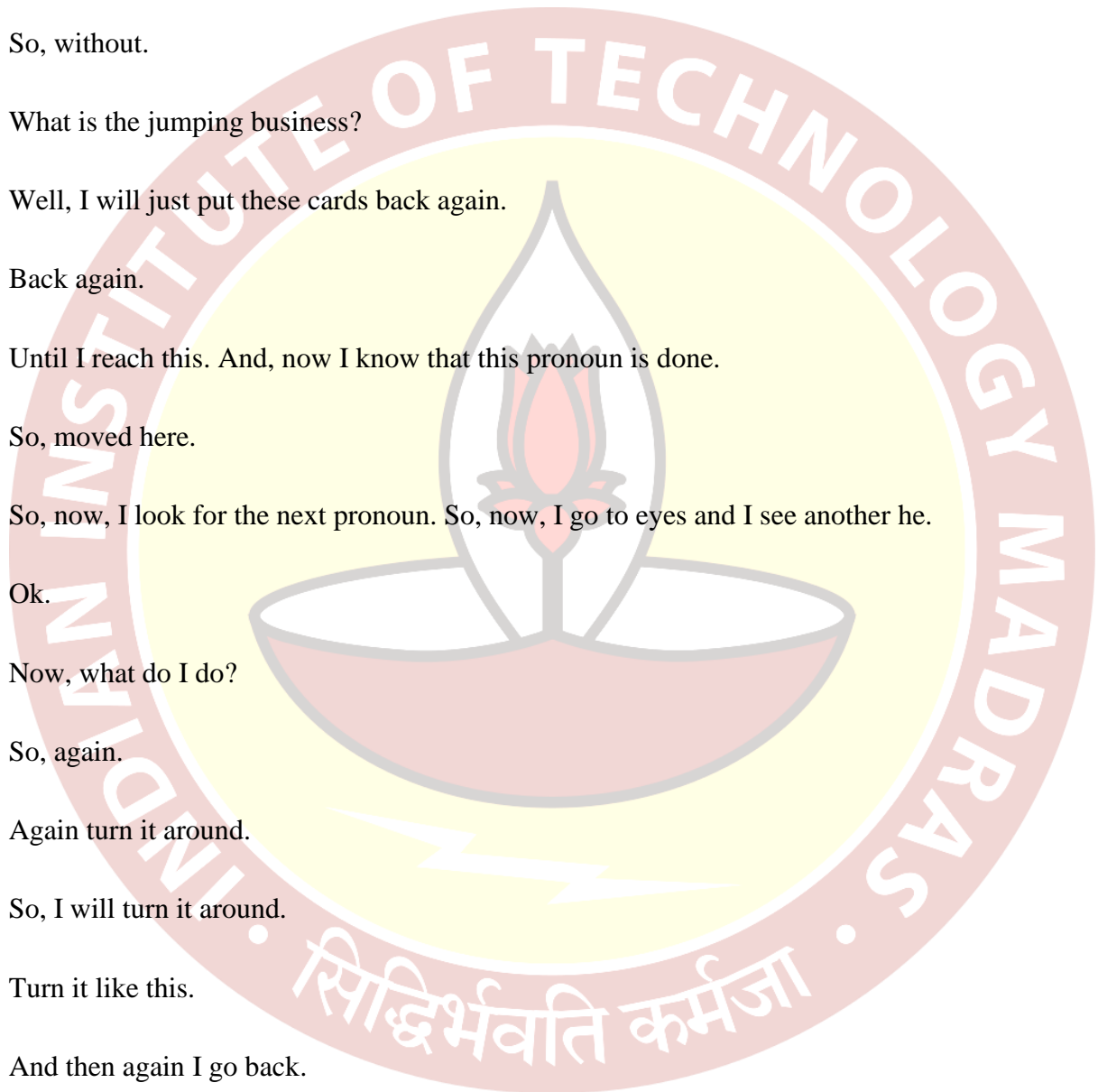
Turn it like this.

And then again I go back.

Again go back like this go back like this till you find a noun.

Till you go back find a noun and in this case again we (Refer Time: 05:17).

Swaminathan we got.



Same Swaminathan.

So, which means that this he is also Swaminathan.

Yes.

And, then I want to jump to this again.

Yeah. So, again I will have to just.

Cannot I just move these cards from here? No, that will change the order.

Yeah.

I have to do one by one.

Yeah.

Ok.

So, one by one otherwise because we want this.

To be in reverse order.

Reverse order and this to be in.

Forward order.

Forward order. Otherwise going back and forth will get messed up and in the long run we do not want the sentence order also to be messed up, right. So, now, we go.

But, this is going to consume a lot of steps right?

So, let us see because yeah. So, really for every pronoun that we see here we have to go back through a sequence of words. So, it is really like for every word here we are comparing the words before it to find out which noun.

Not only that. Then, again when you want to jump back again you have to go back and do the same thing again.

Yes.

Two times you have to do that right.

Yes, we are shifting a lot of things backwards and forwards that is true. So, let us so, we have actually.

So, we have not found a pronoun so far..

We have not found a pronoun for a while.

He, alright.

He.

So, ok. So, now, for same method. So, I if you turn this like this and then now what we have to do is basically go down this list.

Go down all the way back to the nearest noun.

Nearest the named noun.

Of.

There are many nouns.

Yeah like.

Monday is a.

Monday is a noun.

Name.

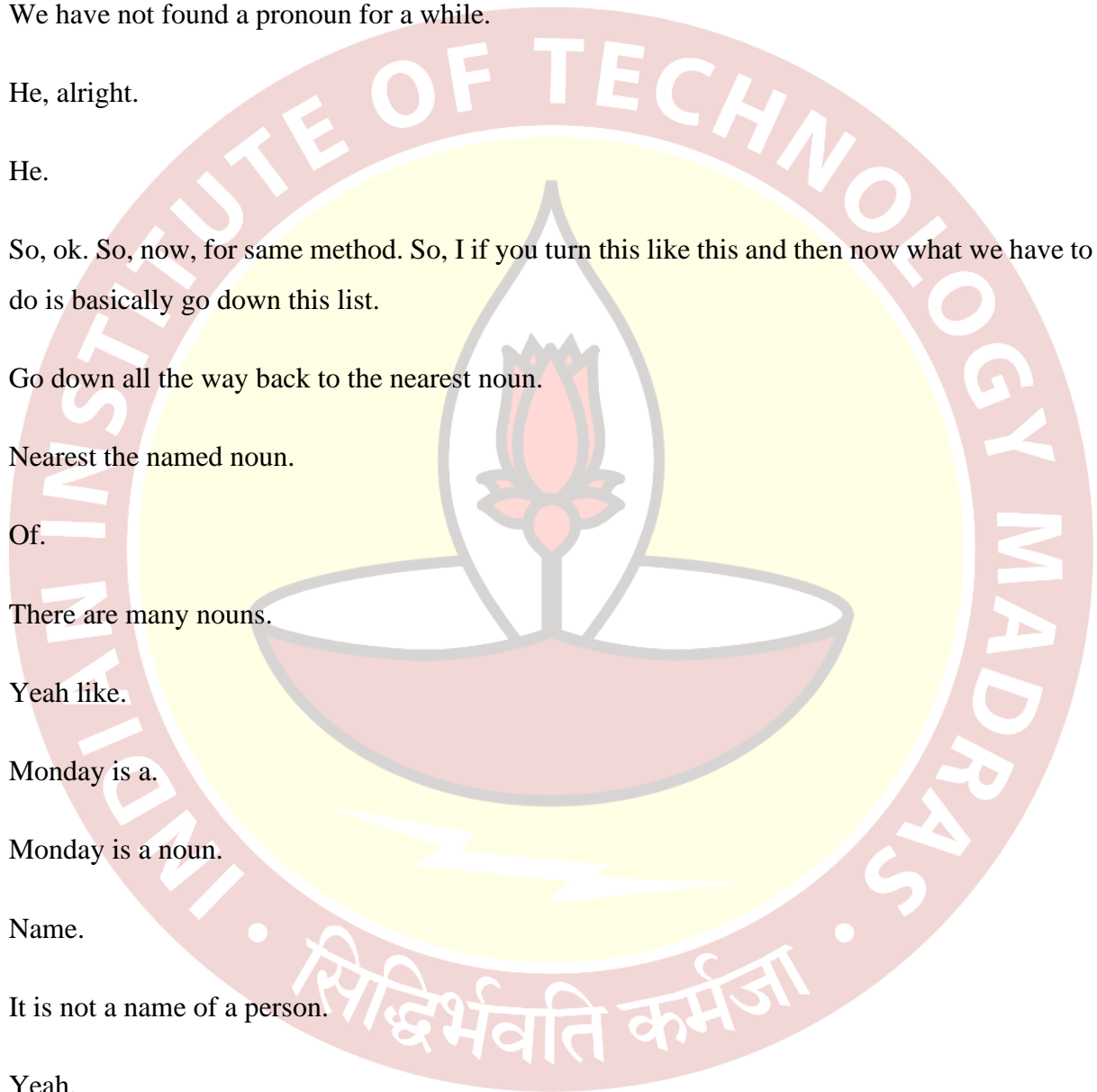
It is not a name of a person.

Yeah.

So, you look at a person's name.

Yeah.

Sunday is again a noun, but not a name of person Saturday.



That you have to find out from some you know some way find out.

Yeah.

You have to know that.

Calendar is a noun, but it is not a person. Again a Monday, this is our old he you can see (Refer Time: 07:03).

Ok.

Eyes these are all nouns which are not useful and finally.

You really saw, so many cards.

All the way back to Swaminathan.

Swaminathan.

The same Swaminathan who was there before.

Ok.

But, also what did we skipped a lot of nouns in between.

Where did we skip? Yeah. Not named nouns.

Monday, Sunday and all that.

Named nouns.

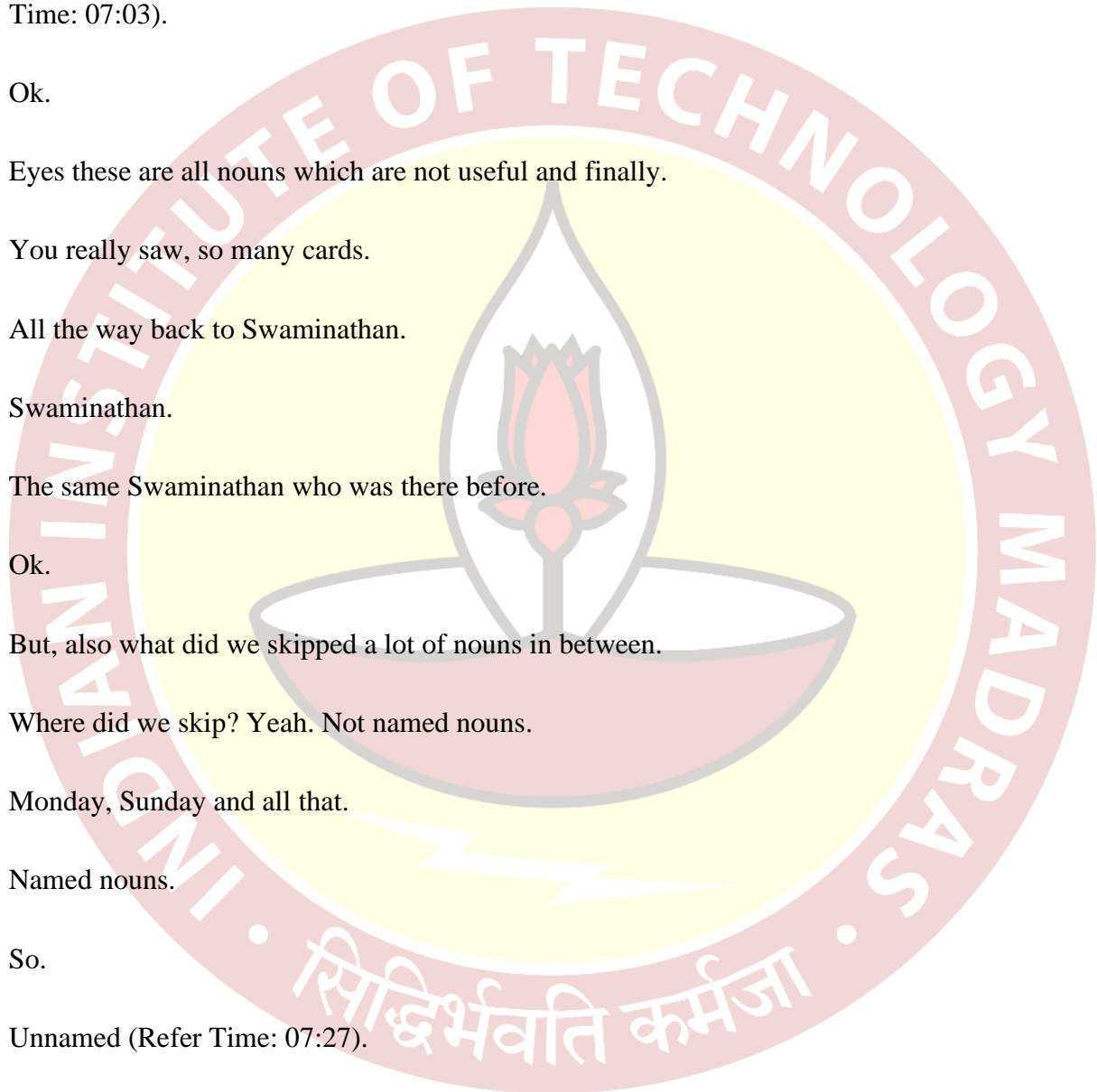
So.

Unnamed (Refer Time: 07:27).

Basically, we are coming backwards to the same Swaminathan right. So, we have spent a lot of time coming back to the same Swaminathan.

And, then see now point is that we found this then now again I have to go back like this.

Yes.



And, then jump go back to this I mean I put all these cards back here.

Yeah.

And, then continue from there.

Yeah.

That is better must be better way of doing this right.

Well, the other thing is that see it seems a bit silly to come back to the same Swaminathan from, 40 because while going forward we knew that we did not see another name right.

We were going forward and we saw Sunday, Monday, eyes things like that. So, unless we see a different name from Swaminathan, there can be no doubt as to who, he or his right. There is only one person in our conversation. So, why do we need to go back, why cannot we remember forwards for example?

What will you remember?

So, I will just say that the last name I remembered was Swaminathan.

Just keep one name you are saying. Keep a name keep a variable called name last name seen.

Yes. Every time I see a he or his.

Every time you see he or.

His.

His, it must be that name.

Of course it could be her.

In which case.

You might keep more than one name.

More than one name.

So, you can keep a male name and a female name and if a neutral gender you can keep an object name also.

Yes.

Right.

Example.

And, whenever you see, he you resolve it with the male name.

Yeah.

If you see another male name.

Then you will update.

Is there another male name?

I think.

Is not it?

The teacher comes I think later on.

Look.

So, I think if we.

This may be just go back like this. This is a see I mean, what have we done here? This is a nested loop right.

Yeah, we were doing a nested loop.

So, the nested loop basically what is the nested loop? Can we kind of understand what this nested loop is?

So, we are going down the paragraph. So, that is the.

So, the word. So, we are we are iterating over the cards. So, one by one we are looking at the cards.

Beginning to the end.

Ok.

Whenever we find a pronoun.

Pronoun.

Now, we are going to.

We start an inner loop. What is the inner loop?

Is to go back up all the cards we have seen so far, in this order.

Go back in reverse order.

Searching for the nearest name.

Name, and then when we find the name.

We match that and say this he refers to that name, then we come back down again to this point and start the outer loop again outer loop again.

Outer loop again. So, basically so, the going back coming back here like this is to restore.

Yes.

Remove the side effect looks like to me.

Yes.

Is not it?

Yes.

Where we doing this? This business, what are you doing now is because you want to remove the.

Correct, because while going back we have again disturb the order of.

Disturb the order.

Of the (Refer Time: 09:42).

So, like we discussed last time the side effects and all.

Yes.

You want to remove the side effect that is why you are doing it right. So, when we write the procedure correctly.

Hopefully, we will not have to do this.

We will see we do not have to do this, because procedure will remove the side effect and.

Yeah.

Return it.

So, we have this.

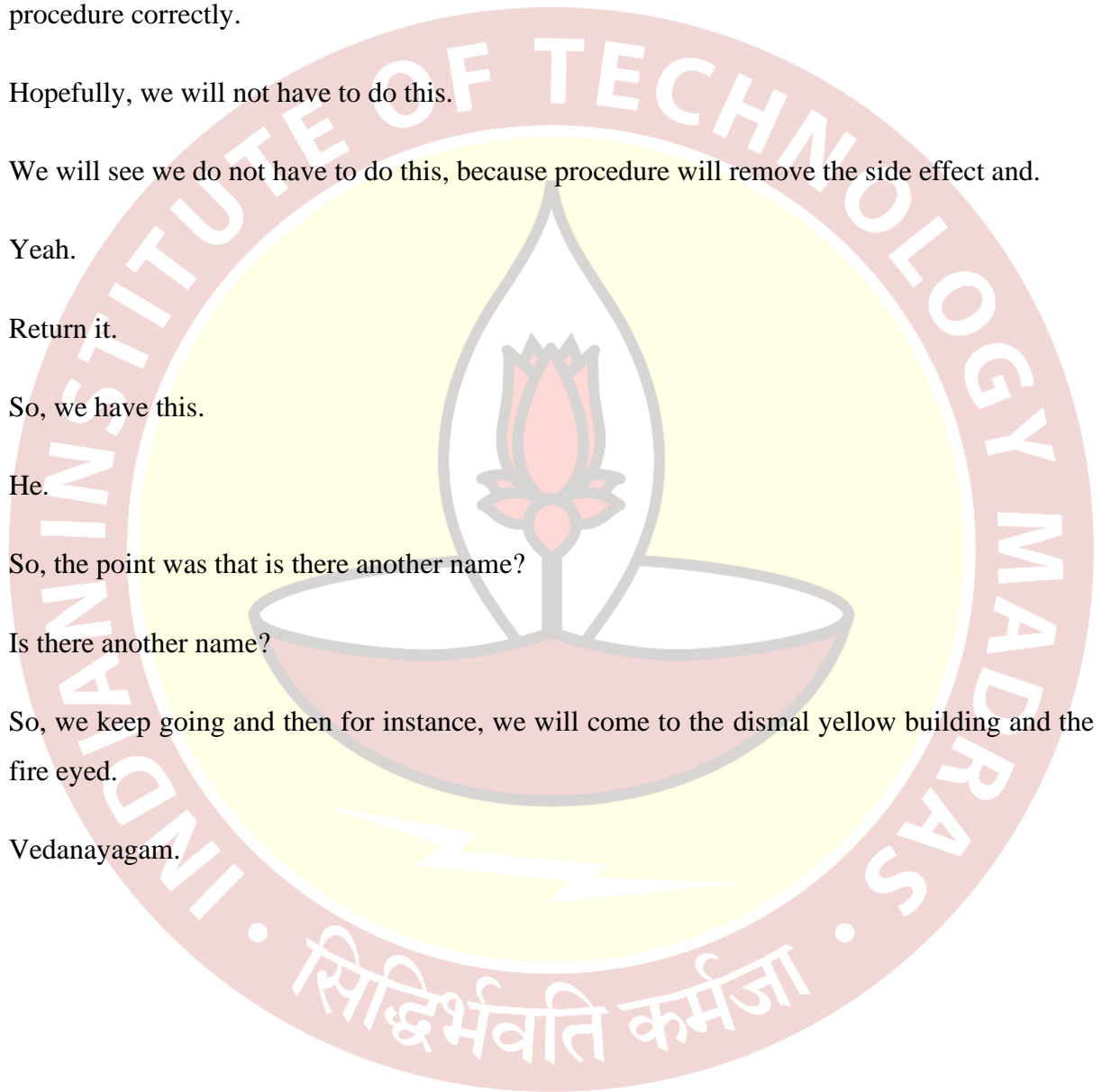
He.

So, the point was that is there another name?

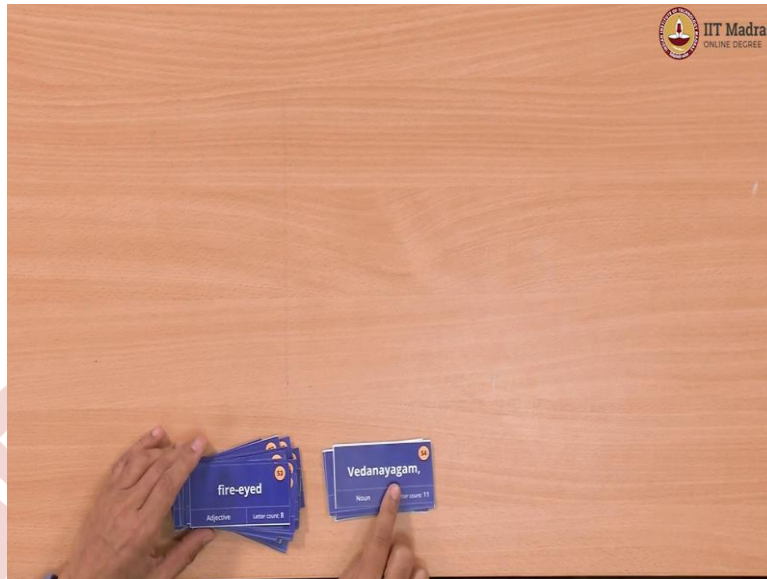
Is there another name?

So, we keep going and then for instance, we will come to the dismal yellow building and the fire eyed.

Vedanayagam.



(Refer Slide Time: 10:15)



So, now we.

There was Swaminathan.

So, that was Swaminathan.

So, this is.

This is Vedanayagam.

Comes the new name.

Is a new name. So, we replace. If you have kept a variable called last name seen.

Yes.

First it was Swaminathan, and every he you see or his you see will replace by Swaminathan, now you saw Vedanayagam. So, now you replace this variable last name seen to Vedanayagam.

Yes.

And, now you start going forward. Now, you do not need to do nested loop at all.

Yeah.

His.

When you say a his.

He says. So, let me read the sentence. Fire eyed Vedanayagam his class teacher. No, this his class teacher seems to be referring to.

Vedanayagam, his class teacher.

(Refer Slide Time: 10:51)



So, I think this there is some little bit more which we have not.

You have to just a just read a little bit more.

Yeah.

What does it say?

It says he is talking about how he does not like the school. So, the dismal yellow building.

So, they are saying.

What does not he like?

The dismal yellow building.

He does not like the dismal yellow building, he does not like his class teacher.

Yes. So, this is.

But, his class his class teacher is named Vedanayagam.

Yes.

His class teacher I mean whose his?

So, this is.

Swaminathan.

Yeah. So, it does not always work.

So, this his is not Vedanayagam. This his is Swaminathan.

Yeah, let us (Refer Time: 11:27).

So, what you have to do is not keep track of one name you may have to keep track of more than one name.

Yeah.

And then.

Depending on the way in which the sentence is constructed.

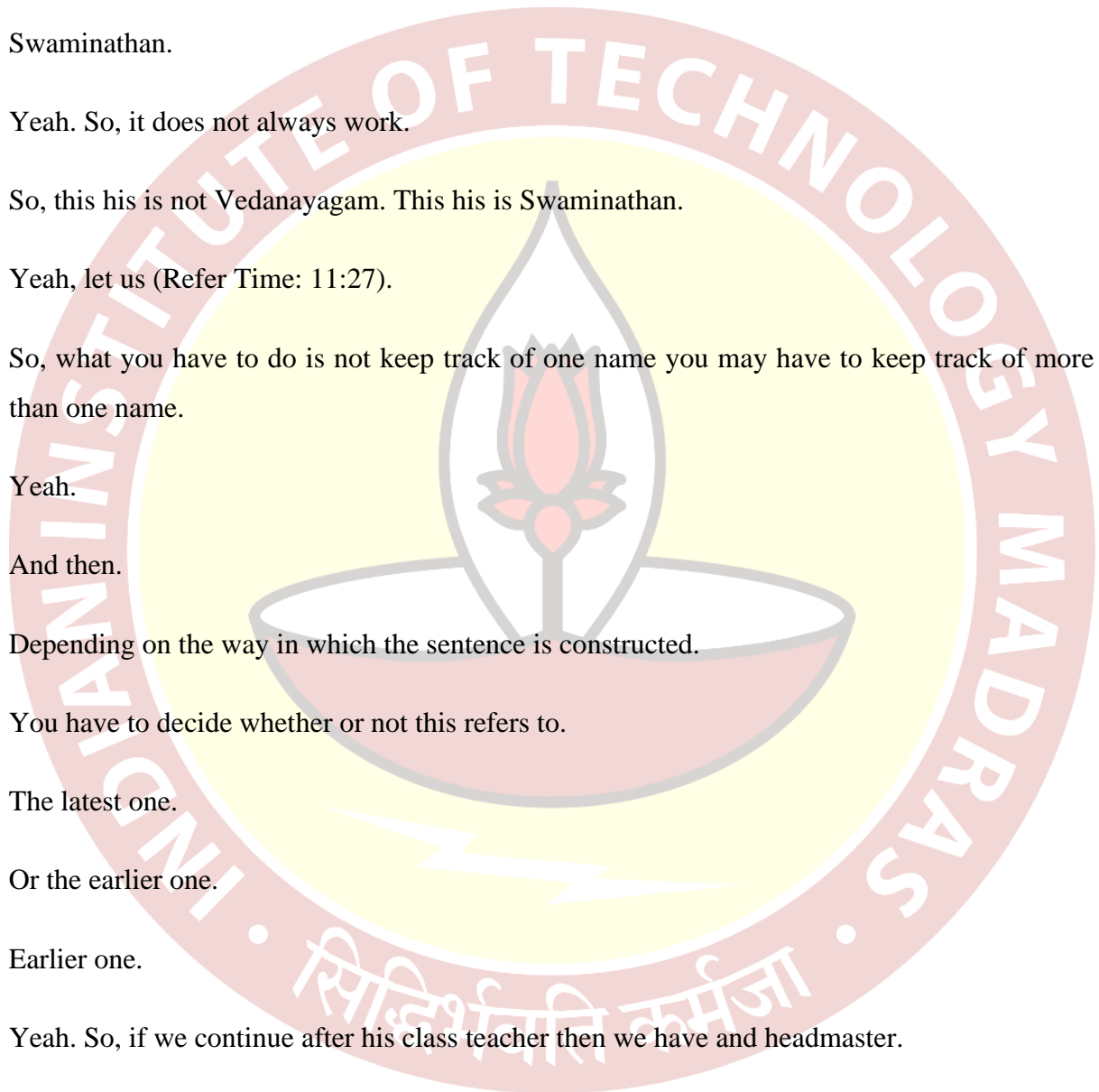
You have to decide whether or not this refers to.

The latest one.

Or the earlier one.

Earlier one.

Yeah. So, if we continue after his class teacher then we have and headmaster.



(Refer Slide Time: 11:47)



So, headmaster although is there is no name it is a person. And, here you have headmaster with his.

His.

Thin long cane. So, in this case.

So, this his.

This his is the headmaster.

This his is the headmaster. So, in two cases it worked in one case it did not work which is that Vedanayagam, but that is because that Vedanayagam was actually part of a different sentence structure.

It is a kind of a class right some kind of a.

So, there some.

Descriptive element.

So, there is some complication which comes from the structure of the language.

Language.

But to some extent we can computationally.

Try and compute find out.

Computationally find out where this.

So, here, so we said ok, let us see what we did. We did basically there is a procedure here. Which says give me a pronoun. So, this is an inner loop.

Yes.

Then outer loop and inner loop, of course, in this case we tried to remove it.

Yeah.

By keeping track of the last variable. But let us just stay with this.

Yeah.

Outer loop which basically is examining all the cards. When you hit a pronoun you want to give that pronoun to a subcontractor.

Yes.

Along with this bunch of cards. You want to give it to the subcontractor along with a bunch of cards and you are telling the subcontractor let us say it is me. Please go through this bunch of cards searching for backward.

The name to which this pronoun.

Name to which this refers and I will search backward and. In fact, I might keep to also I might search.

Yeah.

One I might search two and I might resolve all that I might do right, but whatever it is the subcontractor will basically go backward. And resolve the name. For this pronoun and what it will return to you? Will return to you the name.

The name correct.

So, I will say to you that this he refers to Vedanayagam, or this he refers to Swaminathan.

Correct.

I will tell you, but in addition you are also telling me do not mess with my cards.

Yes, because this order is important.

Order is important now in this.

Yes.

So, you are saying to me do whatever you want go back and all that you can do all that.

But, keep the sentence and the paragraph.

But, you must return this card back to me.

(Refer Time: 13:52)

In the way in which you gave it to me.

Correct.

So, the; I cannot have no side effects can be there.

Yes.

So, even if I did make any changes like we did we went backward.

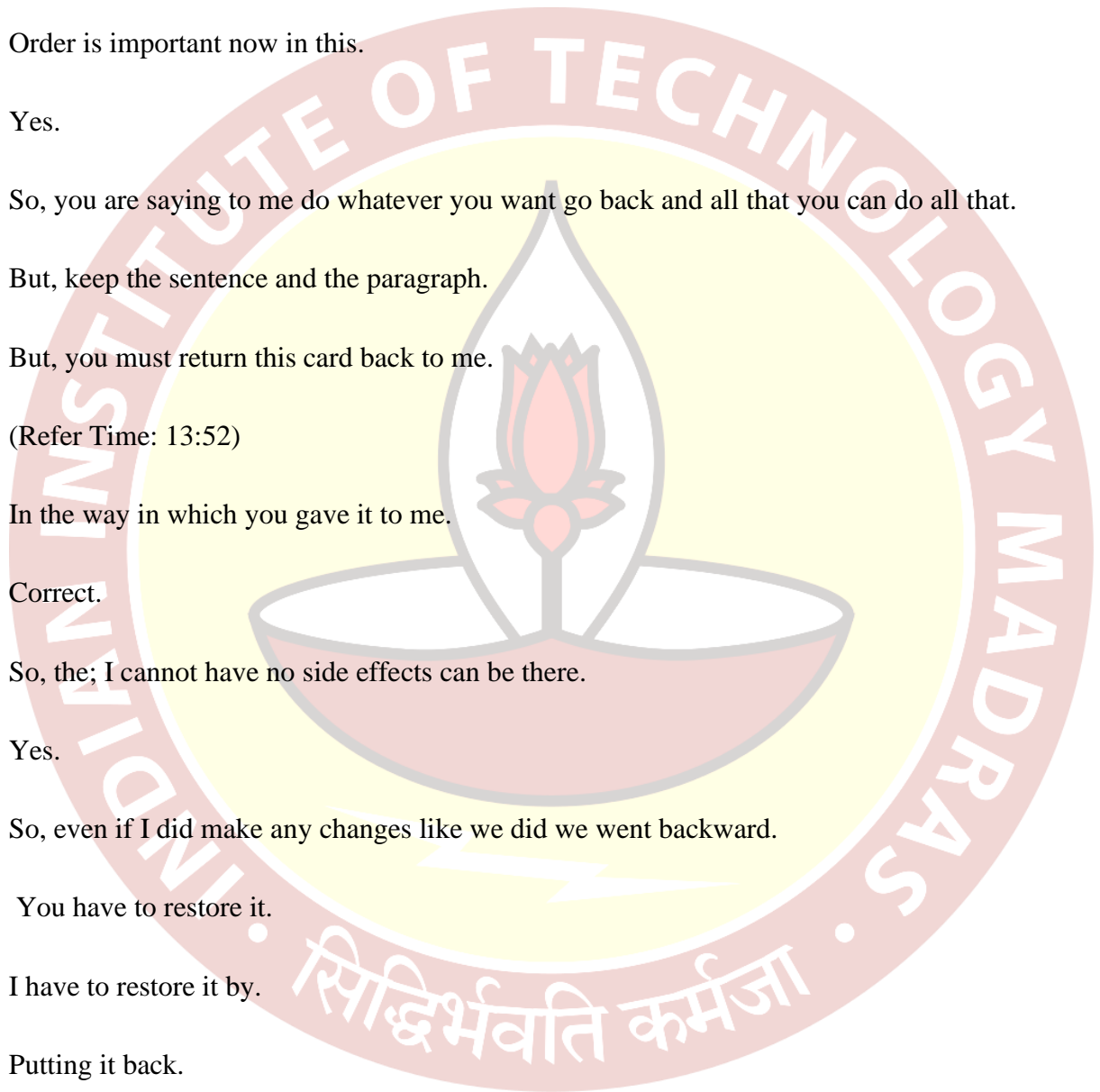
You have to restore it.

I have to restore it by.

Putting it back.

Putting it back.

And, giving it to me correct.



Right, I have to restore it by putting it back. And after restoring it then I have to give back the deck in the same way. What is the same way? The same way is that some cards are over here one card is like this.

(Refer Slide Time: 14:19)



This is how it is, you know. And, then I am searching so I then I this is how we searched. This I search like this and then I found something.

I found Swaminathan let us say. Then I have to put this back like this because you gave it to me like this, right.

Yes. I then I give this whole thing back to you like this. So, I gave it back to you in exactly the same way.

Correct.

You gave me I remove the side effects and gave it back to you along with an answer. The answer is for this pronoun this is the noun.

Yes.

Name.

Yes.

Ok.

There I have to trust you. So, for example, if you tell me that it is Vedanayagam even though it might be wrong I have to believe.

You have to trust me and you also have to trust me that I have restored the cards.

Yes. So, it is part of a contract. Of course, later on if I find out that my other work is suffering because of this, I might come back and catch you and sue you for breaking the contract.

Right.

Or something, but as far as the procedure goes this is the assumption.

Assumption.

If I tell you that this is what you need to do, the procedure should be doing that and under that assumption my rest of my work will proceed correctly.

So, again here this procedure basically has one parameter.

Yes.

Which is, or there is no parameter required here as it is named.

It is kind of a.

You are just saying.

Parameter in the sense that it is the position in the paragraph, where the name comes because you know that the name that pronoun comes because you know the name has to come before that position.

But you gave me a deck with something turned and all that.

Yeah.

So, that position is inside the deck.

Yeah it is.

So, there is no parameter really for this procedure I have to only ensure that the deck comes back in the same way you gave me.

Yeah, but in that sense the deck itself is a parameter.

Parameter.

So, that deck changes each time I give it to you; it is not the same, it is not like.

In a different state.

Yeah, it is not like the deck of report cards or marks cards, where I gave you the deck and I separately told you which subject to look at. So, the deck was always the same.

Here the deck.

So, deck has some.

Deck itself has got the parameter sitting inside somewhere.

Yeah I have.

The.

We made some changes to that.

Made you have changed the deck and then given me and I have to give back the deck in the same way.

Yes.

So, that is the parameter is the deck actually in a way you think about it.

Yeah.

Right, ok.